Final Report:
Technical Assistance for the Gilson Road Superfund Site
Nashua, New Hampshire
EPA Region 1

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EXECUTIVE SUMMARY

The following report reviews and provides recommendations for a long-term groundwater monitoring network for the Gilson Road (Sylvester) Superfund Site (Gilson Road). Extensive remedial actions have been successfully implemented at the site over the past 30 years, and the site is currently in a long-term operation and maintenance phase (O&M). The primary goal of developing an optimized groundwater monitoring strategy at the Gilson Road site is to create a dataset that fully supports site management decisions while minimizing expense and effort associated with long-term O&M.

The current groundwater monitoring network at the site has been evaluated using a formal qualitative approach as well as statistical tools found in the Monitoring and Remediation Optimization System software (MAROS). Recommendations are made for groundwater sampling frequency and location based on current hydrogeologic conditions as well as the long-term monitoring (LTM) goals for the site. The following report evaluates the monitoring system using analytical data collected from the site after cessation of the extraction remedy, including the time between 1999 and 2009. The report outlines recommendations based on a formal evaluation, but final determination of sampling locations and frequencies are to be decided by the overseeing regulatory agencies.

Site Groundwater Monitoring Goals and Objectives

Groundwater data at the Gilson Road site will be collected to address the following primary objectives:

- Evaluate the risk to human health and the environment.
- Establish long term trends in contaminant levels to support future site management decisions.
- Evaluate the effectiveness of the current remedial action (monitored natural attenuation) in achieving risk reduction.
- Document changes to the area groundwater quality and geochemistry after cessation of the groundwater extraction and treatment system.
- Ensure that contaminant concentrations above applicable screening levels are not migrating horizontally and vertically to potential surface water receptors.
- Monitor groundwater concentrations at the boundaries of the groundwater management zone (GMZ).

The goal of the long-term monitoring optimization (LTMO) analysis presented in this report is to review the current groundwater monitoring program and provide recommendations for improving the efficiency and accuracy of the network in supporting the site monitoring objectives listed above. Specifically, the LTMO process provides information on the site characterization, stability of the plume, sufficiency and redundancy of monitoring locations, and the appropriate frequency of sampling. The end product of the LTMO process at the Gilson Road site is a recommendation for specific sampling locations and frequencies that best address monitoring goals and support future management and redevelopment decisions (see Figure 8 for the final network recommendations).

Results

Statistical and qualitative evaluations of the Gilson Road site analytical data have been conducted, and the following general conclusions have been developed based on the results of these analyses:

- *Historic remedial activities have diminished the size of the plume*. The containment wall and groundwater extraction remedies have removed the majority of volatile organic contaminants (VOCs) from the overburden and bedrock aquifers. Arsenic is currently the contaminant of concern (COC) that exceeds cleanup standards at the most locations and by the highest amount.
- *Site characterization and conceptual model development are comprehensive and explain significant site details.* No significant data gaps in site characterization were found. The current network is sufficient to support most site management decisions. However, due to the age of the site and the format and distribution of historic documents, relevant site data can be time-consuming to access.
- *Individual well trends and plume-wide trends indicate a stable to shrinking plume for all COCs in both the overburden and bedrock aquifers.* Arsenic concentrations show strongly decreasing trends, particularly in the area downgradient of the slurry wall. Concentration trends for benzene, lead, and chlorobenzene are largely decreasing in both source (inside the slurry wall) and tail (outside the slurry wall) regions of the plume.
- *Chlorobenzene shows some variable trends in the overburden aquifer, outside of the slurry wall.* Concentrations results for 2009 indicate chlorobenzene at well T-64-2 is just below the screening level; however, the concentrations show an overall increasing trend at this location. Chlorobenzene concentrations at HA-5-A have exceeded standards historically, but now show a decreasing trend. Nested wells at T-48 have some historic exceedances of the standard but now show a stable to decreasing concentration trend. Chlorobenzene concentrations at the downgradient boundary of the GMZ are below regulatory screening levels and show stable concentration trends.
- *Monitoring Well Redundancy/Sufficiency*: Spatial analysis indicates networks in both aquifers can be reduced in the number of locations monitored. Overall, the aquifers show low variability and low uncertainty in concentrations.
- *Reduced Sampling Frequency:* The statistical sampling frequency analysis along with a qualitative review indicated that a reduced sampling frequency (biennial) may be appropriate for many wells in the network.

Recommendations

The following recommendations are made based on the results of the qualitative and quantitative review of data received, with findings summarized above and in Sections 3 and 4.

- *Plume Stability:* Based on the results of the individual well trend and plume-wide stability analysis, the plumes in both the overburden and bedrock aquifers are stable to shrinking. Stable or shrinking plumes are candidates for reduction in monitoring effort.
- *Routine Monitoring Program:* Several wells have been recommended for removal from the routine monitoring program for both the overburden and bedrock aquifers (see Table 6). For the overburden aquifer, 33 monitoring locations are recommended for retention in a routine monitoring program; 12 of these locations are recommended for biennial sampling with the remainder recommended for annual sampling. For the bedrock aquifer, 16 monitoring locations are recommended, with 3 at a biennial sampling frequency and the remainder recommended for annual sampling. *Going forward, a consistent set of wells should be sampled at regular intervals to provide a dataset that supports plume-wide statistical evaluation of trends and plume-wide progress toward cleanup goals.* A consistent dataset will provide a higher level of confidence in statistical results.
- *One additional bedrock monitoring well is recommended.* While the spatial analysis indicates very low concentration uncertainty within the current network, there is currently no bedrock monitoring location at the northwestern boundary of the GMZ near HA-10 and HA-11. This area is downgradient from locations that exceed standards for arsenic and other COCs in the bedrock zone. A bedrock monitoring location in this area would provide information on concentrations at the edge of the institutional control (IC).
- *GMZ monitoring.* One objective of the monitoring network is to confirm that groundwater outside of the GMZ meets quality standards. However, several wells that monitor the boundary of the current GMZ show concentrations above the background and some above the AGWS (e.g. HA-10-C for arsenic, T-54-3 for benzene and arsenic, T-60-3 for lead and arsenic). Technically, the GMZ must delineate the boundary between affected and unaffected groundwater. Based on results from the 2009 sampling, either the size of the GMZ must be adjusted or the requirements for groundwater attainment should be modified (e.g. calculating regional background concentrations for arsenic and lead). Additional monitoring locations may be required after expansion of the GMZ. Additional sampling locations may include the overburden downgradient from HA-10-C, and cross-gradient from HA-5-A and T-54-2. In addition to the bedrock well described above, another well may be necessary cross gradient from T-54-3.
- *Sampling Frequency:* An annual sampling frequency is recommended for the majority of the monitoring locations and is recommended for locations in the source area and wells that monitor the downgradient area near Lyle Reed Brook. No locations are recommended for quarterly or semi-annual sampling. Biennial

sampling is recommended for wells that delineate the GMZ or serve as point of compliance (POC) locations.

- *Data Management:* Continue efforts to organize site data and transfer new and significant historical information to an electronic format to improve access to site data.
- *Chlorobenzene concentrations should be monitored and trends reviewed in the area immediately downgradient from the slurry wall in the overburden aquifer*. Chlorobenzene concentrations at HA-5-A, T-64-2, and T-48-2, 3, and 4 should be carefully monitored for any increasing trends. Surface water in Lyle Reed Brook should be sampled downgradient from these locations in order to determine if concentrations exceed surface water quality standards.
- *Surface water and sediment monitoring:* While surface water and sediment sampling locations were not evaluated in this report, the recommendation is to continue sampling the locations identified in the database on an annual basis along with groundwater locations.
- *Future reductions in monitoring effort* may be possible if trends continue downward. After collection of a consistent dataset over a period of approximately 4 years, the network can be re-evaluated and reductions, particularly in sampling frequency may be appropriate.

1.0 INTRODUCTION

The Gilson Road (Sylvester) Superfund Site is a National Priorities Listed (NPL) site near Nashua, New Hampshire in Region 1 of the U.S. Environmental Protection Agency (USEPA). The site comprises about 28 acres historically affected by the operation of an illegal waste disposal facility between the 1960s and 1979. Investigation and remediation activities began in the early 1980s, making the Gilson Road site one of the oldest sites to be managed under the Comprehensive Environmental Response and Liability Act (CERCLA or Superfund). Management of the site predated the 1986 Superfund Amendments and Reauthorization Act (SARA).

The Gilson Road site has undergone significant remedial activities over the past 30 years including isolation of a 20 acre parcel with a subterranean containment wall (slurry wall) and cap and installation of a groundwater pump and treat (P&T) system. Groundwater testing and monitoring began in 1981. Groundwater within the slurry wall was determined to have attained initial cleanup goals in 1995 and the active P&T remedy was terminated in 1996 (USEPA 2004). Groundwater monitoring efforts are currently underway to evaluate conditions after the cessation of the P&T remedy. Groundwater monitoring data will be used to evaluate whether monitored natural attenuation (MNA) is an appropriate long-term remedy for residual contamination. Therefore, current monitoring goals for the site include: 1) confirming that concentrations of constituents of concern (COCs) remain below relevant regulatory levels; 2) documenting changes to the groundwater quality and geochemistry after cessation of the P&T system; and 3) ensuring that COCs are not migrating horizontally and vertically to potential surface water receptors or beyond the boundaries of the groundwater management zone (GMZ). Groundwater data collected for the Gilson Road site may also be important in evaluating regional groundwater quality.

EPA Region 1 has requested GSI Environmental (GSI) under contract to EMS to review the Gilson Road site groundwater monitoring network *and provide recommendations for improving the efficiency and accuracy of the network for supporting site management decisions.* To this end, the following tasks have been performed:

- Review monitoring objectives and current groundwater quality, and evaluate the ability of the monitoring network to achieve goals and objectives.
- Evaluate individual well concentration trends over time, both within and outside of the slurry wall.
- Evaluate overall plume stability through concentration trend and moment analysis.
- Develop sampling location recommendations based on an analysis of spatial concentration uncertainty.
- Develop sampling frequency recommendations based on both qualitative and quantitative statistical analysis results.

1.1 SITE BACKGROUND

The Gilson Road (Sylvester Site) is located near Nashua, New Hampshire about one-half mile east of the Nashua River, a tributary of the Merrimack River (see Figure 1). The site is bounded on the south by Gilson Road with low-density residential property to the south and west. Higher density residential property lies to the east and north of the site. The Four Hills Municipal Landfill is located to the northeast. Groundwater flow from the municipal landfill is in the direction of Lyle Reed Brook and the landfill may affect groundwater quality and geochemistry in this area. Lyle Reed Brook circles the site flowing northward from the west and bounding the site to the north. Lyle Reed Brook joins with Trout Brook northwest of the site, eventually discharging to the Nashua River to the northwest. The Nashua River joins the Merrimack River seven miles to the east of the site. The Merrimack is a water supply for the City of Lowell, Massachusetts.

The original source of contamination was a six-acre former sand and gravel borrow pit that was converted into an illegal solid waste disposal facility sometime in the 1960s by C & S Disposal Company. The disposal area was operated adjacent to the home of the owner, William Sylvester. The borrow pit was originally used to dispose of residential solid waste and demolition material; however, in the mid- 1970s the operator began accepting significant quantities of industrial hazardous wastes. Waste liquids and sludges containing VOCs, flammable solvents, heavy metal waste, and semivolatile organic compounds (SVOCs) (H&A 1994) were delivered to the site by tanker trucks and piped directly to the borrow pit or into subsurface leaching fields. Drums containing waste liquids and solids also were buried in the pit and stored on site.

A court order was issued in 1979 prohibiting further disposal of hazardous wastes at the site. In 1980, regulatory agencies acquired access to the property and removed 1,324 drums of primarily liquid BTEX (benzene, ethylbenzene, toluene, and xylenes) waste. Remedial investigation activities and an emergency response occurred between 1981 and 1982. Groundwater monitoring wells were installed in 1981, and a groundwater extraction system to contain affected groundwater was installed in 1982. A Record of Decision (ROD) was issued in July 1982 (USEPA 1982) requiring the construction of a slurry trench cutoff wall and surface cap isolating a 20-acre area. The slurry wall was constructed in December 1982 and several groundwater monitoring wells were installed during this time. (A list of current groundwater monitoring locations is provided in Table 1 and on Figure 1). A 1983 Supplemental ROD (SROD) (USEPA 1983) specified that a 300 gallon per minute (gpm) groundwater treatment plant be constructed to extract and treat affected groundwater from within the slurry wall. The 1983 SROD established cleanup goals, known as Alternative Concentration Limits (ACLs), for 16 constituents.

Because the remedial action was initiated before the widespread development of risk-based cleanup goals, the ACLs for the site were established at 90% of the original maximum concentrations of identified contaminants. ACLs were modified in a 2002 Explanation of Significant Differences (ESD) revising cleanup goals for 1,1-dichloroethane and 1,1,2-trichloroethane. ACLs apply to groundwater within the containment wall. No ACL for arsenic was specified in the SROD and analyses and state standards for 1,4-dioxane have only recently been developed.

In the intervening years, the state of New Hampshire has developed risk-based Ambient Groundwater Quality Standards (AGQS) and Ambient Water Quality Standards (AWQS) for surface water. The site currently has institutional controls (ICs) in place which incorporate a GMZ. Compliance at the boundary of the GMZ is based on the AGQS standards and AWQS apply to surface water in Lyle Reed Brook and the Nashua River. ACLs are the applicable standard within the containment wall. ACLs and AGQS values are shown in Table 2 for priority contaminants of concern (COCs) along with the most recent maximum concentrations in the plume. For the purpose of this report, ACLs are used to evaluate attainment of cleanup goals within the containment wall and to ensure an active remedy is not required in this area. AGQS apply outside the wall and to all compounds not specified in the SROD (e.g., arsenic, 1,4-dioxane).

1.2 REMEDIAL ACTIVITIES

At the time of the initial investigation, contaminated groundwater was estimated to be moving through the upper aquifer at a rate of 2 ft/day (Backers and Beljin 1996). The soil/bentonite slurry cutoff wall was constructed in September 1982 and consisted of a three-foot thick wall extending between 90 and 110 feet below ground surface (bgs) fully encompassing 20 acres (see Figure 1). A synthetic cover was installed over the site. The 300 gpm groundwater pump and treat (P&T) system was initiated in April 1986, becoming the first P&T system installed in the nation (USEPA 2004). Inorganic contaminants were removed from groundwater and disposed of in an onsite, lined landfill while volatile organic compounds (VOCs) were incinerated onsite. Following treatment, 250 gpm of effluent was discharged to trenches inside the slurry wall with 50 gpm discharged outside the slurry wall. Discharge within the slurry wall was intended to flush contaminants while discharge upgradient of the slurry wall was intended to raise the hydraulic head and facilitate groundwater migration from bedrock into the containment area. The remedial conceptual model from a 1989 report by Weston Solutions (Weston 1989) is illustrated on Figure 2. The groundwater extraction system was originally anticipated to run for three years.

The Gilson Road remedial system was reviewed in 1989 (Weston 1989), and an ESD was issued in 1990 (USEPA 1990). The 1990 ESD identified additional remedial measures including a soil vapor extraction system to address residual toluene and addition of six groundwater recovery wells to extend the capture zones to areas where contaminants had been redistributed by the trenching system. The ESD also stipulated than a Remedial Action Evaluation Study was to be conducted to evaluate the progress toward attaining ACLs. In 1994, the Remedial Action Evaluation Study (H&A 1994) concluded that the additional remedial measures had been successful and that groundwater was close to attaining ACLs within the containment wall. The groundwater P&T system was shut down in 1996 when the EPA determined that the cleanup goals set forth in the SROD had been attained. Between 1986 and 1996 the P&T system had pumped more than a billion gallons of water and removed more than 430,000 pounds of contaminants (USEPA 1997).

While several studies of the remedial system (Weston 1989) (H&A 1994) indicated that the slurry wall effectively prevented contaminant migration through the overburden, it was known that contaminated groundwater was escaping through the bedrock flow zone. In a 1996 study, transport through the slurry wall was found to be minimal (Backers and Beljin 1996). However, groundwater migrating through the bedrock fractures beneath the cutoff wall was found to be substantial, with approximately 7,800 gal/day exiting the containment area (H&A 1994). Currently, one objective of the groundwater monitoring network is to document how leakage through and under the slurry wall affects surrounding ground and surface water.

ICs have been established at the site. A chain-link fence currently surrounds the 20-acre containment area and former treatment plant, and a GMZ has been established encompassing the containment area and downgradient locations around Lyle Reed Brook (see Figure 1). The current remedy at the site is monitored natural attenuation (MNA). Groundwater at the site has been monitored since 1997 with the objective of confirming that groundwater has attained standards within the slurry wall and that the plume is stable to decreasing outside of the slurry wall during the period since cessation of the active remedy.

While concentrations of VOCs were dramatically reduced as a result of the P&T system, concentrations of arsenic in site groundwater have remained fairly high. It is unclear how much of dissolved arsenic is a result of residual waste and how much may have been mobilized from endogenous rock by changes in site geochemistry. Regionally, groundwater from the Four Hills Landfill discharges to the Lyle Reed Brook area and data indicate elevated arsenic in this area as well. The Gilson Road monitoring network contributes to a regional network evaluating arsenic concentrations.

1.3 GEOLOGY AND HYDROLOGY

Regional geology consists of two principal subsurface zones: a stratified drift in the overburden (overburden aquifer) and a fractured biotite schist bedrock layer (bedrock aquifer). At the Gilson Road site, the overburden consists of anthropogenic fill, glacial outwash, and a glacial till. The sand and gravel borrow pit in the eastern portion of the site was filled with various types of refuse including construction/demolition debris during the 1960s. Test borings indicate that the fill ranges from 3 to 25 feet in depth and consists largely of coarse sand, gravel with bricks and wood fragments. The majority of the native overburden consists of glacial outwash, a coarse to fine sand with varying amounts of gravel and silt. The outwash ranges in thickness from 8 to 53 feet in depth, with thicker deposits to the south. Groundwater in the overburden aquifer is largely unconfined. A discontinuous layer of low-permeability glacial till separates the overburden from the bedrock and can be confining in some areas.

The bedrock surface varies with highs to the northeast and northwest, with a depression in the north central portion of the site. The bedrock elevation drops to the west of the site. The bedrock unit is moderately weathered and highly to moderately fractured. Fractures in the bedrock result in preferential groundwater flow paths. Groundwater in the bedrock aquifer is semi-confined in the secondary fractures. Based on the 1989 Weston report (Weston 1989), the two principal flow zones have similar transmissivity. A summary of aquifer input parameters used in the analysis of overburden and bedrock groundwater is provided in Table 3.

The general groundwater flow direction is to the northwest toward the Nashua River. Groundwater flow in the overburden and bedrock are largely parallel. While the slurry wall contains overburden groundwater within the 20-acre enclosure, the hydraulic trend is vertically downward on the upgradient side of the northern slurry wall and vertically upward on the downgradient side (see Figure 2 for generalized conceptual model). Groundwater flowing downward under the wall then flows upward partially discharging to Lyle Reed Brook. Flow through the bedrock aquifer is toward the Nashua River where it discharges to the surface. With the current ICs in place, primary risk to environmental receptors focuses on human and ecological exposure pathways associated with discharge to Lyle Reed Brook.

Due to the age of many of the groundwater monitoring wells, accurate potentiometric surface measurements are difficult to obtain. Freezing and thawing of the ground can cause well casings to change position, resulting in inaccuracies in calculated depth to groundwater. Additionally, due to the age of the site, boring logs and as-built diagrams are not available for all wells and records of well installation are not uniform nor are they available in electronic format.

1.4 CURRENT REGULATORY STATUS AND SITE MONITORING OBJECTIVES

Since shutdown of the P&T system in 1996, groundwater monitoring has been conducted to confirm attainment of ACLs within the slurry wall and to monitor concentrations outside of the wall and in adjacent surface water as part of the MNA remedy. The site is currently in a verification stage to confirm that groundwater cleanup objectives will continue to be met under the current passive treatment scenario. In addition to groundwater monitoring, the slurry wall and surface cap and institutional controls are maintained.

Groundwater monitoring since 1999 has not been conducted on a regular schedule or with a regular group of wells. Additionally, results for 1,4-dioxane, used as an industrial solvent stabilizer during the 1970s, are limited to samples taken in 2009.

Based on the 2008 Draft Sampling and Analysis Plan (SAP) (NHDES 2008) for Gilson Road, the specific data quality objectives for the groundwater sampling program are to:

- Evaluate the risk to human health and the environment.
- Establish long term trends in contaminant levels to support future site management decisions.
- Evaluate the effectiveness of the remedial action in achieving risk reduction.

In order to address these objectives, the following monitoring location categories were used to design the network. Each groundwater monitoring location in the network was evaluated qualitatively to determine how well it fulfilled one or more of the following functions:

- Monitor possible exposure pathways such as discharge to surface water bodies (near Lyle Reed Brook);
- Evaluate plume stability and possible migration of contaminants;
- Monitor the boundaries of the GMZ to ensure that concentrations do not exceed regulatory limits outside of the IC;
- Monitor the historic source area inside of containment wall to confirm attenuation of constituents and to anticipate future source strength;

Recommendations developed in the following report for the Gilson Road monitoring network are designed to address the objectives listed above. Results from both the qualitative evaluation and the statistical analyses contained in the MAROS software were reviewed to recommend optimized sampling locations and frequencies. Each well recommended for the final monitoring network (see Table 7) has been identified as addressing one or more of the monitoring objectives above.

2.0 MAROS EVALUATION

The MAROS 2.2 software was used to evaluate the LTM network at the Gilson Road site. MAROS is a collection of tools in one software package that is used to statistically evaluate groundwater monitoring programs. The tool includes models, statistics, heuristic rules, and empirical relationships to assist in optimizing a groundwater monitoring network system. Results generated from the software tool can be used to develop lines of evidence, which, in combination with professional judgment, can be used to inform regulatory decisions for safe and economical long-term monitoring of affected groundwater. A summary description of each tool and statistical method used in the analysis is provided in Appendix A of this report. For a detailed description of the structure of the software and further utilities, refer to the MAROS 2.2 Manual ((AFCEE 2004); http://www.gsi-net.com/software/MAROS_V2_2Manual.pdf) and Aziz et al., 2003 (Aziz, Newell, et al. 2003).

Groundwater data collected between 1999 and 2009, after total shutdown of the P&T system, were used for the majority of statistical analyses. Data from the overburden and bedrock aquifers were evaluated separately, despite the hydraulic connection and variability in vertical gradients between the two units. A summary of wells evaluated is presented in Table 1; regulatory screening levels are show in Table 2 and generalized aquifer input parameters for the MAROS software are presented in Table 3.

2.1 OVERBURDEN RESULTS

2.1.1 COC Choice

MAROS includes a short module that provides recommendations for prioritizing COCs plume-wide based on toxicity, prevalence, and mobility. A report showing results of the

COC prioritization for the overburden aquifer is shown in Appendix B. Based on a comparison with AGQS screening levels (which are largely below the ACLs) arsenic, 1,4-dioxane and benzene are the only constituents that exceed standards on a plume-wide basis. Due to the low screening level (10 μg/L), arsenic is the priority COC both inside and outside the containment wall. Benzene concentrations are well below ACLs within the slurry wall and have exceeded AGQS in the recent past in a limited area outside the wall at T-48-2/3/4, T64-2, and HA-5A/C.

The dataset for 1,4-dioxane is small, with results for only eight wells in the network from 2009. The AGQS for 1,4-dioxane is very low (3 μg/L), so even low concentration detections can be problematic. Because of the limited dataset, trends for 1,4-dioxane as well as sampling locations and frequency could not be evaluated statistically. 1,4-Dioxane is highly mobile and detected at T-60-1, indicating that area impacts may originate from other sources such as the Four Hills Landfill. Additional data on the prevalence and distribution of 1,4-dioxane is needed.

Historically, chlorobenzene concentrations have exceeded AGQS standards in a limited area in the overburden aquifer outside the slurry wall (HA-5-A/C, T-48-2/3/4, and T64-2), but chlorobenzene does not exceed standards over a broad area, and recent (2009) samples indicate concentrations may be attenuating.

2.1.2 Plume Stability

Plume stability is an important concept in long-term site maintenance. A stable plume is one that is predictable under ambient conditions and requires less monitoring effort than plumes that are expanding or changing rapidly. Within the MAROS software, time-series concentration data and plume-wide trends are analyzed to develop a conclusion about plume stability.

Individual Well Trends

Data from 51 wells monitoring the overburden aquifer were evaluated. Summary statistics, including maximum detected concentrations (1999 – 2009), detection frequencies and concentration trends for arsenic, benzene, and chlorobenzene are shown in Table 4. Historic maximum concentrations for arsenic and benzene have been normalized by the AGQS and plotted on Figure 3 in order to provide an idea of the distribution of groundwater above the standards.

Individual well concentration trends were determined using the Mann-Kendall (MK) and linear regression (LR) methods for data collected between 1999 and 2009. A summary of trend results for the overburden aquifer is provided in the table below and in Table 4. Roughly one quarter of wells (12) sampled in the 2009 event have not been sampled more than three times in the previous ten years. A concentration trend cannot be calculated for locations with less than 4 sampling results. Detailed reports for MK trends are provided in Appendix B. Results of the individual well MK trends for arsenic and benzene are illustrated on Figure 3.

Overburden COC	Total Wells	Number and Percentage of Wells for Each Trend Category					
		Non Detect	Decreasing/ Probably Decreasing	Stable	Increasing/ Probably Increasing	No Trend	N/A
Arsenic	51	1 (2%)	19 (37%)	13 (25%)	0	6 (12%)	12 (24%)
Benzene	50	14 (28%)	8(16%)	13 (26%)	0	4 (8%)	11 (22%)
Chlorobenzene	50	13 (26%)	6 (12%)	11 (22%)	3 (6%)	6 (12%)	11 (22%)
Lead	51	7 (14%)	14 (27%)	10(19%)	0	8 (16%)	12 (24%)

Note: Number and percentage of total wells in each category shown. N/A = insufficient data to evaluate a trend.

For arsenic, the majority of well locations show decreasing to stable trends. This is true for the other constituents as well, with non-detect, decreasing and stable trends dominating results for wells with sufficient data to determine a trend. No locations show increasing or probably increasing trends for arsenic. Trend results indicate a shrinking arsenic plume, perhaps indicating that geochemical conditions conducive to arsenic mobility have reversed. Six wells have no trend for arsenic, indicating higher variability in the data.

While no increasing concentration trends were found for arsenic, benzene, lead, and vinyl chloride, three locations show an increasing trend for chlorobenzene. The three locations with increasing trends for chlorobenzene are T-13-3 and T-19-3 inside the slurry wall and T-64-2 outside of the wall (MK trend reports are in Appendix B). While concentrations are below AGQS at T-19-3, concentrations exceed AGQS at T-13-3 and are close to exceeding at T-64-2. An area of elevated chlorobenzene exists outside of the slurry wall around T-64-2, including HA-5-A and C, the T-48 nested wells and T-63-1. Concentrations of chlorobenzene are decreasing at location T-64-3, co-located with T-64-2 and screened approximately 30 feet deeper than T-64-2.

The MAROS software groups trend results from individual wells to determine a general trend for a specific area. For the overburden aquifer, arsenic trends within the slurry wall are generally stable while concentrations outside the wall show an overall decreasing trend. Figure 4 shows the combined MAROS trend results for priority constituents inside the slurry wall (Source Stability) and outside the wall (Tail Stability). For the five COCs evaluated, all show decreasing or probably decreasing concentration trends outside of the slurry wall and most show probably decreasing trends within the slurry wall. These results support the conclusion of a stable to shrinking plume.

Moment Analysis

Moment analysis was used to estimate the total dissolved mass (zeroth moment) and center of mass (first moment) for dissolved constituents for the full plume (both inside and outside the slurry wall) and for a limited number of wells outside of the slurry wall. Zeroth and first moments were found for annually consolidated data collected between 1999 and 2009, and an MK trend was determined for each. Due to variations in the number and identity of wells sampled during each event, annual consolidation of data was necessary in order to calculate moments based on a more consistent set of wells. Results of the moment analysis of priority COCs for the full plume area are summarized in the table below.

Zeroth moments are rough estimates of total dissolved mass, assuming a constant porosity and uniform plume thickness across the site. Because of heterogeneities in the subsurface, the mass estimates are best used to calculate a trend of dissolved mass over time within the network rather than accurate calculations of total mass. The total dissolved mass estimate between 1999 and 2009 for arsenic is strongly decreasing. The total dissolved mass of benzene, chlorobenzene and lead were found to be stable. These results support the conclusion of a largely stable to decreasing plume.

Type of Moment	Arsenic	Benzene	Chlorobenzene	Lead
Zeroth Moment	D	S	S	S
First Moment	NT	I	I	PI
Second Moment X	S	NT	S	S
Second Moment Y	S	NT	S	S

Decreasing trend (D), Probably decreasing trend (PD), Stable (S), Probably Increasing trend (PI), and Increasing trend (I); (NT) No trend; (N/A) insufficient data to evaluate a trend.

The plume center of mass (first moment) was estimated for each year, and the distance of the center of mass from the source (assumed to be near T-33-1) was calculated. MK trends were evaluated for the distance of the center of mass from the source over time. No trend was seen in the center of mass for arsenic; however, benzene, chlorobenzene, and lead showed an increasing center of mass indicating that concentrations may have shifted downgradient over time. Because the total mass is stable, the results indicate that concentrations in the upgradient area are decreasing leaving more relative mass in the downgradient area of the plume. Centers of mass for all constituents evaluated are in the vicinity of well T-13. Centers of mass for arsenic and benzene are shown on Figure 3.

Second moments indicate the spatial distribution of mass between the center and the edge of the plume. Second moments in the X direction are metrics of the distribution of mass in the direction of groundwater flow, while those in the Y direction indicate the spread of mass orthogonal to groundwater flow. An increasing second moment would indicate an increase in mass at the edge of the plume relative to the center. For the overburden aquifer, most second moments are stable, with some variability seen in the second moments for benzene.

Moments calculated only for the plume outside of the slurry wall support the conclusion of stability. Annually consolidated data for 14 wells were evaluated for the priority constituents between 1999 and 2009. For arsenic outside the slurry wall, total mass was strongly decreasing and the center of mass was stable. For benzene, chlorobenzene and lead, total dissolved mass was stable. The center of mass for chlorobenzene was stable, and that for lead showed a probably decreasing trend. The center of mass for benzene showed not trend. No increasing trends were found for any of the constituents evaluated.

2.1.3 Well Redundancy and Sufficiency

Spatial analysis modules in MAROS recommend elimination of sampling locations that have little impact on the characterization of contaminant concentrations. Algorithms also identify areas within the monitoring network where additional wells may be needed. The spatial redundancy and sufficiency analysis for Gilson Road included a statistical analysis using data collected between 2006 and 2009 as well as a qualitative evaluation of well locations relative to monitoring objectives. For details on the MAROS redundancy and sufficiency analyses, see Appendix A or the MAROS Users Manual (AFCEE 2004).

Redundancy

A Delaunay mesh spatial analysis method was used to evaluate well redundancy for 54 wells in the overburden aquifer. The algorithm includes calculation of a slope factor (SF) that mathematically evaluates how well the concentration at a particular location can be estimated from the nearest neighbors. Because the analysis is for a two-dimensional slice of the aquifer, for each well nest, data from the screened interval with the highest concentration was used for the redundancy analysis. An average SF less than 0.30 was the criteria to identify a well that may provide redundant information and may be eligible for removal from the network. Average SFs for arsenic and the MAROS recommendation for elimination from the network are shown in Table 6. Results of the qualitative analysis were combined with the results of statistical analyses to make a final recommendation for inclusion of the well in the network.

The general results of the spatial redundancy analysis indicate overall low SFs and a moderate level of spatial redundancy. The results of the spatial redundancy analysis were considered along with the qualitative review of the function of the well in the network (also summarized in Table 6) in order to make the final recommendation. Some wells were recommended by the software for removal because they are located close together and have similar concentrations. However, for wells on opposite sides of the slurry wall (e.g. T-12-1/3 and HA-5-A/C), the monitoring objective of assessing contaminant passage through the slurry wall is served by close proximity of wells. For the most part, if the software recommended including one well in a nested group, the entire group was retained for vertical delineation. Of the 54 wells reviewed, 21 were recommended for removal from the program. For the overburden, 33 monitoring locations are recommended for inclusion in the program with varying sampling frequencies (see 2.1.4 Sampling Frequency).

Sufficiency

The well sufficiency module recommends potential locations for new wells in areas of high concentration uncertainty. The graphical results of the well sufficiency analysis for arsenic are shown on Figure 5. Like the redundancy analysis, well sufficiency is evaluated using SF. Areas between wells with higher SF, corresponding to higher concentration uncertainty, are candidates for new wells. For the Gilson Road overburden network, no areas of excess concentration uncertainty were found for the priority COCs within the current extent of the network. Overall, the plumes show very low spatial uncertainty, so no new wells are recommended.

In order to determine if removal of redundant wells causes excess spatial uncertainty, the sufficiency analysis was re-run with the final recommended well network. The results of the well sufficiency analysis of the final network for arsenic are shown on Figure 6. No excess concentration uncertainty resulted from removal of sampling locations from the program.

Because MAROS only evaluates well sufficiency within the current network, a qualitative review of the delineation of affected groundwater at the Gilson Road site was conducted. The boundary of the current GMZ is shown on Figure 1. Groundwater outside of the GMZ should be unaffected by site contaminants. The extent of the current GMZ presents some challenges for the plume outside of the slurry wall. Concentrations of arsenic at several sampling locations on the boundary of the GMZ are above the AGQS, such as HA-10-C, T-60-3, and T-54-2. Locations T-60-3 and T-62-2 exceed for lead. Groundwater at HA-5-A/C, very close to the cross-gradient boundary of the GMZ, exceeds standards for several constituents.

Currently, wells along the GMZ do not confirm that groundwater outside of the GMZ meets AGQS. For the inorganic constituents, arsenic and lead, no background concentrations are specified in the documents reviewed. If current lead and arsenic concentrations are a result of indigenous geochemical processes, then screening concentration levels may be adjusted and the GMZ does not need to be expanded. However, if the boundary of the GMZ changes, additional wells may be required for delineation. Specifically, additional wells below AGQS may be required downgradient from HA-10-C and T-60-1/3 and cross-gradient from HA-5-A/C and T-54-2.

2.1.4 Sampling Frequency

The recent sampling frequency and identity of wells at Gilson Road has not been consistent. Sampling has been roughly annual for the years between 2002 and 2006 with varying numbers of wells sampled (30 in 2003, 24 in 2004, 37 in 2005, and 29 in 2006). No samples were recorded in the years 2007 and 2008. A comprehensive sampling event was conducted in February and March 2009 where 47 wells were sampled.

Because of the uneven sampling interval, several wells in the network could not be evaluated for recent (2003 – 2009) rate of change and trends to determine an appropriate sampling interval. Wells with insufficient data within the recent sampling interval are assigned a default quarterly sampling frequency recommendation by the software in order to collect a sufficient amount of data. For wells with sufficient recent data, the MAROS results were considered along with other lines of evidence (see Table 6) to recommend a final sampling frequency. For wells with smaller datasets, sampling frequency was recommended based on the overall concentration trend and monitoring rationale for the well. Final recommendations are shown on Table 6 and on Figure 8.

Of the 33 wells recommended for the final network, 13 are recommended for biennial sampling (every two years). These can be sampled in alternate years (even and odd) or all every two years, depending on which is easier for contracting purposes. Wells recommended for biennial sampling function as point of compliance (POC) or GMZ monitoring locations. 20 wells in the overburden aquifer are recommended for annual monitoring. These wells largely function as source monitoring locations (inside the slurry wall) and sentry wells that may indicate when concentrations in excess of standards may be migrating toward potential receptors. A summary of locations, frequencies, associated monitoring objectives, and suggested data analysis strategies is located in section 2.3.

2.2 BEDROCK AQUIFER

2.2.1 COC Choice

The results of the COC prioritization for the bedrock aquifer indicate that arsenic concentrations exceed the AGQC by the highest amount and at the largest number of monitoring locations. Lead and benzene also exceed AGQCs on a plume-wide basis, but exceedances are neither as high nor as widespread as those for arsenic. As in the overburden aquifer, 1,4-dioxane exceeds the AGQC, but analytical results for this constituent are so limited that it is difficult to determine if 1,4-dioxane is a long-term issue.

While chlorobenzene has been detected above AGQCs in the bedrock aquifer at three locations (T-12-4 inside the slurry wall and HA-5B and T-48-5), the distribution of chlorobenzene is limited.

2.2.2 Plume Stability

Individual Well Trend Analyses

MK and linear regression trend results for select constituents are shown on Table 5 and summarized below. Historic maximum concentrations for arsenic and benzene have been normalized by the AGQS and plotted on Figure 7 in order to provide an idea of the distribution of groundwater above the standards.

Overburden COC	Total Wells	Number and Percentage of Wells for Each Trend Category					
		Non Detect	Decreasing/ Probably Decreasing	Stable	Increasing/ Probably Increasing	No Trend	N/A
Arsenic	21	0	9 (43%)	5 (24%)	1 (5%)	1 (5%)	5 (24%)
Benzene	21	7 (33%)	8 (38%)	5 (24%)	0	0	1 (5%)
Chlorobenzene	21	8 (38%)	4 (19%)	3 (14%)	0	5 (24%)	1 (5%)
Lead	21	3 (14%)	3 (14%)	8 (38%)	0	4 (19%)	3 (14%)

N/A = insufficient data to evaluate a trend.

As in the overburden aquifer, the majority of bedrock monitoring locations showed decreasing to stable trends for arsenic. In particular, wells located along and just outside of the northern section of the slurry wall show strongly decreasing trends (HA-5B, T-12-4, T-64-4, and T-48-5). The only location with an increasing trend for arsenic is the upgradient bedrock location T-33-4, with an average concentration roughly twice that of the AGQC. T-33-4 is just inside the slurry wall. The adjacent location, T-32-4, is just outside the slurry wall and shows a probably decreasing trend for arsenic. These results may indicate some type of geochemical effect of the slurry wall on adsorption and desorption behavior of arsenic.

No increasing trends were found for benzene, chlorobenzene, or lead. Individual well trend results for bedrock indicate largely stable to decreasing concentrations for priority constituents and are consistent with reduced monitoring effort.

Moment Analysis

The results of the moment trend analyses are summarized below for the priority COCs. All bedrock wells were included in the analysis. As with the overburden, data were consolidated annually. Zeroth moments (estimates of total dissolved mass) for arsenic, benzene and chlorobenzene show decreasing to probably decreasing trends, indicating continued attenuation of COC concentrations after shut-down of the active remedy. Lead concentrations show no trend, due to higher variability in the data.

Type of Moment	Arsenic	Benzene	Chlorobenzene	Lead
Zeroth Moment	PD	D	D	NT
First Moment	S	PI	S	NT
Second Moment X	NT	I	NT	NT
Second Moment Y	S	I	S	S

Decreasing trend (D), Probably Decreasing trend (PD), Stable (S), Probably Increasing trend (PI), and Increasing trend (I); (NT) No Trend; (N/A) insufficient data to evaluate a trend.

Centers of mass over time for arsenic and benzene are shown on Figure 7. The first moment, or center of mass for arsenic is stable indicating that arsenic concentrations are decreasing uniformly across the network. The center of mass for benzene is probably increasing, however, the spatial variation in centers of mass over time is quite low relative to the size of the plume. All centers of mass for the bedrock network are close to well T-24-2/3.

2.2.3 Well Redundancy and Sufficiency

Redundancy

The well-redundancy analysis for the bedrock aquifer included a review of 22 wells. The bedrock aquifer was analyzed as one 2-dimensional slice. Average SFs calculated for arsenic and the MAROS recommendation for elimination from the network are shown in Table 6. Results of the qualitative analysis were combined with the results of statistical analyses to make a final recommendation for inclusion of each well in the network.

As in the overburden aquifer, the spatial analysis for the bedrock network indicates low variability and low uncertainty within the network. The general results of the spatial redundancy analysis indicate overall low SFs, with only 4 locations with SF for arsenic above 0.3 (T-62-3, T-33-4, T-99, and T-44-2). The results of the spatial redundancy analysis were considered along with the qualitative review of the function of the well in the network in order to make the final recommendation. Six locations were recommended for elimination from the network either due to MAROS recommendation (T-19-4 and T-100-2) or due to low SF and lack of sufficient monitoring rationale (T-38-2 and T-44-2) or insufficient recent data (T-29-3 and T-25-3). Sixteen bedrock locations are recommended for future monitoring. A summary of the recommended locations and monitoring rationales is provided in section 3.3.

Sufficiency

The well sufficiency analysis for the bedrock aquifer resulted in no recommendations for new monitoring locations. However, the algorithm is not designed to recommend locations outside of the current network. The extent of affected groundwater in the bedrock is not as well delineated as that in the overburden. Overburden locations HA-10 and HA-11 as well as T-63 are significantly downgradient of the 20-acre source and define the plume to the northwest at the boundary of the GMZ. The bedrock well T-99 monitors bedrock in the vicinity of the Nashua River; however, there are very few bedrock wells between locations HA-5-B, T-64-4, and T-48-5 and the Nashua River. In particular, the concentration of arsenic at the extent of the GMZ in bedrock is not known. A bedrock monitoring location in the area of HA-10 or HA-11 may provide important data for evaluating the regional geochemistry of arsenic and the extent of exceedance in the bedrock aquifer.

2.2.4 Sampling Frequency

The sampling history of the bedrock aquifer is similar to that of the overburden. The MAROS sampling frequency analysis was performed for locations with sufficient data (more than 4 recent sampling events). The final sampling frequency recommendation is based on both the quantitative rate of change estimates and a qualitative review based on the monitoring rationale of the location.

Of the 16 wells recommended for the final network, three are recommended for biennial sampling (every two years): T-32-4, G-42-2, and T-99. Wells recommended for biennial sampling function as POC or GMZ monitoring locations. Thirteen bedrock wells are recommended for annual sampling. A summary of locations, frequencies, and associated monitoring objectives as well as suggested data analysis strategies are located in section 3.3.

2.3 SUMMARY RESULTS

The final recommended monitoring network is summarized below and shown on Figure 8 and Table 6.

Monitoring locations have been recommended to address the monitoring objectives for delineating the plume, monitoring the GMZ boundary, assessing source attenuation and for monitoring the plume outside of the slurry wall for possible expansion. The recommended network contains 49 locations with an estimated average of 41 samples annually.

Overall results for the site indicate continued decreasing concentrations trends for COCs in most locations. In particular, arsenic concentrations appear to be strongly decreasing downgradient from the original source area. Statistical and qualitative results indicate a stable to shrinking plume in both bedrock and overburden aquifers during the time since cessation of the P&T remedy. Results are supportive of a reduction in monitoring effort for the site.

The table below summarizes the recommended monitoring network for the near future. As concentrations decrease with time, further reduction in monitoring effort may be appropriate.

Final Recommended Monitoring Network

Monitoring Objective	Recommended Wells		Number of Wells	Recommended Sampling Frequency	Recommended Statistical Analysis
	Overburden	Bedrock			
Monitor GMZ Boundary or Point of Compliance or Upgradient Location	HA-10-A HA-10-B HA-10-C HA-11-A HA-11-B HA-11-C HA-13-B HA-14 HA-9-A T-32-3 T-42-1 T-62-2 T-98	T-32-4 T-42-2 T-99 (possible new well)	16 (+1)	Biennial	Detection Monitoring, Comparison Compare detections with screening levels
Monitor GMZ Boundary or Point of Compliance	HA-4-B T-60-1 T-60-3	HA-4-A T-54-3	5	Annual	Detection Monitoring, Compare detections with screening levels
Sentry/Plume Attenuation	HA-5-A HA-5-C HA-7-B T-48-2 T-48-3 T-64-2 T-64-3	HA-5-B HA-7-A T-48-5 T-62-3 T-64-4	12	Annual	Statistical Trends; 95% UCL
Source Attenuation	T-12-1 T-13-1 T-13-2 T-13-3 T-19-1 T-24-1 T-27-1 T-33-1 T-8-1 T-8-2	T-12-4 T-13-4 T-24-2 T-24-3 T-33-4 T-8-3	16	Annual	Statistical Trends; Comparison with cleanup goals
TOTAL Wells			**49**		
TOTAL Samples Annually			**41**		

Note: The recommended statistical trend analysis is Mann-Kendall, 95% UCL= upper confidence limit.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Extensive remedial activities at the Gilson Road site have achieved groundwater cleanup standards set forth in the 1982 and 1983 RODs for the area within the containment wall. Extensive groundwater extraction and treatment has removed the overwhelming majority of VOC contaminants in groundwater. However, some residual contamination remains both within and outside of the slurry wall. While dissolved arsenic may not have been a major concern during the initial site investigation phase, arsenic is currently the major site COC in both the overburden and bedrock aquifers.

Arsenic concentrations have become more problematic both because regulatory screening levels have dropped from 50 µg/L to 10 µg/L (USEPA MCLs) and because changes in the geochemistry of the Gilson Road site may have enhanced desorption of arsenic from native sediments. Dissolved arsenic concentrations appear to result from a combination of historic waste disposal and geochemical conditions exacerbated by the installation and operation of the waste disposal and remedial systems. Part of the objective of the Gilson Road monitoring network is to evaluate regional arsenic geochemistry and the possible impact of both the Gilson Road site and the Four Hills Municipal Landfill on area ground and surface water.

Overall, arsenic concentrations are decreasing across the groundwater plume, both within the slurry wall and particularly downgradient of the slurry wall. A decreasing plume indicates that the monitoring effort may be reduced without loss of significant decision support metrics. Concentrations are also decreasing for benzene, chlorobenzene, and lead. Results for most other VOCs have dropped below detection limits. The center of mass of most of the constituent plumes is near well T-13 at the northern end of the containment area, where the majority of the monitoring effort is now centered.

Spatial redundancy and sufficiency analyses indicate very little spatial uncertainty in the plume and that the site has been well characterized by the number and location of the wells. Several locations are recommended for elimination from the routine monitoring program. No new locations are recommended for the overburden aquifer within the current network and only one possible downgradient POC/GMZ boundary well may be necessary for the bedrock aquifer. If the GMZ is expanded to encompass all groundwater currently above AGQC, additional overburden and bedrock wells may be required downgradient from HA-10 and cross-gradient from HA-5 and T-54.

Overall, statistical and qualitative analyses indicate that the sampling frequency can be reduced at most locations where concentrations are not changing rapidly. However, monitoring a consistent set of wells at regular intervals would provide a dataset that is easier to analyze and more robust to evaluate plume-wide trends and plume-wide progress toward cleanup goals.

Results and Recommendations

- *Result:* Site characterization and conceptual model development are comprehensive and explain significant site details. No significant data gaps were found. The current network is largely sufficient to support site management decisions. However, due to the age of the site and the format and distribution of historic documents, site data can be time-consuming to access.

Recommendation: Continue efforts to organize site data and transfer new and significant historical information to an electronic format. When possible, scan pages from historic site reports with boring logs, geologic cross sections, and remedial designs into electronic format.

- *Result:* The sampling frequency and number and identity of wells sampled have been variable over the last 5 to 10 years.

  Recommendation: Choose a specific set of wells and a regular sampling interval to institute over the next few years. A consistent set of wells sampled at regular intervals can provide important data for comparing site-wide trends over time and demonstrating site-wide compliance with cleanup goals. A consistent dataset will provide a higher level of confidence in statistical results.

- *Result:* Historic remedial activities have diminished the size of the plume and removed the majority of VOCs. Arsenic is currently the contaminant of concern (COC) that exceeds cleanup standards at the most locations and by the highest amount in both the overburden and bedrock aquifers.

  Recommendation: Optimize the groundwater monitoring network for arsenic and to a lesser extent, lead contamination. Continue to develop a regional conceptual model for arsenic fate and transport that includes possible contributions from changes in area geochemistry and the Four Hills Municipal Landfill.

- *Result:* Individual well trends and plume-wide trends indicate a stable to shrinking plume for all COCs in both geologic formations.

  Recommendation: Based on trend and stability analysis, reduction in monitoring effort is appropriate. With continued decreasing concentration trends, further reduction in monitoring effort, particularly in sampling frequency may be appropriate.

- *Result*: Concentration trends for chlorobenzene are increasing at a limited number of locations in the overburden aquifer, including one location outside of the slurry wall.

  Recommendation: Monitor chlorobenzene concentrations in the overburden area of HA-5, T-48 and T-64 nested locations outside of the slurry wall. Continue monitoring surface water in Lyle Reed Brook for chlorobenzene on an annual basis. If concentration trends continue to increase at T-64-2, consider monitoring the surface water semi-annually and outline possible triggers for installation of a contingent remedy for this location.

- *Result:* Well redundancy analysis indicates that networks in both aquifers can be reduced in number. Overall, the aquifers show low variability in concentrations.

  Recommendation: Several wells have been recommended for removal from the routine monitoring program for both the overburden and bedrock aquifers (see Table 6).

- *Result:* Well sufficiency analysis indicates very low spatial uncertainty in the plumes and that no new monitoring locations are required within the current networks. However, there is currently no bedrock monitoring location at the northwestern boundary of the GMZ, downgradient from locations that exceed standards for arsenic. Also, not all overburden wells bounding the GMZ have concentrations below AGQS.

  Recommendation: Install a new bedrock monitoring location in the vicinity of HA-10 or HA-11 to delineate arsenic impacts near the GMZ boundary. If the GMZ is modified, additional overburden wells may be necessary to delineate affected groundwater.

- *Result:* Sampling frequency can be reduced at many locations due to the low rate of concentration change, the limited likelihood of plume migration and the reduced need for frequent management decisions.

  Recommendation: Reduce the sampling frequency at many locations to biennial (every two years) and maintain annual sampling frequency within and just downgradient of the slurry wall for the next four years to confirm decreasing trends.

- *Result:* Concentrations of COCs are decreasing across the site. ACLs already have been met within the containment area, and the site is progressing toward attainment of all cleanup goals.

  Recommendation: Re-evaluate data needs in four years, and reduce both the number and frequency of sampling locations as appropriate for the designated land re-use.

Additional

While surface water and sediment sampling locations were not evaluated for this report, it is recommended that the locations indicated in the database be sampled annually, at roughly the same time as groundwater is sampled. Compliance with AWQC for arsenic, benzene and chlorobenzene should be confirmed along Lyle Reed Brook. Sampling for chlorobenzene downgradient from T-64-2 is particularly important as concentrations in this area are variable.

No recommendations have been made for a reduction in the analyte list for groundwater samples. The 2008 SAP indicates that some locations will only be sampled for arsenic and lead, and others for an expanded list of geochemical indicators. There is nothing in the analysis above that would counter-indicate this strategy and the approach appears reasonable.

4.0 REFERENCES

AFCEE (2004). Monitoring and Remediation Optimization Software User's Guide, Air Force Center for Environmental Excellence.

Aziz, J. A., C. J. Newell, et al. (2003). "MAROS: A Decision Support System for Optimizing Monitoring Plans." Ground Water 41(3): 355-367.

Backers, M. and M. Beljin (1996). Ground-Water Models of the Gilson Road Hazardous Waste Site. Ada, OK, US EPA RSKERL.

H&A (1994). Remedial Action Evaluation Study Gilson Road Superfund Site Nashua, New Hampshire. Concord, NH, New Hampshire Department of Environmental Services.

NHDES (2008). Sampling and Analysis Plan Gilson Road Superfund Site. Concord, NH, New Hampshire Department of Environmental Services.

USEPA (1982). Record of Decision: Sylvester. Washington D.C., US Environmental Protection Agency.

USEPA (1983). Record of Decision: Sylvester. Washington D.C., US Environmental Protection Agency.

USEPA (1990). Explanation of Significant Differences: Sylvester. Washington, D. C., US Environmental Protection Agency.

USEPA (1997). Sylvester/Gilson Road Superfund Site Verification of Attainment Phase. Boston, MA, US Environmental Protection Agency Region 1.

USEPA (2004). Five-Year Review Report: Third Five-Year Review Report for the Sylvester Superfund Site. Boston, US Environmental Protection Agency Region 1.

Weston (1989). Remedial Program Evaluation Gilson Road Site, Nashua, New Hampshire. Concord, New Hampshire, Roy F. Weston.

Groundwater Monitoring Network Optimization
Gilson Road Superfund Site

Nashua, New Hampshire

TABLES

TABLE 1
GILSON ROAD MONITORING WELL NETWORK

Long-Term Monitoring Optimization
Gilson Road Superfund Site, Nashua, New Hampshire

Well Name	Interior or Exterior of Slurry Wall	Screened Interval (FT below TOC)	Total Depth (FT below TOC)	Minimum Sample Date	Maximum Sample Date	Number of Samples 1999 - 2009	Priority Constituent	Above or Below AGQS
Overburden Locations								
HA-10-A	Exterior			12/1/1999	2/27/2009	10	ARSENIC	Below
HA-10-B	Exterior			12/1/1999	2/27/2009	11	ARSENIC	Below
HA-10-C	Exterior			11/29/1999	2/27/2009	11	ARSENIC	Above
HA-11-A	Exterior			12/1/1999	3/4/2009	11	LEAD	Below
HA-11-B	Exterior			12/1/1999	3/4/2009	11	ARSENIC	Below
HA-11-C	Exterior			11/29/1999	3/16/2009	11	ARSENIC	Below
HA-12-A	Exterior			6/2/2005	3/10/2009	3	ARSENIC	Below
HA-12-B	Exterior			6/2/2005	3/10/2009	3	None	Below
HA-12-C	Exterior			6/2/2005	3/10/2009	3	None	Below
HA-13-B	Exterior			12/2/1999	3/17/2009	12	ARSENIC	Above
HA-14	Exterior			12/2/1999	3/16/2009	10	ARSENIC	Above
HA-4-B	Exterior	24	29	7/25/2003	3/9/2009	6	LEAD	Below
HA-5-A	Exterior	50	55	12/3/1999	3/5/2009	14	ARSENIC	Above
HA-5-C	Exterior	20	25	12/3/1999	3/5/2009	13	ARSENIC	Above
HA-7-B	Exterior	5	15	12/3/1999	3/10/2009	9	ARSENIC	Above
HA-9-A	Exterior	96	112.2	12/2/1999	3/16/2009	11	ARSENIC	Below
T-100-1	Exterior			12/1/2000	3/17/2009	11	LEAD	Above
T-12-1	Interior	19	29	12/9/1999	3/6/2009	14	ARSENIC	Above
T-12-3	Interior		55	12/9/1999	4/25/2002	7	ARSENIC	Above
T-13-1	Interior	15	25	12/10/1999	3/6/2009	16	ARSENIC	Above
T-13-2	Interior		39	12/10/1999	3/12/2009	14	ARSENIC	Above
T-13-3	Interior		55	12/10/1999	3/12/2009	15	ARSENIC	Above
T-18-1	Interior	10	20	12/10/1999	3/6/2009	4	ARSENIC	Above
T-18-2	Interior		40	12/10/1999	4/12/2000	2	ARSENIC	Above
T-18-3	Interior		65	12/10/1999	4/12/2000	2	ARSENIC	Above
T-19-1	Interior	5	15	12/10/1999	3/6/2009	11	ARSENIC	Above
T-19-3	Interior		50	12/10/1999	3/12/2009	8	LEAD	Above
T-24-1	Interior		0	12/8/1999	3/6/2009	16	ARSENIC	Above
T-25-1	Interior	28	38	12/8/1999	3/6/2009	9	ARSENIC	Above
T-25-2	Interior		48	12/8/1999	4/25/2002	7	ARSENIC	Above
T-27-1	Interior			12/7/1999	3/10/2009	8	ARSENIC	Above
T-32-3	Exterior		65	12/6/1999	3/12/2009	11	ARSENIC	Below
T-33-1	Interior	17.5	27.5	12/7/1999	3/9/2009	15	ARSENIC	Above
T-33-2	Interior		45	12/7/1999	6/9/2005	10	METHYLENE CHLORIDE	Above
T-34-1	Interior	25	35	12/6/1999	3/9/2009	12	ARSENIC	Above
T-42-1	Exterior	17	27	7/28/2003	3/9/2009	6	ARSENIC	Below
T-44-1	Exterior	15	25	7/16/2003	3/6/2009	6	ARSENIC	Above
T-47	Exterior	1.2	6.2	12/6/1999	3/9/2009	8	ARSENIC	Above
T-48-2	Exterior	32	37	12/6/1999	3/10/2009	15	ARSENIC	Above
T-48-3	Exterior	62	67	12/6/1999	3/10/2009	16	ARSENIC	Above
T-48-4	Exterior		85.5	12/6/1999	3/12/2009	8	ARSENIC	Above
T-54-2	Exterior		43	7/16/2003	3/13/2009	6	ARSENIC	Above
T-58	Exterior			12/2/1999	3/16/2009	7	CHLOROFORM	Below
T-60-1	Exterior	3	8	12/2/1999	3/9/2009	13	1,4-DIOXANE	Above
T-60-3	Exterior	36.5	38	12/2/1999	3/17/2009	13	LEAD	Above
T-61	Exterior			12/2/1999	3/13/2009	13	LEAD	Above
T-62-2	Exterior	28.5	30	10/18/2000	3/13/2009	9	LEAD	Above
T-63-1	Exterior	13.3	18.3	12/2/1999	3/4/2009	10	ARSENIC	Above
T-64-2	Exterior	33.8	38.8	12/2/1999	3/4/2009	8	ARSENIC	Above
T-64-3	Exterior	64.8	69.8	12/2/1999	4/24/2002	7	ARSENIC	Above
T-8-1	Interior	10	20	12/9/1999	3/6/2009	7	ARSENIC	Above
T-8-2	Interior		38.2	12/9/1999	3/13/2009	7	ARSENIC	Above
T-97	Exterior			7/23/2003	6/9/2005	4	None	Below
T-98	Exterior	11.5	14	7/23/2003	3/9/2009	6	CHLOROFORM	Below

See notes end of table

TABLE 1
GILSON ROAD MONITORING WELL NETWORK

Long-Term Monitoring Optimization
Gilson Road Superfund Site, Nashua, New Hampshire

Well Name	Interior or Exterior of Slurry Wall	Screened Interval (FT below TOC)	Total Depth (FT below TOC)	Minimum Sample Date	Maximum Sample Date	Number of Samples 1999 - 2009	Priority Constituent	Above or Below AGQS
Bedrock Locations								
HA-4-A	Exterior	49.3		7/25/2003	3/16/2009	6	ARSENIC	Above
HA-5-B	Exterior	77.2		12/3/1999	3/5/2009	18	ARSENIC	Above
HA-7-A	Exterior			12/3/1999	3/10/2009	14	ARSENIC	Above
T-100-2	Exterior			12/1/2000	3/17/2009	11	ARSENIC	Above
T-12-4	Interior		70	12/9/1999	3/12/2009	17	ARSENIC	Above
T-13-4	Interior		66.7	12/10/1999	3/12/2009	9	ARSENIC	Above
T-19-4	Interior		64	12/10/1999	3/12/2009	13	ARSENIC	Above
T-24-2	Interior		60	12/8/1999	3/13/2009	8	ARSENIC	Above
T-24-3	Interior		95.2	12/8/1999	3/13/2009	8	ARSENIC	Above
T-25-3	Interior		62.6	12/8/1999	4/25/2002	7	ARSENIC	Above
T-29-3	Interior		79.75	12/7/1999	3/13/2009	9	ARSENIC	Above
T-32-4	Exterior		89	12/6/1999	3/12/2009	13	LEAD	Above
T-33-4	Interior		81	12/7/1999	7/18/2006	13	ARSENIC	Above
T-38-2	Exterior		47.9	12/7/1999	3/17/2009	9	ARSENIC	Above
T-42-2	Exterior		40.33	7/28/2003	6/9/2005	4	ARSENIC	Below
T-44-2	Exterior		38.4	7/16/2003	3/13/2009	6	LEAD	Above
T-48-5	Exterior		97	12/6/1999	5/5/2004	10	ARSENIC	Above
T-54-3	Exterior		60	7/16/2003	3/13/2009	6	ARSENIC	Above
T-62-3	Exterior	44	45.5	10/18/2000	3/13/2009	9	LEAD	Above
T-64-4	Exterior		97.5	12/2/1999	3/17/2009	10	ARSENIC	Above
T-8-3	Interior		60.9	12/9/1999	3/13/2009	16	ARSENIC	Above
T-99	Exterior	26.5	29	7/23/2003	3/9/2009	6	ARSENIC	Below

Notes:
1. Well screened intervals, locations and sample history from the Weston database, 2009.
2. AGQS = Ambient Groundwater Quality Standard for New Hampshire (see Table 2).
3. Priority constituent determined by normalizing historic maximum concentrations by the AGQS.
   The constituent with the highest concentration to screening level ratio is the priority COC for the well.
4. Above = Locations with maximum concentrations of any constituent over the AGQS data 1999 - 2009.

TABLE 2
PRIORITY CONSTITUENTS, SCREENING LEVELS AND MAXIMUM RECENT CONCENTRATIONS

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

Constituent	ACL [ug/L]	AGQS [ug/L]	MCL [ug/L]	Maximum Concentration Spring 2009
1,1,1-Trichloroethane (TCA)	200	200	200	50
1,1,2-Trichloroethane	3	5	5	
1,1-Dichloroethane	81	81		27
1,2-Dichloroethane	1800	15	5	
Benzene	340	5	5	42
Chlorobenzene	110	100	100	316
Chloroform	1505	70		4.8
Lead		15	15	84.2
Methyl Ethyl Ketone (2-Butanone)	8000	4000		
Methyl Methacrylate	350			
Methylene Chloride	12250	5	5	
Phenols	400	4000		
Selenium	2.6	50	50	
Tetrachloroethene (PCE)	57	5	5	17
Toluene	2900	1000	1000	1890
Trichloroethene (TCE)	1500	5	5	100
Vinyl Chloride	95	2	2	5.3
Arsenic		10	10	1010
1,4-Dioxane		3		82

Notes:
1. ACL = Alternate Concentration Limits from 1982 ROD modified in 2002 ESD (EPA, 2002).
2. AGQS = State of New Hampshire Ambient Groundwater Quality Standards.
3. MCL = US EPA Maximum Contaminant Level.
4. Arsenic and 1,4-Dioxane were not identified in the ROD as contaminants of concern, but exist at the site above NH screening levels.
5. Maximum concentrations from site-wide data collected in Februray to March 2009.

TABLE 3
AQUIFER INPUT PARAMETERS

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

Parameter	Value	Units
Porosity(n)	0.3	
Seepage velocity	365	ft/yr
Plume Thickness	20	ft
Plume Length	1500	ft
Plume Width	650	ft
Distance to Receptors (Lyle Reed Brook)	1500	ft
GWFluctuations	Yes	--
SourceTreatment	Cap and slurry wall/historic pump and treat	--
Contaminant Type	Chlorinated solvents/metals	--
NAPLPresent	No	--
Groundwater flow direction (N/NW)	N/NW	135
Source Location near Well	T-33-1	--
Source X-Coordinate	1023045	ft
Source Y-Coordinate	79861.84	ft
Coordinate System	NAD 83 SP New Hampshire	
Non-detect values	Set to lowest detection limit	

Notes:
1. Aquifer data from Weston, 1989 and Haley and Aldrich, 1994.
2. Data above were used for both overburden and bedrock aquifers.

TABLE 4
TREND SUMMARY RESULTS OVERBURDEN AQUIFER

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Result 1999 - 2009 [ug/L]	Max Result Above Standard?	Average Result 1999 - 2009 [ug/L]	Average Result Above Standard?	Mann-Kendall Trend	Linear Regression Trend
ARSENIC									
HA-10-A	9	7	78%	2.2	No	1.38	No	S	S
HA-10-B	9	1	11%	1.1	No	1.01	No	S	D
HA-10-C	9	9	100%	**50.3**	**Yes**	**38.70**	**Yes**	NT	NT
HA-11-A	9	8	89%	3.8	No	2.58	No	S	S
HA-11-B	9	1	11%	1.4	No	1.04	No	S	S
HA-11-C	9	5	56%	7.1	No	2.21	No	D	D
HA-12-A	1	1	100%	6.4	No	6.40	No	N/A	N/A
HA-12-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-12-C	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-13-B	10	6	60%	**10.9**	**Yes**	3.19	No	S	NT
HA-14	1	1	100%	**14**	**Yes**	**14**	**Yes**	N/A	N/A
HA-4-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-5-A	11	11	100%	**796**	**Yes**	**675**	**Yes**	D	D
HA-5-C	10	10	100%	**580**	**Yes**	**542**	**Yes**	D	D
HA-7-B	8	8	100%	**198**	**Yes**	**66**	**Yes**	NT	NT
HA-9-A	1	1	100%	2.2	No	2.15	No	N/A	N/A
T-100-1	9	3	33%	**18.3**	**Yes**	4.29	No	NT	NT
T-12-1	10	10	100%	**496**	**Yes**	**378**	**Yes**	D	D
T-12-3	6	6	100%	**889**	**Yes**	**786**	**Yes**	NT	NT
T-13-1	11	11	100%	**399**	**Yes**	**218**	**Yes**	D	D
T-13-2	11	11	100%	**633**	**Yes**	**572**	**Yes**	S	S
T-13-3	11	11	100%	**1400**	**Yes**	**965**	**Yes**	D	D
T-18-1	1	1	100%	**395**	**Yes**	**395**	**Yes**	N/A	N/A
T-19-1	8	8	100%	**114**	**Yes**	**52.7**	**Yes**	D	D
T-19-3	7	7	100%	4.2	No	2.66	No	NT	PI
T-24-1	11	11	100%	**605.0**	**Yes**	**524**	**Yes**	D	D
T-25-1	7	7	100%	**759.0**	**Yes**	**604**	**Yes**	S	S
T-25-2	6	6	100%	**805.0**	**Yes**	**682**	**Yes**	NT	PI
T-27-1	1	1	100%	**136.0**	**Yes**	**136**	**Yes**	N/A	N/A
T-32-3	9	4	44%	3.6	No	1.66	No	D	D
T-33-1	10	10	100%	**705**	**Yes**	**149**	**Yes**	D	D
T-33-2	8	3	38%	1.5	No	1.11	No	S	S
T-34-1	10	10	100%	**2120**	**Yes**	**347**	**Yes**	D	D
T-42-1	1	1	100%	1.2	**No**	1.20	No	N/A	N/A
T-44-1	1	1	100%	**28.9**	**Yes**	**29**	**Yes**	N/A	N/A
T-47	7	7	100%	**627**	**Yes**	**342**	**Yes**	S	D
T-48-2	11	11	100%	**693**	**Yes**	**550**	**Yes**	D	D
T-48-3	11	11	100%	**703**	**Yes**	**517**	**Yes**	PD	D
T-48-4	7	7	100%	**685**	**Yes**	**566**	**Yes**	PD	D
T-54-2	1	1	100%	**18.1**	**Yes**	**18**	**Yes**	N/A	N/A
T-58	6	0	0%	ND	ND	ND	ND	ND	ND
T-60-1	11	8	73%	3.5	No	1.79	No	D	D
T-60-3	11	11	100%	**30.4**	**Yes**	**11**	**Yes**	D	S
T-61	11	10	91%	9.7	No	2.09	No	D	NT
T-62-2	7	3	43%	1.9	No	1.23	No	S	PD
T-63-1	8	8	100%	**1870**	**Yes**	**963**	**Yes**	D	D
T-64-2	7	7	100%	**1050**	**Yes**	**852**	**Yes**	S	S
T-64-3	6	6	100%	**843**	**Yes**	**679**	**Yes**	D	D
T-8-1	6	6	100%	**455**	**Yes**	**368**	**Yes**	S	S
T-8-2	6	6	100%	**401**	**Yes**	**251**	**Yes**	S	S
T-98	1	0	0%	ND	ND	ND	ND	N/A	N/A

See notes end of table

TABLE 4
TREND SUMMARY RESULTS OVERBURDEN AQUIFER

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Result 1999 - 2009 [ug/L]	Max Result Above Standard?	Average Result 1999 - 2009 [ug/L]	Average Result Above Standard?	Mann-Kendall Trend	Linear Regression Trend
Benzene									
HA-10-A	7	0	0%	ND	ND	ND	ND	ND	ND
HA-10-B	7	0	0%	ND	ND	ND	ND	ND	ND
HA-10-C	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-A	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-B	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-C	7	0	0%	ND	ND	ND	ND	ND	ND
HA-12-A	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-12-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-12-C	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-13-B	9	0	0%	ND	ND	ND	ND	ND	ND
HA-14	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-4-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-5-A	11	11	100%	**11**	**Yes**	**7**	**Yes**	D	D
HA-5-C	11	11	100%	**7.3**	**Yes**	**5**	**Yes**	S	D
HA-7-B	4	0	0%	ND	ND	ND	ND	ND	ND
HA-9-A	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-100-1	9	0	0%	ND	ND	ND	ND	ND	ND
T-12-1	11	9	82%	**6.1**	**Yes**	3.42	No	S	S
T-12-3	6	6	100%	**9.8**	**Yes**	**6**	**Yes**	PD	D
T-13-1	11	4	36%	**5.2**	**Yes**	3	No	PD	D
T-13-2	11	11	100%	**30**	**Yes**	**15**	**Yes**	D	D
T-13-3	11	11	100%	**36**	**Yes**	**21**	**Yes**	D	D
T-19-1	4	0	0%	ND	ND	ND	ND	ND	ND
T-19-3	6	2	33%	**7.4**	**Yes**	3.17	No	PD	D
T-24-1	11	11	100%	**26**	**Yes**	**18.80**	**Yes**	S	S
T-25-1	7	7	100%	**51.0**	**Yes**	**28**	**Yes**	S	D
T-25-2	6	6	100%	**23.0**	**Yes**	**13**	**Yes**	S	D
T-27-1	1	1	100%	**5.7**	**Yes**	**5.7**	**Yes**	N/A	N/A
T-32-3	9	0	0%	ND	ND	ND	ND	ND	ND
T-33-1	11	6	55%	**8.2**	**Yes**	3.49	No	D	D
T-33-2	4	1	25%	2.2	No	2	No	NT	NT
T-34-1	9	1	11%	27	Yes	4.78	No	NT	NT
T-42-1	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-44-1	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-47	5	0	0%	ND	ND	ND	ND	ND	ND
T-48-2	11	10	91%	**7.8**	**Yes**	**5**	**Yes**	S	D
T-48-3	11	11	100%	**8.9**	**Yes**	**6**	**Yes**	S	D
T-48-4	7	7	100%	**8.4**	**Yes**	**6**	**Yes**	NT	D
T-54-2	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-58	5	0	0%	ND	ND	ND	ND	ND	ND
T-60-1	9	2	22%	2.2	No	2.03	No	S	S
T-60-3	9	1	11%	2.2	No	2.02	No	S	D
T-61	9	2	22%	2.9	No	2	No	S	S
T-62-2	7	0	0%	ND	ND	ND	ND	ND	ND
T-63-1	8	7	88%	8.7	Yes	4.76	No	PD	PD
T-64-2	7	7	100%	**13**	**Yes**	**6**	**Yes**	NT	S
T-64-3	5	1	20%	4.4	No	2	No	S	PD
T-8-1	7	6	86%	**42**	**Yes**	**25**	**Yes**	S	NT
T-8-2	7	7	100%	**55**	**Yes**	**28.1**	**Yes**	S	S
T-98	1	0	0%	ND	ND	ND	ND	N/A	N/A

See notes end of table

TABLE 4
TREND SUMMARY RESULTS OVERBURDEN AQUIFER

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Result 1999 - 2009 [ug/L]	Max Result Above Standard?	Average Result 1999 - 2009 [ug/L]	Average Result Above Standard?	Mann-Kendall Trend	Linear Regression Trend
Chlorobenzene									
HA-10-A	7	0	0%	ND	ND	ND	ND	ND	ND
HA-10-B	7	0	0%	ND	ND	ND	ND	ND	ND
HA-10-C	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-A	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-B	7	0	0%	ND	ND	ND	ND	ND	ND
HA-11-C	7	0	0%	ND	ND	ND	ND	ND	ND
HA-12-A	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-12-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-12-C	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-13-B	9	0	0%	ND	ND	ND	ND	ND	ND
HA-14	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-4-B	1	0	0%	ND	ND	ND	ND	N/A	N/A
HA-5-A	11	11	100%	**160**	**Yes**	**130**	**Yes**	D	S
HA-5-C	11	11	100%	**130**	**Yes**	**104**	**Yes**	S	S
HA-7-B	4	2	50%	7	No	4	No	S	S
HA-9-A	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-100-1	9	0	0%	ND	ND	ND	ND	ND	ND
T-12-1	11	11	100%	**118**	**Yes**	72.8	No	D	S
T-12-3	6	6	100%	90	No	77	No	NT	PI
T-13-1	11	11	100%	87	No	49	No	NT	I
T-13-2	11	11	100%	**123**	**Yes**	68	No	NT	NT
T-13-3	11	11	100%	**150**	**Yes**	67	No	I	I
T-19-1	5	5	100%	28	No	14.6	No	S	S
T-19-3	6	6	100%	36	No	13.1	No	I	I
T-24-1	11	11	100%	**470**	**Yes**	**219.00**	**Yes**	PD	S
T-25-1	7	7	100%	**168.0**	**Yes**	75	No	S	NT
T-25-2	6	6	100%	16.0	No	10	No	S	S
T-27-1	1	1	100%	23.0	No	23	No	N/A	N/A
T-32-3	9	0	0%	ND	ND	ND	ND	ND	ND
T-33-1	11	11	100%	26	No	12.60	No	D	D
T-33-2	4	0	0%	ND	ND	ND	ND	ND	ND
T-34-1	9	0	0%	ND	ND	ND	ND	ND	ND
T-42-1	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-44-1	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-47	5	3	60%	20	No	8	No	NT	S
T-48-2	11	11	100%	**110**	**Yes**	70	No	S	D
T-48-3	11	11	100%	**142**	**Yes**	79	No	S	PD
T-48-4	7	7	100%	**110**	**Yes**	84	No	NT	S
T-54-2	1	0	0%	ND	ND	ND	ND	N/A	N/A
T-58	5	0	0%	ND	ND	ND	ND	ND	ND
T-60-1	11	11	100%	54	No	36.40	No	S	S
T-60-3	11	11	100%	59	No	30.40	No	S	S
T-61	11	11	100%	60	No	34	No	S	S
T-62-2	7	0	0%	ND	ND	ND	ND	ND	ND
T-63-1	8	8	100%	**120**	**Yes**	82.10	No	S	S
T-64-2	7	7	100%	**110**	**Yes**	72	No	I	NT
T-64-3	6	6	100%	25	No	16	No	D	D
T-8-1	7	7	100%	88	No	26	No	NT	NT
T-8-2	7	7	100%	32	No	21.4	No	PD	NT
T-98	1	0	0%	ND	ND	ND	ND	N/A	N/A

Notes

1. Trends were evaluated for data collected between 1999 and 2009.
2. Number of Samples is the number of samples for the compound at this location 1999 -2009.
   Number of Detects is the number of times the compound has been detected for data 1999 - 2009.
3. Maximum Result is the maximum concentration for the COC analyzed between 1999 and 2009.
4. Screening level Arsenic = 10 ug/L; Benzene = 5 ug/L; Chlorobenzene = 100 ug/L.
5. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC; INT = Intermittent detections <30% detection frequency.
6. Mann-Kendall trend results for arsenic are illustrated on Figure 3.

TABLE 5
TREND SUMMARY RESULTS BEDROCK AQUIFER

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Result 1999 - 2009 [ug/L]	Max Result Above Standard?	Average Result 1999 - 2009 [ug/L]	Average Result Above Standard?	Mann-Kendall Trend	Linear Regression Trend
ARSENIC									
HA-4-A	1	1	100%	**559**	**Yes**	**559**	**Yes**	N/A	N/A
HA-5-B	11	11	100%	**853**	**Yes**	**718**	**Yes**	D	D
HA-7-A	11	11	100%	**656**	**Yes**	**534**	**Yes**	D	D
T-100-2	9	9	100%	**18.1**	**Yes**	8.33	No	D	D
T-12-4	11	11	100%	**1030**	**Yes**	**850**	**Yes**	D	D
T-13-4	7	7	100%	**1730**	**Yes**	**1470**	**Yes**	S	D
T-19-4	11	11	100%	**183**	**Yes**	**158**	**Yes**	S	D
T-24-2	7	7	100%	**947**	**Yes**	**834**	**Yes**	PD	D
T-24-3	7	7	100%	**96.6**	**Yes**	**84**	**Yes**	D	D
T-25-3	6	6	100%	**1150**	**Yes**	**888**	**Yes**	S	S
T-29-3	6	6	100%	**429**	**Yes**	**347**	**Yes**	S	D
T-32-4	10	10	100%	**14.9**	**Yes**	8.31	No	PD	S
T-33-4	9	9	100%	**20.2**	**Yes**	**16**	**Yes**	I	I
T-38-2	1	1	100%	**10.6**	**Yes**	**11**	**Yes**	N/A	N/A
T-44-2	1	1	100%	1	No	1	No	N/A	N/A
T-48-5	8	8	100%	**1170**	**Yes**	**854**	**Yes**	D	D
T-54-3	1	1	100%	**419**	**Yes**	**419**	**Yes**	N/A	N/A
T-62-3	7	3	43%	**160**	**Yes**	**39.2**	**Yes**	NT	NT
T-64-4	8	8	100%	**929**	**Yes**	**574**	**Yes**	D	D
T-8-3	10	10	100%	**781**	**Yes**	**688**	**Yes**	S	S
T-99	1	1	100%	2.1	No	2	No	N/A	N/A
Benzene									
HA-4-A	1	0	0%	ND	ND	ND	ND	ND	ND
HA-5-B	11	11	100%	**11**	**Yes**	**7.14**	**Yes**	D	D
HA-7-A	11	4	36%	2.5	No	2.08	No	S	S
T-100-2	9	0	0%	ND	ND	ND	ND	ND	ND
T-12-4	11	11	100%	**22**	**Yes**	**9.53**	**Yes**	D	D
T-13-4	7	7	100%	**37**	**Yes**	**27.70**	**Yes**	D	D
T-19-4	7	0	0%	ND	ND	ND	ND	ND	ND
T-24-2	6	6	100%	**30**	**Yes**	**13.70**	**Yes**	S	S
T-24-3	7	6	86%	**41**	**Yes**	**18.40**	**Yes**	D	D
T-25-3	6	6	100%	**16**	**Yes**	**9.93**	**Yes**	D	D
T-29-3	7	7	100%	**12**	**Yes**	**9**	**Yes**	S	S
T-32-4	11	5	45%	4.4	No	2.61	No	PD	PD
T-33-4	9	1	11%	**5.3**	**Yes**	2	No	S	PD
T-38-2	1	0	0%	ND	ND	ND	ND	ND	ND
T-44-2	1	0	0%	ND	ND	ND	ND	ND	ND
T-48-5	8	8	100%	**10**	**Yes**	**6.55**	**Yes**	PD	S
T-54-3	1	1	100%	**24**	**Yes**	**24**	**Yes**	N/A	N/A
T-62-3	7	0	0%	ND	ND	ND	ND	ND	ND
T-64-4	8	4	50%	**6.5**	**Yes**	4	No	S	S
T-8-3	11	11	100%	**25**	**Yes**	**12**	**Yes**	D	PD
T-99	1	0	0%	ND	ND	ND	ND	ND	ND

See notes end of table

TABLE 5
TREND SUMMARY RESULTS BEDROCK AQUIFER

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site, Nashua, New Hampshire

WellName	Number of Samples	Number of Detects	Percent Detection	Maximum Result 1999 - 2009 [ug/L]	Max Result Above Standard?	Average Result 1999 - 2009 [ug/L]	Average Result Above Standard?	Mann-Kendall Trend	Linear Regression Trend
Chlorobenzene									
HA-4-A	1	0	0%	ND	ND	ND	ND	ND	ND
HA-5-B	11	11	100%	**140**	**Yes**	**119**	**Yes**	PD	D
HA-7-A	11	11	100%	49	No	29.1	No	D	D
T-100-2	9	0	0%	ND	ND	ND	ND	ND	ND
T-12-4	11	11	100%	**135**	**Yes**	92.2	No	PD	PD
T-13-4	6	6	100%	89	No	52.5	No	S	I
T-19-4	7	1	14%	11	No	3.29	No	NT	NT
T-24-2	6	6	100%	18	No	15.7	No	S	S
T-24-3	5	1	20%	11	No	3.8	No	NT	NT
T-25-3	6	6	100%	13	No	8.72	No	NT	NT
T-29-3	6	6	100%	11	No	8	No	S	PD
T-32-4	9	0	0%	ND	ND	ND	ND	ND	ND
T-33-4	8	0	0%	ND	ND	ND	ND	ND	ND
T-38-2	1	0	0%	ND	ND	ND	ND	ND	ND
T-44-2	1	0	0%	ND	ND	ND	ND	ND	ND
T-48-5	8	8	100%	**110**	**Yes**	92.5	No	NT	D
T-54-3	1	1	100%	15	No	15	No	N/A	N/A
T-62-3	7	0	0%	ND	ND	ND	ND	ND	ND
T-64-4	8	8	100%	63	No	49	No	NT	I
T-8-3	11	11	100%	34	No	17	No	D	PD
T-99	1	0	0%	ND	ND	ND	ND	ND	ND
Lead									
HA-4-A	1	0	0%	ND	ND	ND	ND	ND	ND
HA-5-B	10	1	10%	1.7	No	1.07	No	S	S
HA-7-A	10	0	0%	ND	ND	ND	ND	ND	ND
T-100-2	9	1	11%	2	No	1.11	No	S	S
T-12-4	11	2	18%	2.2	No	1.21	No	S	PD
T-13-4	7	6	86%	13.3	No	7.15	No	S	S
T-19-4	10	4	40%	4.8	No	1.67	No	S	S
T-24-2	7	5	71%	**23.6**	**Yes**	13.10	No	S	S
T-24-3	7	6	86%	**45.4**	**Yes**	**22.90**	**Yes**	S	S
T-25-3	6	5	83%	**241**	**Yes**	**119**	**Yes**	NT	S
T-29-3	6	5	83%	5.6	No	3	No	NT	S
T-32-4	10	10	100%	**83.3**	**Yes**	**21.20**	**Yes**	D	D
T-33-4	9	7	78%	6.2	No	3	No	D	D
T-38-2	1	1	100%	3.1	No	3	No	N/A	N/A
T-44-2	1	1	100%	**29.2**	**Yes**	**29**	**Yes**	N/A	N/A
T-48-5	8	5	63%	**106**	**Yes**	**35.20**	**Yes**	NT	D
T-54-3	1	1	100%	4.1	No	4.10	No	N/A	N/A
T-62-3	8	8	100%	**890**	**Yes**	**191**	**Yes**	NT	NT
T-64-4	8	5	63%	**47.7**	**Yes**	**22**	**Yes**	S	NT
T-8-3	10	5	50%	7.8	No	3	No	PD	S
T-99	1	0	0%	ND	ND	ND	ND	ND	ND

Notes
1. Trends were evaluated for data collected between 1999 and 2009.
2. Number of Samples is the number of samples for the compound at this location 1999 -2009.
   Number of Detects is the number of times the compound has been detected for data 1999 - 2009.
3. Maximum Result is the maximum concentration for the COC analyzed between 1999 and 2009.
4. Screening level Arsenic = 10 ug/L; Benzene = 5 ug/L; Chlorobenzene = 100 ug/L.
5. D = Decreasing; PD = Probably Decreasing; S = Stable; PI = Probably Increasing; I = Increasing; N/A = Insufficient Data to determine trend;
   NT = No Trend; ND = well has all non-detect results for COC; INT = Intermittent detections <30% detection frequency.
6. Mann-Kendall trend results are illustrated on Figures 3 and 4.
7. Well locations are shown on Figure 7.

TABLE 6
FINAL RECOMMENDED MONITORING NETWORK

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

	Lines of Evidence				
Well Name	**Mann Kendall Trends Arsenic**	**Average SF Arsenic**	**Monitoring Rationale**	**MAROS Recommendation**	**Final Recommended Frequency**
OVERBURDEN					
HA-10-A	S	N/A	**Monitors** overburden west of Lyle Reed Brook in neighborhood on the edge of the GMZ. POC locations for area farthest west downgradient of Gilson Road Site. HA-10C exceeds standards for arsenic, but no other COCs are detected.	Recommended for inclusion in network.	Biennial
HA-10-B	S	N/A			Biennial
HA-10-C	NT	0.17			Biennial
HA-11-A	S	N/A	**Monitors** overburden northwest of Lyle Reed Brook in neighborhood on the edge of the GMZ. POC locations for area fratherst northwest downgradient of Gilson Road Site. HA-11C has detected concentrations for arsenic and lead, but does not exceed standards.	Recommended for inclusion in network.	Biennial
HA-11-B	S	N/A			Biennial
HA-11-C	D	0.50			Biennial
HA-12-A	N/A	0.00	Monitors overburden near discharge of Lyle Reed Brook to Nashua River - no exceedances of site COCS	Recommended for removal for arsenic and benzene network by software. Redundant with upgradient locations T-60-1, and T-62-1/2/3.	Eliminate
HA-12-B	N/A	N/A			Eliminate
HA-12-C	N/A	N/A			Eliminate
HA-13-B	S	0.42	Monitors overburden east of site in adjacent neighborhood. Detected concentrations of lead and arsenic. Functions as POC well and alternate point of exposure for potential receptor in the residential area.	Redommended for inclusion in the network	Biennial
HA-14	N/A	0.53	Co-located with well T-58. Limited sample data, arsenic detected.	Recommended for removal for lead and inclusion for arsenic.	Biennial
HA-4-B	N/A	0.64	Monitors overburden just southwest of slurry wall. Limited recent sampling data show no detections. Functions as POC location to monitor GMZ and confirm containment of plume within slurry wall. Redundant with T-54-2	Recommended for inclusion in network.	Annual
HA-5-A	D	0.06	Monitors area just outside of slurry wall on the northwest side. Near high concentration areas within slurry wall. Monitors passage of constituents through slurry wall. Functions as a POC for the GMZ and sentry well for possible discharge to Lyle Reed Brook.	Recommended by software for removal for arsenic, chlorobenzene and lead network. Near wells T-12-1/3 inslude slurry wall.	Annual
HA-5-C	D	N/A			Annual
HA-7-B	NT	0.10	Monitors area just outside of slurry wall on northern end of containment area. Only monitored for metals. Like HA-5A/C, functions as sentry well between slurry wall and Lyle Reed Brook.	Recommended by software for removal for arsenic and lead. Adjacent to T-18-1 and T-19-1/3 inside of slurry wall.	Annual
HA-9-A	N/A	0.08	Monitors neighborhood downgradient from Four Hills Landfill. Significant for regional groundwater quality, does not directly monitor Gilson Road Site.	Software recommends retention as outer hull well.	Biennial

See notes end of table

TABLE 6
FINAL RECOMMENDED MONITORING NETWORK

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

	Lines of Evidence				
Well Name	**Mann Kendall Trends Arsenic**	**Average SF Arsenic**	**Monitoring Rationale**	**MAROS Recommendation**	**Final Recommended Frequency**
T-100-1	NT	0.18	Monitors area downgradient from Lyle Reed Brook; a non-detect location for VOC. Adjacent to T-62-2.	Recommended by software for removal for arsenic .	Eliminate
T-12-1	D	0.06	Monitors overburden inside slurry wall on northwest. Functions as source monitoring location. Exceedances for arsenic and benzene. T-12-3 not sampled in the recent time frame.	Recommended by software for removal for arsenic, chlorobenzene and lead network. Adjacent to HA-5A/C, but separated by slurry wall.	Annual
T-12-3	NT	N/A		No recent data for location. Presumed removed from network.	Eliminate
T-13-1	D	N/A	Monitors overburden inside slurry wall in center. Located near center of mass of the plumes. Monitors high concentration source area. Exceeds standards for arsenic, 1,4-dioxane, benzene, lead and vinly chloride.	Recommended by software for removal for arsenic, chlorobenzene and lead.	Annual
T-13-2	S	N/A			Annual
T-13-3	D	0.14			Annual
T-18-1	N/A	0.26	Monitors interior of slurry wall on northern side, only monitored for lead and arsenic. Exceeds for arsenic concentrations. Limited recent sample results.	Recommended for removal for lead and inclusion for arsenic.	Eliminate
T-18-2	N/A	N/A	No recent data.	No recent data for location. Presumed removed from network.	Eliminate
T-18-3	N/A	N/A	No recent data.	No recent data for location. Presumed removed from network.	Eliminate
T-19-1	D	0.56	Monitors interior of slurry wall on northern side, only monitored for lead and arsenic. Exceeds for arsenic concentrations.	Recommended for removal for lead and inclusion for arsenic.	Annual
T-19-3	NT	N/A	Low level detections for organic compounds, lower concentrations for metals than 19-1.		Eliminate
T-24-1	D	0.13	Monitors center of area contained within slurry wall in closed landfill cell.	Recommended by software for removal for arsenic and lead.	Annual
T-25-1	S	0.08	Monitors center of area contained within slurry wall southeast of closed landfill cell. Exceedances for arsenic, vinyl chloride, lead, chlorobenzene and benzene. Monitors residual source of COCs	Recommended by software for removal for arsenic, chlorobenzene and lead. Not sampled between 2002 and 2009.	Eliminate
T-25-2	NT	N/A		Not sampled since 2002; presumed removed from network.	Eliminate
T-27-1	N/A	0.30	Monitors upgradient area of containment area. Only one sample is available between 1999 and 2009. Concentrations exceed for benzene and arsenic.	Recommended by software for inclusion in the network.	Annual
T-32-3	D	0.61	Monitors area upgradient from slurry wall to the south. Largely non-detect for site COCs, background concentrations for lead and arsenic. Does not characterize affected groundwater.	Recommended by software for inclusion in the network.	Biennial

See notes end of table

TABLE 6
FINAL RECOMMENDED MONITORING NETWORK

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

	Lines of Evidence				
Well Name	**Mann Kendall Trends Arsenic**	**Average SF Arsenic**	**Monitoring Rationale**	**MAROS Recommendation**	**Final Recommended Frequency**
T-33-1	D	0.34	Monitors most upgradient location within slurry wall. Historic exceedances for arsenic, benzene, PCE, TCE, 1,4-dioxane, and vinyl chloride.	Recommended for by software for inclusion in the network.	Annual
T-33-2	S	N/A		Largely non-detect values, redundant with T-33-1.	Eliminate
T-34-1	D	0.19	Monitors upgradient area of contaminant area. Area of highest arsenic concentration in plume, other COCs not detected. Monitors historic source of arsenic.	Recommended by software for removal for arsenic and lead.	Eliminate
T-42-1	N/A	0.61	Monitors area just outside of the slurry wall to the northeast. Limited recent sampling, concentrations below detection and below screening levels. Delineates GMZ to east.	Recommended by software for inclusion in the network.	Biennial
T-44-1	N/A	0.01	Monitors area within slurry wall downgradient to the northeast. Limited recent samples, exceeds only for arsenic.	Recommended by software for removal for arsenic.	Eliminate
T-47	S	0.20	Monitors area outside of slurry wall to the north at very shallow depth. Some redundancy with T-48 wells.	Recommended by software for removal for arsenic and lead.	Eliminate
T-48-2	D	0.11	Monitors area outside of slurry wall to the north, monitors deeper locations in overburden. Immediately upgradient of Lyle Reed Brook. Arsenic concentrations increase with depth.	Recommended by software for removal for arsenic, chlorobenzene and lead.	Annual
T-48-3	PD	N/A			Annual
T-48-4	PD	N/A	Redundant with T-48-2 and T-48-3	No samples between 2002 and 2009.	Eliminate
T-54-2	N/A	0.23	Monitors area outside of slurry wall to west. Limited recent samples. Functions as POC well to monitor edge of GMZ. Redundant with HA-4B.	Recommended by software for removal for arsenic.	Eliminate
T-58	ND	0.53	Monitors area outside of slurry wall to north, co-located with and redundant with HA-14. Non-detect for site COCs.	Recommended by software for removal for chlorobenzene and lead.	Eliminate
T-60-1	D	N/A	Monitors downgradient of site along Lyle Reed Brook in residential area. POC location that monitors edge of GMZ. Exceeds for arsenic. May be impacted by Four Hills Landfill.		Annual
T-60-3	D	0.32		Recommended for removal for lead and benzene.	Annual
T-61	D	0.36	Monitors downgradient of site adjacent to T-60 nest. Redundant with T-60.	Recommended by software for removal for benzene, chlorobenzene and lead.	Eliminate
T-62-2	S	0.47	Monitors downgradient area west of Lyle Reed Brook. POC location that monitors edge of GMZ. Exceedances for lead.	Recommended by software for inclusion in the network.	Biennial
T-64-2	S	0.13	Monitors area north of Lyle Reed Brook, near T-63-1. Exceedances for arsenic, benzene, chlorobenzene and vinyl chloride. Functions as a sentry well for spread of plume downgradient. Increasing trend for chlorobenzene.	Recommended by software for retention in the network.	Annual
T-64-3	D	N/A			Annual
T-8-1	S	0.34	Monitors area inside of slurry wall near western portin of slurry wall. Exceedances for arsenic, benzene, lead and vinyl chloride.	Recommended by software for inclusion in the network.	Annual
T-8-2	S	N/A			Annual
T-97	N/A	N/A	Monitors area far downgradient near Nashua River. Functions as POC location.	No data for this location	Eliminate
T-98	N/A	0.38	Monitors area far downgradient near Nashua River. Functions as POC location.	Recommended by software for inclusion in the network.	Biennial

See notes end of table

TABLE 6
FINAL RECOMMENDED MONITORING NETWORK

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

Well Name	Lines of Evidence				
	Mann Kendall Trends Arsenic	**Average SF Arsenic**	**Monitoring Rationale**	**MAROS Recommendation**	**Final Recommended Frequency**
Bedrock					
HA-4-A	N/A	0.08	Monitors overburden just southwest of slurry wall. Limited recent sampling data show arsenic exceedances. Functions as POC location to monitor GMZ and confirm containment of plume within slurry wall. Redundant with T-54-3	Recommended by software for inclusion in the network.	Annual
HA-5-B	D	0.03	Monitors area just outside of slurry wall on the northwest side. Near high concentration areas within slurry wall. Monitors passage of constituents through slurry wall. Functions as a POC for GMZ and a sentry well for possible discharge to Lyle Reed Brook. Part of nested location.	Recommended by software for removal for arsenic, benzene, chlorobenzene and lead.	Annual
HA-7-A	D	0.15	Monitors area just outside of slurry wall on northern end of containment area. Only monitored for metals. Like HA-5, functions as sentry well between slurry wall and Lyle Reed Brook.	Recommended by software for removal for arsenic and lead.	Annual
T-100-2	D	0.19	Monitors area downgradient from Lyle Reed Brook; a non-detect location for VOC. Adjacent to T-62.	Recommended by software for removal for arsenic, benzene, chlorobenzene and chloroform.	Eliminate
T-12-4	D	0.03	Monitors overburden inside slurry wall on northwest. Functions as source monitoring location. Exceedances for arsenic, 1,4-dioxane and benzene. Near exterior well HA-5B.	Recommended by software for removal for arsenic, benzene, chlorobenzene and lead.	Annual
T-13-4	S	0.17	Monitors overburden inside slurry wall in center. Located near center of mass of the plumes. Monitors high concentration source area. Exceeds standards for arsenic, and benzene.	Recommended by software for removal for arsenic and lead.	Annual
T-19-4	S	0.05	Monitors interior of slurry wall on northern side, only monitored for lead and arsenic. Exceeds for arsenic concentrations.	Recommended by software for removal for arsenic and lead	Eliminate
T-24-2	PD	0.26	Monitors center of area contained within slurry wall in closed landfill cell.	Recommended by software for removal for lead and inclusion in the network for arsenic.	Annual
T-24-3	D	0.26		Recommended by software for removal for arsenic and lead	Annual
T-25-3	S	0.14	Monitors center of area contained within slurry wall southeast of closed landfill cell. Exceedances for arsenic, vinyl chloride, lead, chlorobenzene and benzene. Monitors residual source of COCs	Not sampled since 2001; presumed removed from network.	Eliminate
T-29-3	S	N/A	Monitors center of area enclosed by slurry wall. Not sampled between 2001 and 2009. Exceeds for arsenic concentrations.	Insufficient data for spatial analysis.	Eliminate

See notes end of table

TABLE 6
FINAL RECOMMENDED MONITORING NETWORK

LONG-TERM MONITORING OPTIMIZATION
Gilson Road Superfund Site

Well Name	Lines of Evidence				
	Mann Kendall Trends Arsenic	**Average SF Arsenic**	**Monitoring Rationale**	**MAROS Recommendation**	**Final Recommended Frequency**
T-32-4	PD	0.28	Monitors area upgradient from slurry wall to the south. Largely non-detect for site COCs, background concentrations for lead and arsenic. Does not characterize affected groundwater.	Recommended by software for inclusion in the network.	Biennial
T-33-4	I	0.36	Monitors most upgradient location within slurry wall. Monitors depth below major contamination, some exceedances for arsenic.	Recommended by software for inclusion in the network.	Annual
T-38-2	N/A	0.15	Monitors area upgradient from slurry wall to the southeast. Limited sample results. Outside of plume, but exceeds for arsenic.	Recommended by software for inclusion in the network.	Eliminate
T-42-2	N/A	N/A	Monitors area just outside of the slurry wall to the northeast. Limited recent sampling, concentrations below detection and below screening levels. Delineates GMZ to east.	Limited sample results. Insufficient data for spatial analysis.	Biennial
T-44-2	N/A	0.69	Limited recent sample results	Recommended by software for inclusion in the network.	Eliminate
T-48-5	D	N/A	Monitors area outside of slurry wall to the north, immediately upgradient of Lyle Reed Brook. Exceedances for arsenic, and benzene. The overburden shows increasing trends for chlorobenzene in the area.	Not sampled since 2004, insufficient data for spatial analysis.	Annual
T-54-3	N/A	0.04	Monitors area outside of slurry wall to west. Limited recent samples. Functions as POC well to monitor edge of GMZ. Evidence of benzene above screening levels. Redundant with HA-4B.	Recommended by software for inclusion in the network.	Annual
T-62-3	NT	0.32	Monitors downgradient area west of Lyle Reed Brook. Exceedances for arsenic and lead. Sentry point for spread of metals.	Recommended by software for inclusion in the network for arsenic and lead.	Annual
T-64-4	D	0.02	Monitors area north of Lyle Reed Brook, near T-63-1. Functions as a sentry well for spread of chlorobenzene and benzene.	Recommended by software for removal for arsenic.	Annual
T-8-3	S	0.13	Monitors area inside of slurry wall near western portin of slurry wall. Exceeds for arsenic and benzene.	Recommended by software for removal for arsenic, lead, and benzene.	Annual
T-99	N/A	0.44	Monitors area far downgradient near Nashua River. Functions as POC location.	Recommended by software for inclusion in the network.	Biennial

Notes:
1. Arsenic MK trend results detailed in Tables 4 and 5.
2. SF = Slope Factor. SF <0.3 indicates potentially redundant location.
3. Monitoring Rationale summarizes the results of the qualitative review of the well..
4. MAROS Recommendation is a summary of the well redundancy results.
5. Final Recommended Frequency is based on both qualitative and quantitative results.

Groundwater Monitoring Network Optimization
Gilson Road Superfund Site

Nashua, New Hampshire

FIGURES

N

Legend

Sampling Locations

- Groundwater Monitoring Well
- Sediment Sample
- Surface Water Samples

- Slurry Wall
- Lyle Reed Brook
- Approximate GMZ

Scale (ft)

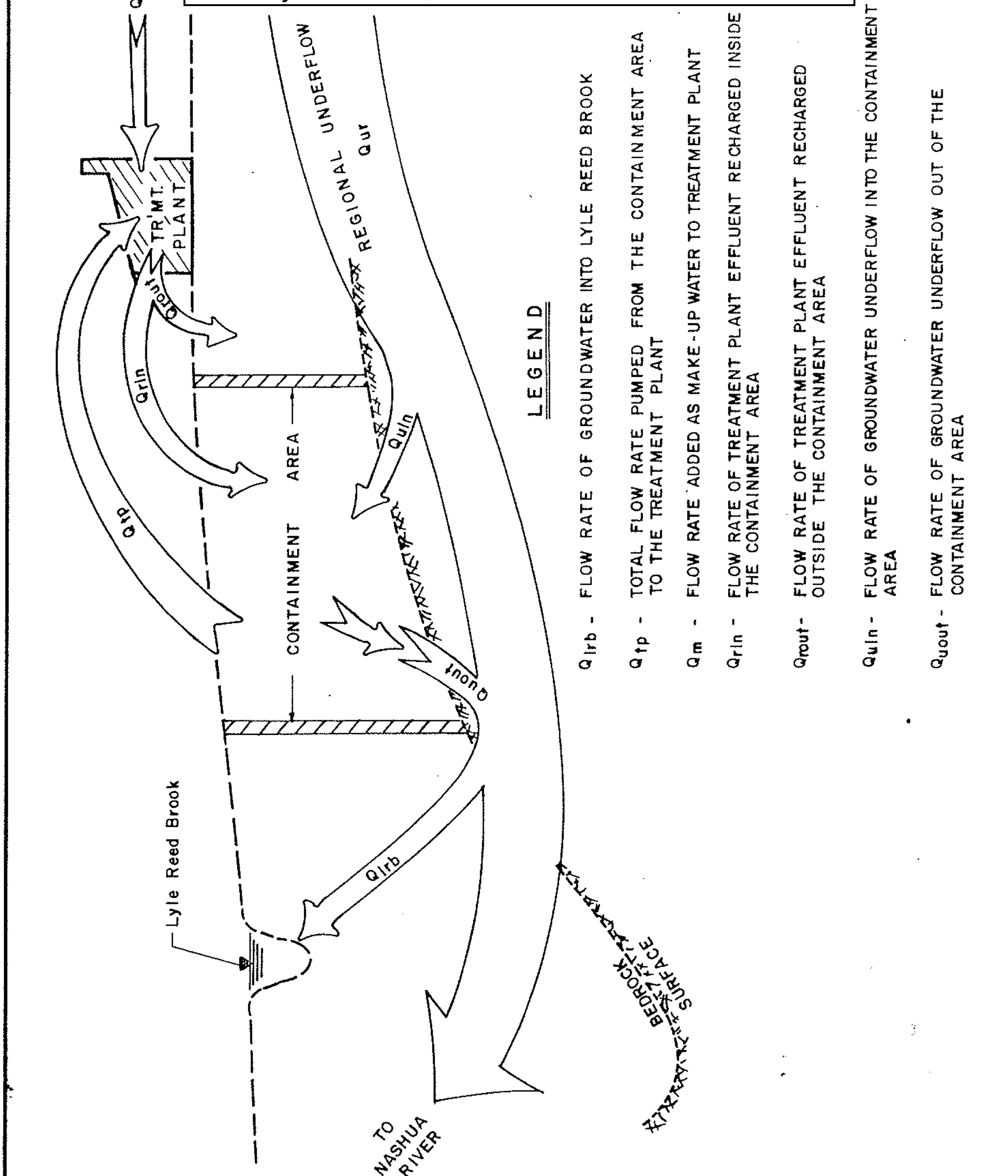
0 200 400

GILSON ROAD SITE
MONITORING NETWORK

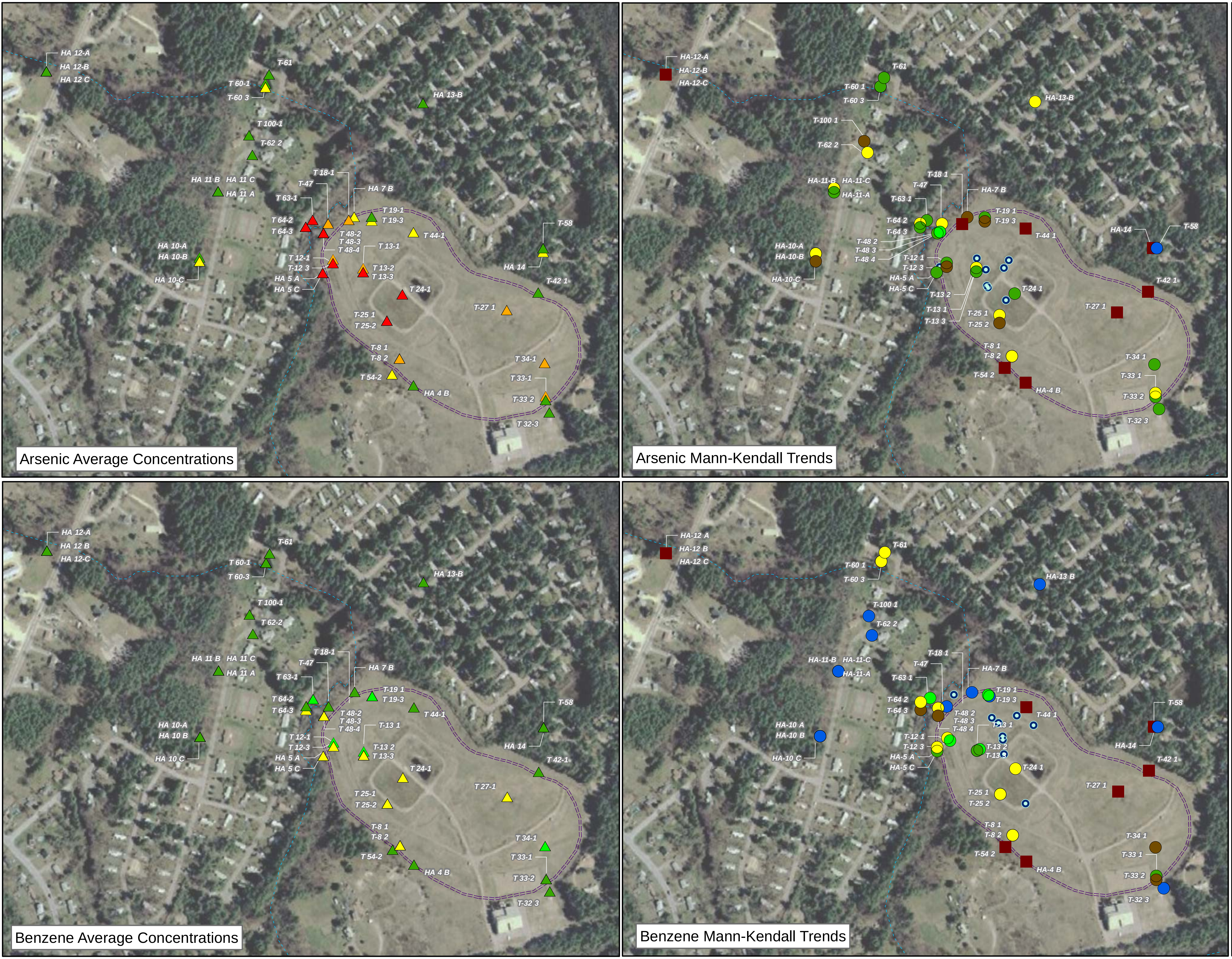
Gilson Road Superfund Site
Nashua, New Hampshire

Coord sys: NAD 83 SP NH	Issued: 11-SEPT-2009
Drawn By: MV	Revised:
Ck'd By: MV	Map ID:
Appv'd By:	Figure 1

Figure 2: Historic Site Conceptual Model reproduced from Roy F. Weston, 1989.



GILSON ROAD SITE NASHUA, NEW HAMPSHIRE	SCHEMATIC REPRESENTATION OF GILSON ROAD SITE WATER BALANCE			
WESTON MANAGERS DESIGNERS/CONSULTANTS	DRAWN R.E.C.	DATE 2/89	FIGURE 4-25	
	CHECKED A.D	W.O. 1395-19-10		



N

Legend

Ratio of Average Concentration to AGQS

- 0 - 0.05
- 0.05 - 1
- 1 - 10
- 10 - 50
- 50 - 100

Mann-Kendall Trend Results

- Non-detect
- Decreasing
- Probably Decreasing
- Stable
- No Trend
- Insufficient Data
- First Moments 1999 - 2009

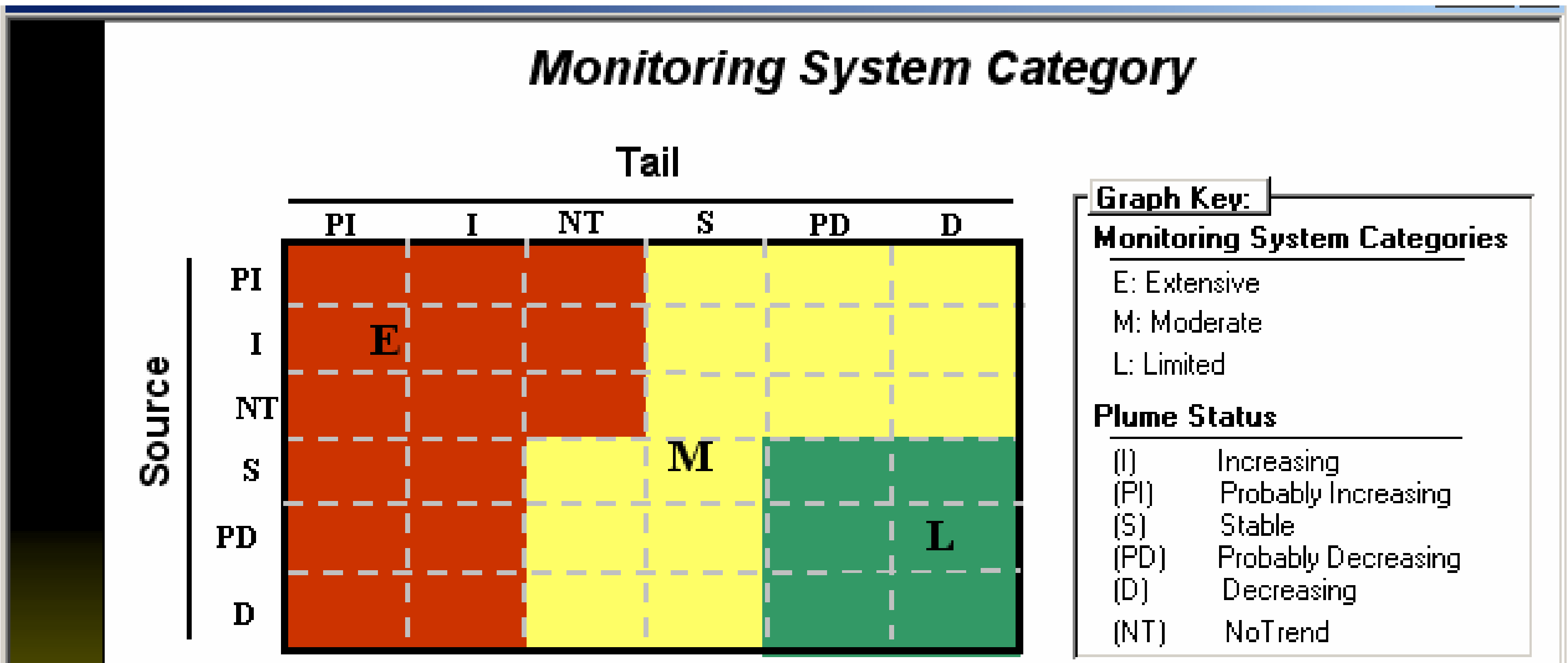
- Slurry Wall
- Lyle Reed Brook

Scale (ft)
0 230 460

OVERBURDEN GROUNDWATER ARSENIC AND BENZENE AVERAGE CONCENTRATIONS AND TREND RESULTS

Gilson Road Superfund Site
Nashua, New Hampshire

Coord sys:	NAD 83 SP NH	Issued:	11-SEPT-2009
Drawn By:	MV	Revised:	
Ck'd By:	MV	Map ID:	
Appv'd By:			Figure 3



COC	Tail Stability	Source Stability	Category Result
ARSENIC	D	S	L
BENZENE	D	PD	L
CHLOROBENZENE	PD	PD	L
LEAD	PD	PD	L
VINYL CHLORIDE	D	D	L

Worst Case: L

Figure 4: Combined concentration trends for wells inside (source stability) and outside (tail stability) the containment wall for overburden aquifer.

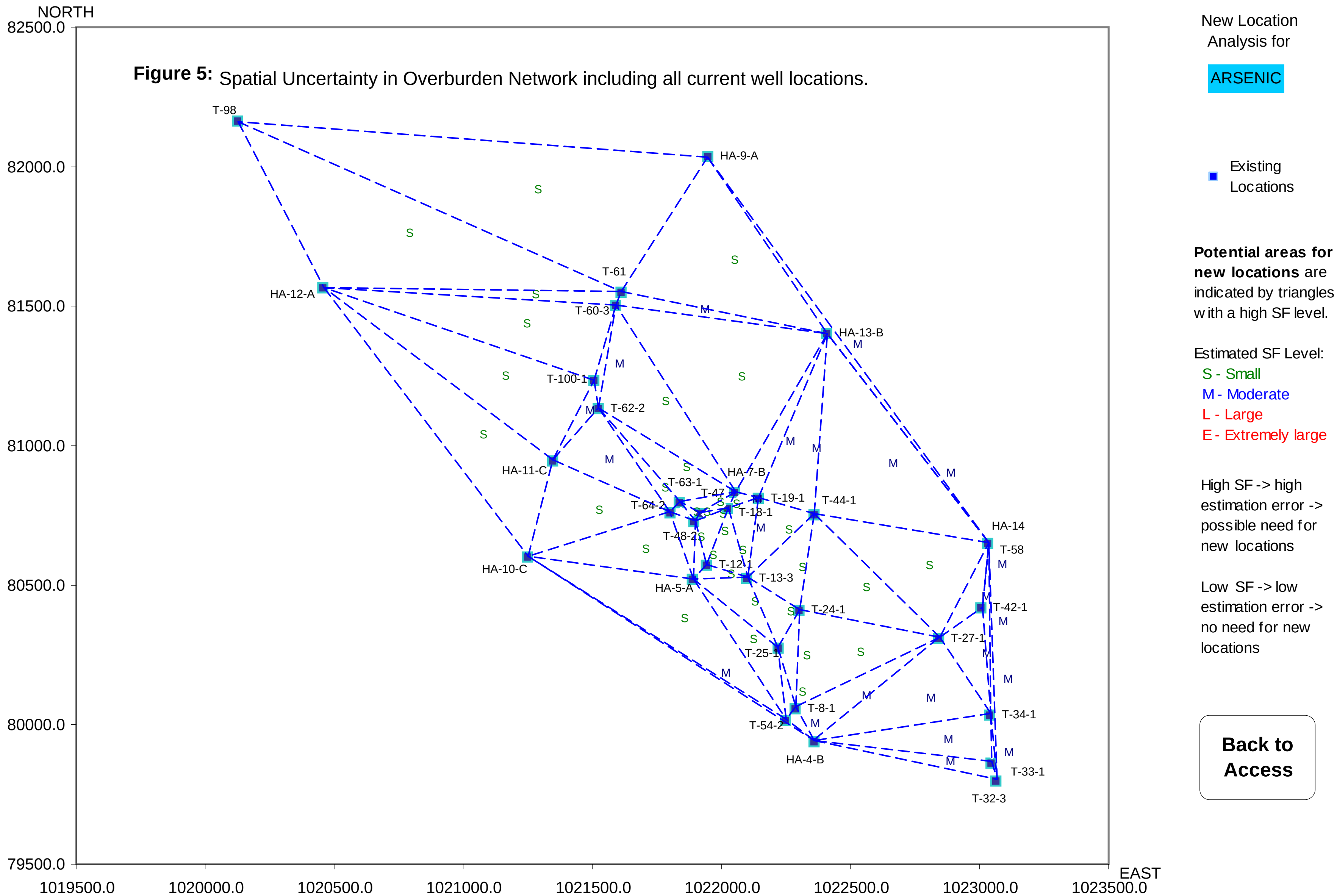
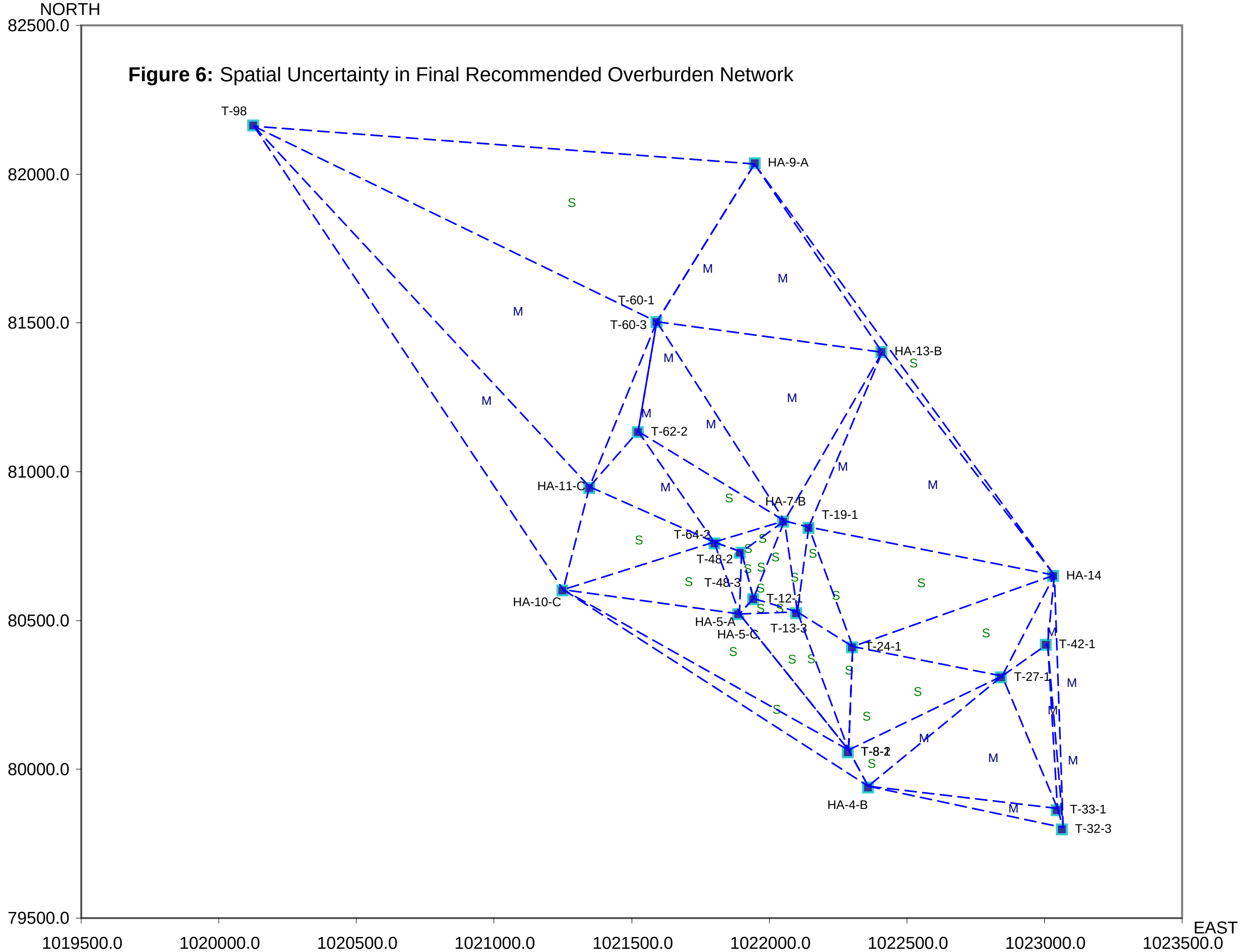


Figure 5: Spatial Uncertainty in Overburden Network including all current well locations.



New Location Analysis for

ARSENIC

Existing Locations

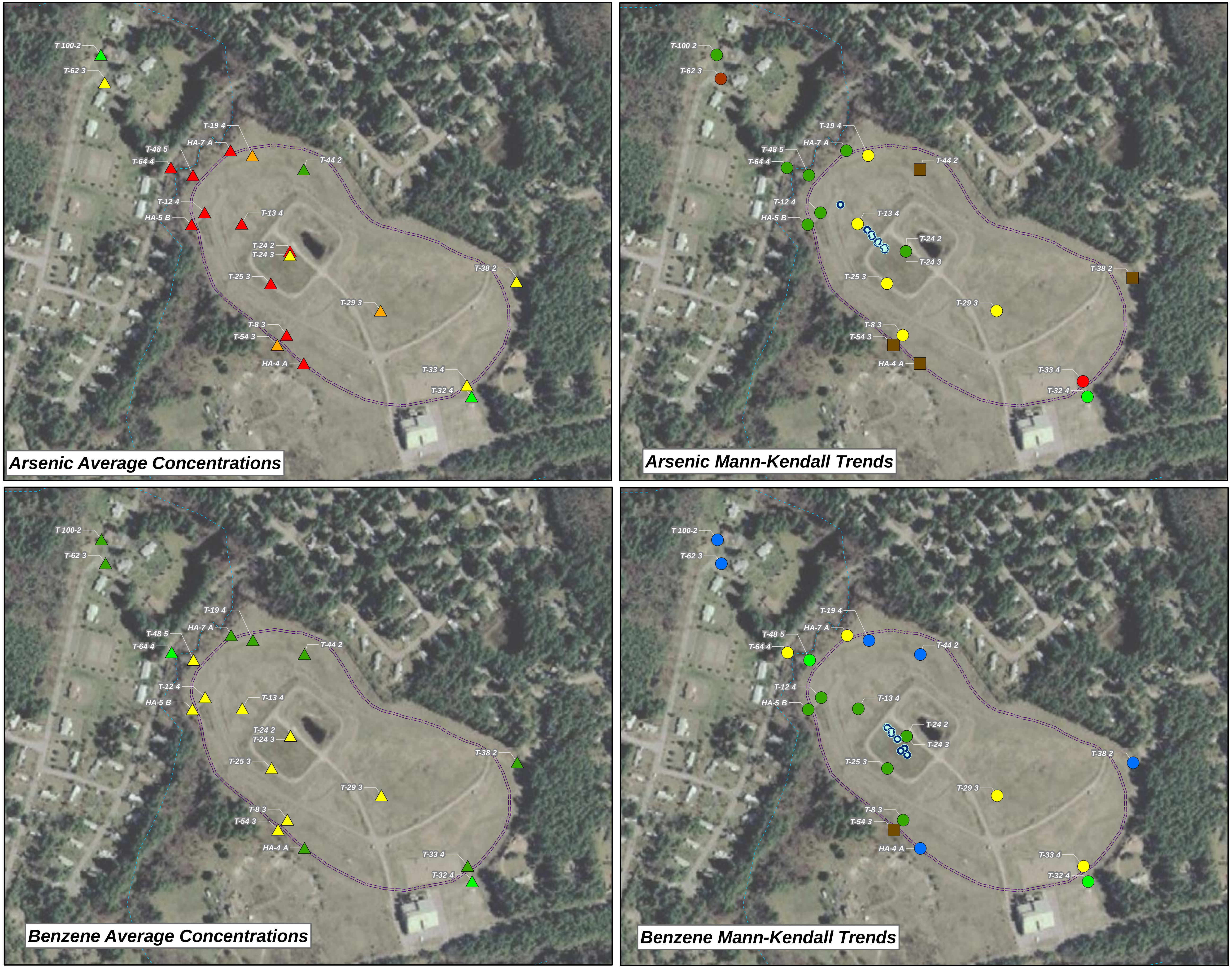
Potential areas for new locations are indicated by triangles with a high SF level.

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



N

Legend

Ratio of Average Concentration to AGQS

- 0 - 0.05
- 0.05 - 1
- 1 - 10
- 10 - 50
- 50 - 150

Mann-Kendall Trend Results

- Non-detect
- Decreasing
- Probably Decreasing
- Stable
- No Trend
- Insufficient Data

- Slurry Wall
- Lyle Reed Brook
- First Moments 1999 - 2009

Scale (ft)
0 200 400

BEDROCK GROUNDWATER ARSENIC AND BENZENE AVERAGE CONCENTRATIONS AND TREND RESULTS

Gilson Road Superfund Site
Nashua, New Hampshire

Coord sys:	NAD 83 SP NH	Issued:	11-SEPT-2009
Drawn By:	MV	Revised:	
Ck'd By:	MV	Map ID:	
Appv'd By:			Figure 7

N

Legend

Sampling Locations and Frequencies

- Annual
- Biennial
- Sediment Sample
- Surface Water Samples
- Slurry Wall
- Lyle Reed Brook
- Approximate GMZ

Scale (ft)
0 200 400

FINAL RECOMMENDED MONITORING NETWORK

Gilson Road Superfund Site
Nashua, New Hampshire

Coord sys:	NAD 83 SP NH	Issued:	11-SEPT-2009
Drawn By:	MV	Revised:	
Ck'd By:	MV	Map ID:	
Appv'd By:			Figure 8

APPENDIX A:
MAROS 2.2 METHODOLOGY

<u>**TABLES**</u>

MAROS METHODOLOGY

MAROS is a collection of tools in one software package that is used in an explanatory, non-linear but linked fashion to review and increase the efficiency of groundwater monitoring networks. 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 more 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/en/software/free-software/maros.html) 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 based on temporal trend analyses and plume stability information; and 2) a more detailed statistical optimization based on spatial and temporal redundancy and sufficiency identification 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 analyses assess the general monitoring system category by considering individual well concentration trends, overall plume stability, and qualitative factors such as seepage velocity, remedial systems, and the location of potential receptors. The method relies on temporal trend analysis to assess plume stability, which is then used to determine the general monitoring system category. The monitoring system category is evaluated separately for both source and tail regions.

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 ground water. Alternately, a source zone could be an area upgradient of a remedy such as a pump and treat (P&T) system or barrier wall. 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 or major remedial system. 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 source 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.

Figure A.1. MAROS Decision Support Tool Flow Chart

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 (0^{th} Moment), center of mass (1^{st} Moment), and plume spread (2^{nd} 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.

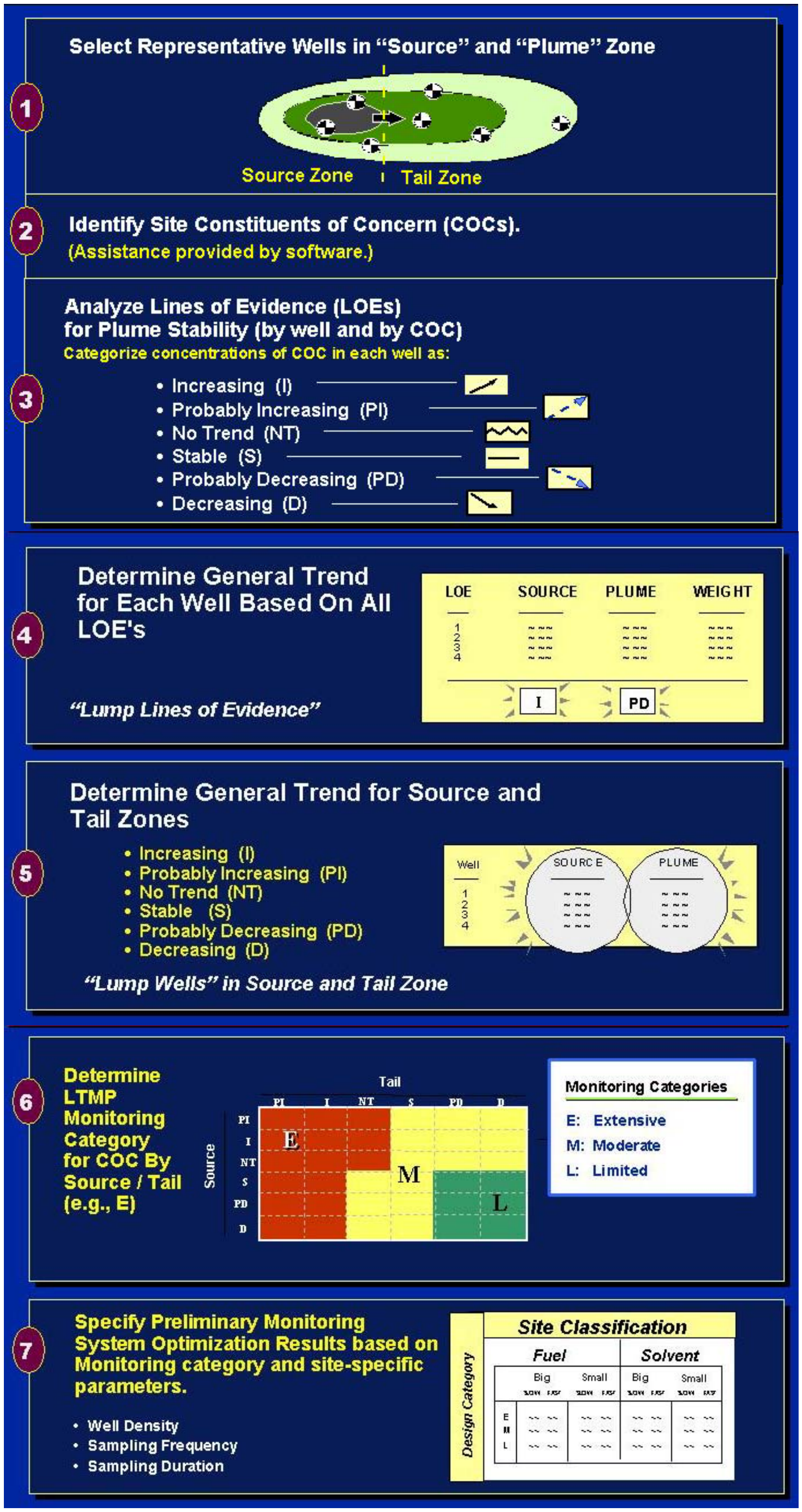
2) **Well Redundancy Analysis:** uses the Delaunay Method to evaluate if any wells within the monitoring network are redundant and can be eliminated without any significant loss of plume information.

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 A.2: MAROS Overview Statistics Trend Analysis Methodology



The detailed sampling optimization modules consist of well redundancy and well sufficiency analyses using the Delaunay method, a sampling frequency analysis using the Modified Cost Effective Sampling (MCES) method. For plumes very close to the cleanup standards, a data sufficiency analysis including statistical power analysis can be used to identify statistically 'clean' locations. The well redundancy analysis is designed to eliminate monitoring locations that do not contribute unique data to the program. The sampling frequency module is designed to suggest an optimal frequency of sampling based on the rate of change of constituent concentrations. 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 to evaluate 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 later-stage analytical tool designed for long-term planning after site investigation and remedial system installation, impacts of seasonal variation in the water unit are treated on a broad scale, as they relate to multi-year trends.

Imported ground water monitoring data and the site-specific information entered in the *Site Details* input screens 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 redundancy recommendations made by MAROS.

The type of data required to run MAROS is shown in Table 1 below.

TABLE 1
Data Input for MAROS

Data Input	Format	Details
Sample Dates	MM/DD/YYYY	Sampling event dates can be consolidated in the
Well Names	Text format	Well names must be spelled consistently
Analyte Name	Text format	Analyte names must conform to MAROS input standards outlined shown in MAROS_ConstituentList.xls
Result	Number format; null cell for non-detect results	
Detection Limit	Number format	Detection limits must be included for all samples. Missing detection limits can be estimated.
Data Flag	ND or TR	Flag non-detect results with “ND”. Identification of trace values (J flag) data is optional.
X and Y Coordinates	Geographical coordinates in number format; units are feet.	Coordinates can be in State Plane feet or in a site specific coordinate system. Values must be in units of feet.
Seepage velocity	Number in units of feet per year	Estimated value for formation
Plume length and width	Number in units of feet	Estimated value from plume maps
Distance to receptors	Number >0	Estimated distance from source/tail to surface water, property boundaries or drinking water wells that represent potential points of exposure.
Groundwater flow direction	Number between 1 and 359	Predominant groundwater flow direction with due east being 0 and moving counter-clockwise, north 90, west 180 and south 270.
Porosity	Number <1	Total porosity estimate for soil type
Source Coordinates	Geographic coordinates in number format; units are feet	An estimate of the coordinates of the most likely source area
Saturated Thickness	Number >1	An estimate of plume thickness, either plume-wide or at each well location.

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 exceedance of the screening level. The evaluation of prevalence is performed by determining a representative concentration for each well location and evaluating the total number of wells with exceedances (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 networks have been measured irregularly in time or contain many non-detects, trace level results, and duplicate results. 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, analyses of historical data provide support for a conclusion about plume stability (e.g., increasing plume, etc.). Plume stability results are assessed from time-series concentration data with the application of three statistical tools: Mann-Kendall Trend analysis, linear regression trend analysis and moment analysis. Mann-Kendall and Linear Regression methods are used to estimate the concentration trend for individual well and COC combinations based on the statistical trend analysis of concentrations versus time. These trend analyses are then consolidated to give the user a general stability estimate for source, tail and plume-wide areas as well as a preliminary recommendation for monitoring frequency and well density (see Figures 1 through 3 for further step-by-step details). 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. The Overview step allows the user to gain information that will support a more informed decision in the next level of detailed statistical optimization analysis.

6.1 MANN-KENDALL ANALYSIS

The Mann-Kendall test is a statistical procedure that is well suited for analyzing trends in groundwater data. The Mann-Kendall test is a non-parametric test for zero slope of the first-order regression of time-ordered concentration data versus time. The advantage of the Mann-Kendall test is that no assumptions as to the statistical distribution of the data (e.g. normal, lognormal, etc.) are required, and it can be used with data sets that 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 test for trend relies on three statistical metrics. The first metric, the S statistic, is based on the sum of the differences between data in sequential order. An S with a positive value may indicate an increase in concentrations over time and negative values indicate possible decreases. The strength of the trend is proportional to the magnitude of the S statistic (i.e., a large value indicates a strong trend). The confidence in the trend is determined by performing a hypothesis test to determine the probability of accepting the null hypothesis (no trend). The S statistic and the sample size, n, are found in a Kendall probability table such as the one reported in Hollander and Wolfe (1973). The Confidence in the Trend is found by subtracting the probability of no trend (ρ) from 1. For low values of ρ (<0.05), confidence in the trend is high (>90%) or (ρ < 0.01) very high (>95%).

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 coefficient of variation (COV) is calculated from the standard deviation divided by the mean for the dataset. The decision matrix for the Mann-Kendall evaluation is shown in Table 2 below. 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)
- Non-detect (ND)
- Insufficient data (N/A)

Wells where the compound is not detected are labeled “ND” for the COC evaluated. These trend estimates are then analyzed to identify the source and tail region overall stability category (see Figure 2 for further details).

TABLE 2
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
S = 0	0	Non-detect

6.2 LINEAR REGRESSION ANALYSIS

Linear Regression is a parametric statistical procedure that is typically used for analyzing trends in data over time for datasets that have a normal or lognormal distribution. The objective of linear regression analysis is to find the trend in the datA through the estimation of the log-slope as well as placing confidence limits on the log-slope of the trend. The Linear Regression analysis in MAROS is performed on Ln(concentration) versus time. The regression model assumes that for a fixed value of x (sample date) the expected value of y (ln(concentration)) can be found by evaluating a linear function. The method of least squares is used to obtain the estimate of the linear function.

In order to test the confidence in the regression trend, confidence limits are placed on the slope of the regression line. A t-test is used to find the confidence interval for the slope by dividing the slope by the standard error of the slope. The result of the t-test along with the degrees of freedom (n-2) is used to find the confidence in the trend from a t-distribution table. 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 resulting confidence in the trend, slope of the regression through the data and variance are used to determine a final trend based on the decision matrix shown on Table 3.

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. 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)

TABLE 3
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

6.3 MOMENT ANALYSIS

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 within the network over time. 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.

The analysis of moments can be summarized as:

- Zeroth Moment: An estimate of the total dissolved mass of the constituent within the network 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 for each sample event.

Moments are calculated using the method of Delaunay Triangulation. The software constructs triangles between all of the wells in the network and estimates the total mass within each triangle using the Saturated Thickness value input as the depth of the plume. To determine the zeroth moment, the mass within each of the triangles is summed to give a plume-wide value. To find the center of mass, or first moment, the center of each triangle is determined and multiplied by the mass within the triangle, which is then normalized by the total mass in the plume. The second moment is an estimate of the relative distribution of mass between the center of the plume and the edges of the plume. Estimates are made of the relative distribution of mass in the direction of groundwater flow (X) and orthogonal to groundwater flow (Y) for each sample event.

Once moments are calculated for each sample event, the Mann-Kendall trend test is applied to determine if the results show increasing, stable or decreasing trends. When considering the results of the zeroth moment trend, the following factors 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 wells within the network). 3) delineation of the plume as mass outside of the network is not included in the estimate.

The first moment estimates the center of mass, coordinates (Xc and Yc) for each sample event and COC and the distance of these coordinates from the source. If the center of mass is farther from the source, then there is an increasing trend. The changing center of mass indicates the relative distribution of mass between the source and tail over time and an increasing trend does not necessarily signal and expanding plume. An increasing center of mass is often found where significant source reduction has occurred. No appreciable movement or a stable 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. An increasing trend in the second moment indicates that there is less mass in the center of the plume relative to the edge. This is often seen in cases where diffusion is occurring or when a remedial system may be removing mass from the center of the plume. A decreasing trend may indicate that mass destructive processes are active on the edge of the plume.

6.4 OVERALL PLUME ANALYSIS

General recommendations for the monitoring network sampling frequency and density are provided by MAROS after the trend and moment analysis modules. Monitoring network improvements are suggested based on heuristic rules applied to the source and tail trend results as well as qualitative factors such as seepage velocity and distance to potential receptors.

Individual well trend results are consolidated and weighted by the MAROS software 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. The software suggests a general, preliminary optimization plan for the current monitoring. The flow chart detailing how the trend analysis results and other site-specific parameters are used to form a general sampling frequency and well density recommendation is shown 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 preliminary 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).

7.0 DETAILED STATISTICS: OPTIMIZATION ANALYSIS

Although the overall plume analysis shows a general recommendation for sampling frequency and sampling density, a more detailed analysis is also available with the MAROS software in order to allow for further refinements on a well-by-well basis. The MAROS Detailed Statistics allows for a quantitative analysis for spatial and temporal optimization of the well network. The MAROS Detailed Statistics results should be evaluated considering the results of the Overview Statistics as well as other qualitative features such as site monitoring objectives and the frequency of site decision making.

The Detailed Statistics 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 Cost Effective Sampling 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 the contaminant plume. An extended method for evaluating well sufficiency based on the Delaunay method is used for recommending new sampling locations in areas with high concentration uncertainty. Details about the Delaunay method can be found in Appendix A.2 of the MAROS Manual (AFCEE, 2003).

The sampling location modules use the Delaunay triangulation method employed during the moment analysis. The method determines the significance of each sampling location relative to the overall monitoring network with respect to characterizing concentration within the plume. The Delaunay method calculates the area within the network and the average concentration of the plume using data from multiple monitoring wells. A slope factor (SF) is calculated for each well by assessing how accurately concentration at the well can be estimated from concentrations at neighboring wells.

The sampling location optimization process is performed in a stepwise fashion. Step one involves assessing the SF; if a well has a small SF (little significance to the network), the well may be removed from the monitoring network. Locations with a SF = 0.3 or less are candidates for removal. Step two involves evaluating the information loss of removing a well from the network. Information loss is measured by evaluating and Area Ratio and a Concentration Ratio, which is the plume-wide area or concentration after removal of the well normalized by the original values. If one well has a small SF, it may or may not be eliminated depending on whether the information loss in terms of area or average concentration estimates 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 characterization of the plume. If the MAROS algorithm calculates a high level of uncertainty in predicting the constituent concentration at nodes for a particular Delaunay triangle, a new sampling location is recommended for that area. The SF values obtained from the redundancy evaluation described above are used to calculate the concentration estimation error for each triangle. The estimated concentration uncertainty value, based on the calculated SF for each area is then classified into four levels: Small, Moderate, Large, or Extremely large (S, M, L, E). 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 or regulatory factors 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.

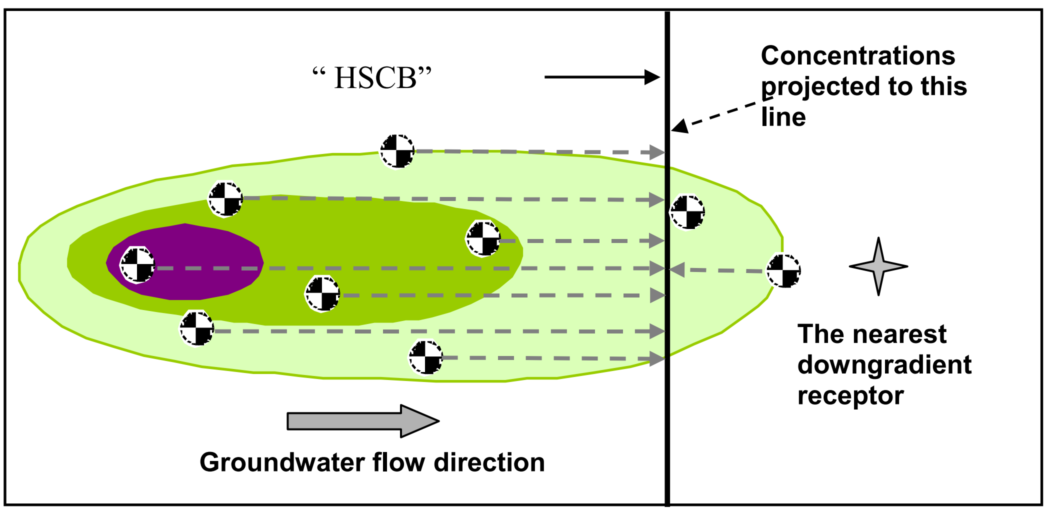
7.4 DATA SUFFICIENCY ANALYSIS – POWER ANALYSIS

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.

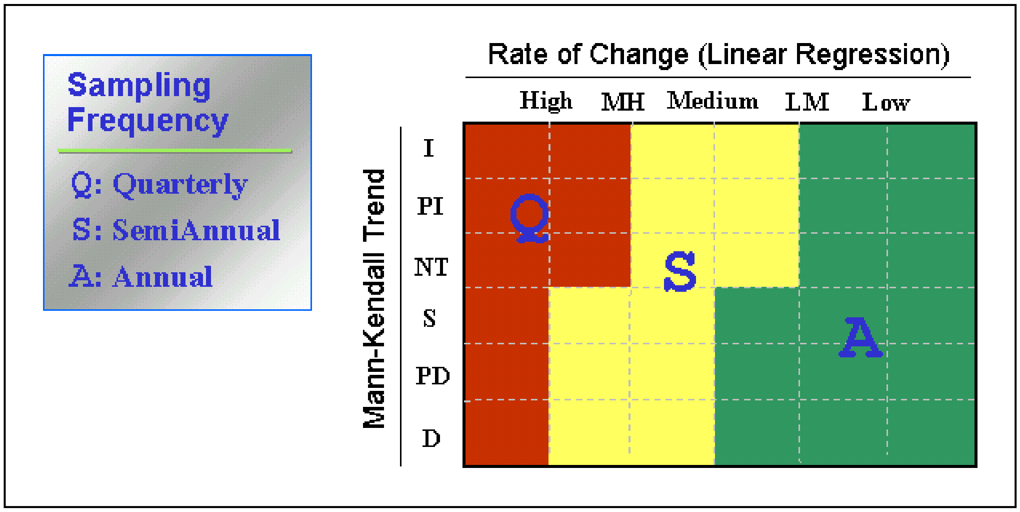


Figure A.3. Decision Matrix for Determining Provisional Frequency
(*Figure A.3.1 of the MAROS Manual (AFCEE 2003*)

8.0 CITED REFERENCES

AFCEE 2003. Monitoring and Remediation Optimization System (MAROS) 2.1 Software Users Guide. Air Force Center for Environmental Excellence. http://www.gsi-net.com/software/MAROS_V2_1Manual.pdf

AFCEE. 1997. Air Force Center for Environmental Excellence, AFCEE Long-Term Monitoring Optimization Guide, http://www.afcee.brooks.af.mil.

Aziz, J. A., C. J. Newell, M. Ling, H. S. Rifai and J. R. Gonzales (2003). "MAROS: A Decision Support System for Optimizing Monitoring Plans." Ground Water 41(3): 355-367.

Gilbert, R. O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York, NY, ISBN 0-442-23050-8.

Hollander, M. and Wolfe, D. A. (1973). Nonparametric Statistical Methods, Wiley, New York, NY.

Ridley, M.N. et al., 1995. Cost-Effective Sampling of Groundwater Monitoring Wells, the Regents of UC/LLNL, Lawrence Livermore National Laboratory.

U.S. Environmental Protection Agency, 1992. Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Ground Water.

Weight, W. D. and J. L. Sonderegger (2001). Manual of Applied Field Hydrogeology. New York, NY, McGraw-Hill.

APPENDIX B

Groundwater Monitoring Network Optimization
Gilson Road Superfund Site

Nashua, New Hampshire

MAROS REPORTS

Overburden Aquifer Reports

COC Assessment
Mann-Kendall Summary Report
Linear Regression Summary Report
Individual Trend Summary Reports
Zeroth Moment Reports
Full Plume: Arsenic
Summary of Moment Analyses – Select Wells Exterior to Slurry Wall

Bedrock Aquifer Reports

COC Assessment
Trend Summary Report
Individual Trend Summary Reports
Zeroth Moment Reports
Full Plume: Arsenic

Overburden Aquifer Reports

COC Assessment
Mann-Kendall Summary Report
Linear Regression Summary Report
Individual Trend Summary Reports
Zeroth Moment Reports
Full Plume: Arsenic
Summary of Moment Analyses – Select Wells Exterior to Slurry Wall

MAROS COC Assessment

Project: Overburden **User Name:** MV

Location: Nashua **State:** New Hampshire

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
ARSENIC	2.4E-01	1.0E-02	2316.5%
1,4-DIOXANE (P-DIOXANE)	1.7E-02	3.0E-03	480.8%
BENZENE	5.3E-03	5.0E-03	5.0%

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	51	30	58.8%	46
1,4-DIOXANE (P-DIOXANE)	ORG	8	4	50.0%	4
BENZENE	ORG	50	16	32.0%	26

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
1,4-DIOXANE (P-DIOXANE)	0.000479
BENZENE	0.0984
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

BENZENE

CHLOROBENZENE

LEAD

VINYL CHLORIDE

MAROS Mann-Kendall Statistics Summary

Project: Overburden
User Name: MV
Location: Nashua
State: New Hampshire

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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								
HA-10-A	T	9	7	0.30	-8	76.2%	No	S
HA-10-B	T	9	1	0.03	-4	61.9%	No	S
HA-10-C	T	9	9	0.13	12	87.0%	No	NT
HA-11-A	T	9	8	0.45	-13	89.0%	No	S
HA-11-B	T	9	1	0.13	-4	61.9%	No	S
HA-11-C	T	9	5	0.88	-29	100.0%	No	D
HA-12-A	T	1	1	0.00	0	0.0%	No	N/A
HA-12-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-C	T	1	0	0.00	0	0.0%	Yes	ND
HA-13-B	T	10	6	0.97	-5	63.6%	No	S
HA-14	T	1	1	0.00	0	0.0%	No	N/A
HA-4-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-5-A	T	11	11	0.11	-45	100.0%	No	D
HA-5-C	T	10	10	0.04	-33	99.9%	No	D
HA-7-B	T	8	8	1.08	-4	64.0%	No	NT
HA-9-A	T	1	1	0.00	0	0.0%	No	N/A
T-100-1	T	9	3	1.39	-5	65.7%	No	NT
T-12-1	S	10	10	0.15	-27	99.2%	No	D
T-12-3	S	6	6	0.08	1	50.0%	No	NT
T-13-1	S	11	11	0.53	-31	99.2%	No	D
T-13-2	S	11	11	0.08	-17	89.1%	No	S
T-13-3	S	11	11	0.22	-45	100.0%	No	D
T-18-1	S	1	1	0.00	0	0.0%	No	N/A
T-19-1	S	8	8	0.86	-22	99.8%	No	D
T-19-3	S	7	7	0.35	7	80.9%	No	NT
T-24-1	S	11	11	0.07	-26	97.5%	No	D
T-25-1	S	7	7	0.20	-3	61.4%	No	S
T-25-2	S	6	6	0.14	7	86.4%	No	NT
T-27-1	S	1	1	0.00	0	0.0%	No	N/A
T-32-3	T	9	4	0.56	-18	96.2%	No	D
T-33-1	S	10	10	1.38	-39	100.0%	No	D
T-33-2	S	8	3	0.19	-9	83.2%	No	S
T-34-1	S	10	10	1.81	-29	99.5%	No	D
T-42-1	T	1	1	0.00	0	0.0%	No	N/A
T-44-1	T	1	1	0.00	0	0.0%	No	N/A
T-47	T	7	7	0.51	-5	71.9%	No	S
T-48-2	T	11	11	0.17	-43	100.0%	No	D
T-48-3	T	11	11	0.12	-21	94.0%	No	PD

Project: Overburden **User Name:** MV

Location: Nashua **State:** New Hampshire

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
ARSENIC								
T-48-4	T	7	7	0.18	-11	93.2%	No	PD
T-54-2	T	1	1	0.00	0	0.0%	No	N/A
T-58	T	6	0	0.00	0	42.3%	Yes	ND
T-60-1	T	11	8	0.56	-31	99.2%	No	D
T-60-3	T	11	11	0.86	-26	97.5%	No	D
T-61	T	11	10	1.21	-26	97.5%	No	D
T-62-2	T	7	3	0.28	-5	71.9%	No	S
T-63-1	T	8	8	0.48	-18	98.4%	No	D
T-64-2	T	7	7	0.15	-9	88.1%	No	S
T-64-3	T	6	6	0.15	-11	97.2%	No	D
T-8-1	S	6	6	0.16	-5	76.5%	No	S
T-8-2	S	6	6	0.30	-3	64.0%	No	S
T-98	T	1	0	0.00	0	0.0%	Yes	ND
BENZENE								
HA-10-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-12-A	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-C	T	1	0	0.00	0	0.0%	Yes	ND
HA-13-B	T	9	0	0.00	0	46.0%	Yes	ND
HA-14	T	1	0	0.00	0	0.0%	Yes	ND
HA-4-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-5-A	T	11	11	0.31	-27	98.0%	No	D
HA-5-C	T	11	11	0.22	-6	64.8%	No	S
HA-7-B	T	4	0	0.00	0	37.5%	Yes	ND
HA-9-A	T	1	0	0.00	0	0.0%	Yes	ND
T-100-1	T	9	0	0.00	0	46.0%	Yes	ND
T-12-1	S	11	9	0.39	-7	67.6%	No	S
T-12-3	S	6	6	0.43	-9	93.2%	No	PD
T-13-1	S	11	4	0.45	-20	92.9%	No	PD
T-13-2	S	11	11	0.48	-36	99.8%	No	D
T-13-3	S	11	11	0.30	-31	99.2%	No	D
T-19-1	S	4	0	0.00	0	37.5%	Yes	ND
T-19-3	S	6	2	0.69	-9	93.2%	No	PD
T-24-1	S	11	11	0.24	-8	70.3%	No	S
T-25-1	S	7	7	0.50	-3	61.4%	No	S
T-25-2	S	6	6	0.59	-7	86.4%	No	S
T-27-1	S	1	1	0.00	0	0.0%	No	N/A
T-32-3	T	9	0	0.00	0	46.0%	Yes	ND
T-33-1	S	11	6	0.56	-33	99.5%	No	D
T-33-2	S	4	1	0.05	1	50.0%	No	NT
T-34-1	S	9	1	1.74	2	54.0%	No	NT
T-42-1	T	1	0	0.00	0	0.0%	Yes	ND
T-44-1	T	1	0	0.00	0	0.0%	Yes	ND
T-47	T	5	0	0.00	0	40.8%	Yes	ND

Project: Overburden

User Name: MV

Location: Nashua

State: New Hampshire

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
BENZENE								
T-48-2	T	11	10	0.30	-2	53.0%	No	S
T-48-3	T	11	11	0.36	-16	87.5%	No	S
T-48-4	T	7	7	0.28	7	80.9%	No	NT
T-54-2	T	1	0	0.00	0	0.0%	Yes	ND
T-58	T	5	0	0.00	0	40.8%	Yes	ND
T-60-1	T	9	2	0.03	-5	65.7%	No	S
T-60-3	T	9	1	0.03	-4	61.9%	No	S
T-61	T	9	2	0.15	-9	79.2%	No	S
T-62-2	T	7	0	0.00	0	43.7%	Yes	ND
T-63-1	T	8	7	0.54	-12	91.1%	No	PD
T-64-2	T	7	7	0.58	1	50.0%	No	NT
T-64-3	T	5	1	0.26	-4	75.8%	No	S
T-8-1	S	7	6	0.70	-4	66.7%	No	S
T-8-2	S	7	7	0.50	-9	88.1%	No	S
T-98	T	1	0	0.00	0	0.0%	Yes	ND
CHLOROBENZENE								
HA-10-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-12-A	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-C	T	1	0	0.00	0	0.0%	Yes	ND
HA-13-B	T	9	0	0.00	0	46.0%	Yes	ND
HA-14	T	1	0	0.00	0	0.0%	Yes	ND
HA-4-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-5-A	T	11	11	0.13	-23	95.7%	No	D
HA-5-C	T	11	11	0.16	-7	67.6%	No	S
HA-7-B	T	4	2	0.62	-1	50.0%	No	S
HA-9-A	T	1	0	0.00	0	0.0%	Yes	ND
T-100-1	T	9	0	0.00	0	46.0%	Yes	ND
T-12-1	S	11	11	0.40	-25	97.0%	No	D
T-12-3	S	6	6	0.18	8	89.8%	No	NT
T-13-1	S	11	11	0.36	17	89.1%	No	NT
T-13-2	S	11	11	0.45	13	82.1%	No	NT
T-13-3	S	11	11	0.63	29	98.7%	No	I
T-19-1	S	5	5	0.58	0	40.8%	No	S
T-19-3	S	6	6	0.94	13	99.2%	No	I
T-24-1	S	11	11	0.56	-20	92.9%	No	PD
T-25-1	S	7	7	0.63	-1	50.0%	No	S
T-25-2	S	6	6	0.41	-3	64.0%	No	S
T-27-1	S	1	1	0.00	0	0.0%	No	N/A
T-32-3	T	9	0	0.00	0	46.0%	Yes	ND
T-33-1	S	11	11	0.67	-43	100.0%	No	D
T-33-2	S	4	0	0.00	0	37.5%	Yes	ND
T-34-1	S	9	0	0.00	0	46.0%	Yes	ND
T-42-1	T	1	0	0.00	0	0.0%	Yes	ND

Project: Overburden **User Name:** MV

Location: Nashua **State:** New Hampshire

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
CHLOROBENZENE								
T-44-1	T	1	0	0.00	0	0.0%	Yes	ND
T-47	T	5	3	1.00	1	50.0%	No	NT
T-48-2	T	11	11	0.39	-11	77.7%	No	S
T-48-3	T	11	11	0.40	-13	82.1%	No	S
T-48-4	T	7	7	0.28	6	76.4%	No	NT
T-54-2	T	1	0	0.00	0	0.0%	Yes	ND
T-58	T	5	0	0.00	0	40.8%	Yes	ND
T-60-1	T	11	11	0.36	-14	84.0%	No	S
T-60-3	T	11	11	0.50	-12	79.9%	No	S
T-61	T	11	11	0.43	-13	82.1%	No	S
T-62-2	T	7	0	0.00	0	43.7%	Yes	ND
T-63-1	T	8	8	0.33	-5	68.3%	No	S
T-64-2	T	7	7	0.43	15	98.5%	No	I
T-64-3	T	6	6	0.42	-15	99.9%	No	D
T-8-1	S	7	7	1.10	-1	50.0%	No	NT
T-8-2	S	7	7	0.35	-10	90.7%	No	PD
T-98	T	1	0	0.00	0	0.0%	Yes	ND
LEAD								
HA-10-A	T	8	0	0.00	0	45.2%	Yes	ND
HA-10-B	T	8	0	0.00	0	45.2%	Yes	ND
HA-10-C	T	8	0	0.00	0	45.2%	Yes	ND
HA-11-A	T	9	6	0.66	-17	95.1%	No	D
HA-11-B	T	9	0	0.00	0	46.0%	Yes	ND
HA-11-C	T	9	7	0.79	-29	100.0%	No	D
HA-12-A	T	1	1	0.00	0	0.0%	No	N/A
HA-12-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-C	T	1	0	0.00	0	0.0%	Yes	ND
HA-13-B	T	9	4	0.47	2	54.0%	No	NT
HA-14	T	1	0	0.00	0	0.0%	Yes	ND
HA-4-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-5-A	T	10	1	0.03	-5	63.6%	No	S
HA-5-C	T	10	0	0.00	0	46.4%	Yes	ND
HA-7-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-9-A	T	1	0	0.00	0	0.0%	Yes	ND
T-100-1	T	9	3	1.99	-5	65.7%	No	NT
T-12-1	S	10	5	1.12	-19	94.6%	No	PD
T-12-3	S	6	5	0.64	1	50.0%	No	NT
T-13-1	S	11	5	1.17	-36	99.8%	No	D
T-13-2	S	11	5	1.07	-20	92.9%	No	PD
T-13-3	S	11	3	0.31	-1	50.0%	No	S
T-18-1	S	1	0	0.00	0	0.0%	Yes	ND
T-19-1	S	7	5	0.65	-10	90.7%	No	PD
T-19-3	S	7	6	1.79	-4	66.7%	No	NT
T-24-1	S	11	5	1.36	-30	99.0%	No	D
T-25-1	S	7	6	0.92	-11	93.2%	No	PD
T-25-2	S	6	5	1.01	3	64.0%	No	NT
T-27-1	S	1	1	0.00	0	0.0%	No	N/A
T-32-3	T	9	3	0.31	-11	84.6%	No	S
T-33-1	S	10	5	0.98	-29	99.5%	No	D

Project: Overburden **User Name:** MV

Location: Nashua **State:** New Hampshire

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
LEAD								
T-33-2	S	8	8	0.61	-8	80.1%	No	S
T-34-1	S	10	6	2.14	-21	96.4%	No	D
T-42-1	T	1	0	0.00	0	0.0%	Yes	ND
T-44-1	T	1	1	0.00	0	0.0%	No	N/A
T-47	T	7	4	0.70	-10	90.7%	No	PD
T-48-2	T	11	5	0.73	-12	79.9%	No	S
T-48-3	T	11	3	0.24	-3	56.0%	No	S
T-48-4	T	7	5	0.42	-3	61.4%	No	S
T-54-2	T	1	1	0.00	0	0.0%	No	N/A
T-58	T	6	0	0.00	0	42.3%	Yes	ND
T-60-1	T	11	6	0.68	-31	99.2%	No	D
T-60-3	T	11	6	1.17	-29	98.7%	No	D
T-61	T	11	7	1.59	-23	95.7%	No	D
T-62-2	T	8	8	0.52	-8	80.1%	No	S
T-63-1	T	7	2	1.27	-3	61.4%	No	NT
T-64-2	T	7	2	0.39	-2	55.7%	No	S
T-64-3	T	6	1	0.54	-1	50.0%	No	S
T-8-1	S	6	5	1.22	-1	50.0%	No	NT
T-8-2	S	6	1	0.12	5	76.5%	No	NT
T-98	T	1	0	0.00	0	0.0%	Yes	ND
VINYL CHLORIDE								
HA-10-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-10-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-A	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-B	T	7	0	0.00	0	43.7%	Yes	ND
HA-11-C	T	7	0	0.00	0	43.7%	Yes	ND
HA-12-A	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-12-C	T	1	0	0.00	0	0.0%	Yes	ND
HA-13-B	T	9	0	0.00	0	46.0%	Yes	ND
HA-14	T	1	0	0.00	0	0.0%	Yes	ND
HA-4-B	T	1	0	0.00	0	0.0%	Yes	ND
HA-5-A	T	11	5	0.23	-21	94.0%	No	PD
HA-5-C	T	10	1	0.00	9	75.8%	No	NT
HA-7-B	T	4	0	0.00	0	37.5%	Yes	ND
HA-9-A	T	1	0	0.00	0	0.0%	Yes	ND
T-100-1	T	9	0	0.00	0	46.0%	Yes	ND
T-12-1	S	11	2	0.11	-17	89.1%	No	S
T-12-3	S	4	0	0.00	0	37.5%	Yes	ND
T-13-1	S	11	4	0.29	-8	70.3%	No	S
T-13-2	S	9	2	0.13	-5	65.7%	No	S
T-13-3	S	11	6	0.33	3	56.0%	No	NT
T-19-1	S	4	0	0.00	0	37.5%	Yes	ND
T-19-3	S	4	0	0.00	0	37.5%	Yes	ND
T-24-1	S	10	3	0.89	-8	72.9%	No	S
T-25-1	S	5	2	1.19	-3	67.5%	No	NT
T-25-2	S	4	0	0.00	0	37.5%	Yes	ND
T-27-1	S	1	0	0.00	0	0.0%	Yes	ND

Project: Overburden **User Name:** MV

Location: Nashua **State:** New Hampshire

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
VINYL CHLORIDE								
T-32-3	T	9	0	0.00	0	46.0%	Yes	ND
T-33-1	S	9	1	0.46	8	76.2%	No	NT
T-33-2	S	4	0	0.00	0	37.5%	Yes	ND
T-34-1	S	9	0	0.00	0	46.0%	Yes	ND
T-42-1	T	1	0	0.00	0	0.0%	Yes	ND
T-44-1	T	1	0	0.00	0	0.0%	Yes	ND
T-47	T	5	0	0.00	0	40.8%	Yes	ND
T-48-2	T	9	1	0.16	0	46.0%	No	S
T-48-3	T	9	0	0.00	0	46.0%	Yes	ND
T-48-4	T	7	2	0.16	1	50.0%	No	NT
T-54-2	T	1	0	0.00	0	0.0%	Yes	ND
T-58	T	5	0	0.00	0	40.8%	Yes	ND
T-60-1	T	10	2	0.18	-17	92.2%	No	PD
T-60-3	T	10	1	0.08	-9	75.8%	No	S
T-61	T	10	1	0.08	-9	75.8%	No	S
T-62-2	T	7	0	0.00	0	43.7%	Yes	ND
T-63-1	T	6	0	0.00	0	42.3%	Yes	ND
T-64-2	T	5	4	0.74	-6	88.3%	No	S
T-64-3	T	4	0	0.00	0	37.5%	Yes	ND
T-8-1	S	5	1	0.32	4	75.8%	No	NT
T-8-2	S	5	0	0.00	0	40.8%	Yes	ND
T-98	T	1	0	0.00	0	0.0%	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 Linear Regression Statistics Summary

Project: Gilson Road

User Name: MV

Location: Overburden

State: New Hampshire

Time Period: 12/1/1999 **to** 3/1/2009

Consolidation Period: No Time Consolidation

Consolidation Type: Median

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									
HA-10-A	T	1.4E-03	1.4E-03	4.1E-04	No	-2.0E-05	0.30	57.8%	S
HA-10-B	T	1.0E-03	1.0E-03	3.3E-05	No	-7.1E-06	0.03	100.0%	D
HA-10-C	T	3.9E-02	3.8E-02	5.1E-03	No	3.0E-05	0.13	74.9%	NT
HA-11-A	T	2.6E-03	3.0E-03	1.2E-03	No	-1.3E-04	0.45	74.3%	S
HA-11-B	T	1.0E-03	1.0E-03	1.3E-04	No	-2.5E-05	0.13	73.5%	S
HA-11-C	T	2.2E-03	1.9E-03	1.9E-03	No	-4.3E-04	0.88	98.2%	D
HA-12-A	T	6.4E-03	6.4E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
HA-12-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-C	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-13-B	T	3.2E-03	2.0E-03	3.1E-03	No	3.0E-05	0.97	54.2%	NT
HA-14	T	1.4E-02	1.4E-02	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
HA-4-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-5-A	T	6.8E-01	6.5E-01	7.2E-02	No	-9.1E-05	0.11	100.0%	D
HA-5-C	T	5.4E-01	5.5E-01	2.2E-02	No	-3.1E-05	0.04	99.8%	D
HA-7-B	T	6.5E-02	3.5E-02	7.1E-02	No	-2.5E-04	1.08	74.5%	NT
HA-9-A	T	2.2E-03	2.2E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-100-1	T	4.3E-03	1.0E-03	6.0E-03	No	2.0E-04	1.39	66.8%	NT
T-12-1	S	3.8E-01	3.7E-01	5.7E-02	No	-1.0E-04	0.15	99.3%	D
T-12-3	S	7.9E-01	7.8E-01	6.1E-02	No	1.3E-05	0.08	54.1%	NT
T-13-1	S	2.2E-01	1.8E-01	1.2E-01	No	-3.4E-04	0.53	95.1%	D
T-13-2	S	5.7E-01	5.8E-01	4.4E-02	No	-3.0E-05	0.08	89.8%	S
T-13-3	S	9.6E-01	9.9E-01	2.1E-01	No	-1.9E-04	0.22	100.0%	D
T-18-1	S	3.9E-01	3.9E-01	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-19-1	S	5.3E-02	5.8E-02	4.5E-02	No	-1.4E-03	0.86	100.0%	D
T-19-3	S	2.7E-03	2.9E-03	9.2E-04	No	1.6E-04	0.35	91.9%	PI
T-24-1	S	5.2E-01	5.2E-01	3.9E-02	No	-4.2E-05	0.07	97.7%	D
T-25-1	S	6.0E-01	6.0E-01	1.2E-01	No	-5.6E-05	0.20	75.0%	S
T-25-2	S	6.8E-01	7.0E-01	9.8E-02	No	3.1E-04	0.14	92.9%	PI
T-27-1	S	1.4E-01	1.4E-01	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-32-3	T	1.7E-03	1.0E-03	9.2E-04	No	-2.7E-04	0.56	96.3%	D
T-33-1	S	1.5E-01	8.4E-02	2.1E-01	No	-8.4E-04	1.38	99.9%	D
T-33-2	S	1.1E-03	1.0E-03	2.1E-04	No	-1.2E-04	0.19	89.5%	S
T-34-1	S	3.5E-01	1.4E-01	6.3E-01	No	-6.3E-04	1.81	97.6%	D
T-42-1	T	1.2E-03	1.2E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-44-1	T	2.9E-02	2.9E-02	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-47	T	3.4E-01	3.3E-01	1.8E-01	No	-5.4E-04	0.51	99.5%	D
T-48-2	T	5.5E-01	5.4E-01	9.2E-02	No	-1.3E-04	0.17	99.9%	D
T-48-3	T	5.2E-01	5.1E-01	6.0E-02	No	-7.7E-05	0.12	99.1%	D
T-48-4	T	5.7E-01	5.7E-01	1.0E-01	No	-1.6E-04	0.18	99.7%	D

Project: Gilson Road **User Name:** MV

Location: Overburden **State:** New Hampshire

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									
T-54-2	T	1.8E-02	1.8E-02	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-58	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-60-1	T	1.8E-03	1.2E-03	1.0E-03	No	-3.8E-04	0.56	99.7%	D
T-60-3	T	1.1E-02	5.8E-03	9.1E-03	No	-3.6E-04	0.86	89.9%	S
T-61	T	2.1E-03	1.4E-03	2.5E-03	No	-2.5E-04	1.21	89.5%	NT
T-62-2	T	1.2E-03	1.0E-03	3.5E-04	No	-1.4E-04	0.28	91.3%	PD
T-63-1	T	9.6E-01	8.8E-01	4.6E-01	No	-2.7E-04	0.48	96.4%	D
T-64-2	T	8.5E-01	8.3E-01	1.2E-01	No	-3.4E-05	0.15	72.6%	S
T-64-3	T	6.8E-01	6.9E-01	1.0E-01	No	-3.7E-04	0.15	96.8%	D
T-8-1	S	3.7E-01	3.7E-01	6.0E-02	No	-3.3E-05	0.16	68.3%	S
T-8-2	S	2.5E-01	2.2E-01	7.5E-02	No	-5.1E-05	0.30	68.6%	S
T-98	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
BENZENE									
HA-10-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-12-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-13-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-14	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-4-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-5-A	T	7.2E-03	6.3E-03	2.2E-03	No	-1.6E-04	0.31	97.2%	D
HA-5-C	T	5.3E-03	5.5E-03	1.2E-03	No	-8.9E-06	0.22	100.0%	D
HA-7-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-9-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-100-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-12-1	S	3.4E-03	3.5E-03	1.3E-03	No	-3.5E-05	0.39	61.5%	S
T-12-3	S	5.5E-03	4.5E-03	2.3E-03	No	-8.9E-04	0.43	96.1%	D
T-13-1	S	2.9E-03	2.0E-03	1.3E-03	No	-2.3E-04	0.45	97.2%	D
T-13-2	S	1.5E-02	1.5E-02	7.2E-03	No	-3.4E-04	0.48	99.7%	D
T-13-3	S	2.1E-02	1.9E-02	6.2E-03	No	-1.7E-04	0.30	99.1%	D
T-19-1	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-19-3	S	3.2E-03	2.0E-03	2.2E-03	No	-1.3E-03	0.69	97.2%	D
T-24-1	S	1.9E-02	1.8E-02	4.5E-03	No	-6.4E-05	0.24	77.9%	S
T-25-1	S	2.8E-02	2.8E-02	1.4E-02	No	-1.5E-06	0.50	100.0%	D
T-25-2	S	1.3E-02	1.0E-02	7.7E-03	No	-1.6E-03	0.59	98.3%	D
T-27-1	S	5.7E-03	5.7E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-32-3	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-33-1	S	3.5E-03	3.4E-03	2.0E-03	No	-3.6E-04	0.56	99.8%	D
T-33-2	S	2.1E-03	2.0E-03	1.0E-04	No	5.3E-05	0.05	62.8%	NT
T-34-1	S	4.8E-03	2.0E-03	8.3E-03	No	5.6E-05	1.74	56.6%	NT
T-42-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-44-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-47	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-48-2	T	5.2E-03	5.2E-03	1.6E-03	No	-2.3E-04	0.30	98.7%	D

Project: Gilson Road **User Name:** MV

Location: Overburden **State:** New Hampshire

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
BENZENE									
T-48-3	T	5.8E-03	5.7E-03	2.1E-03	No	-3.2E-04	0.36	99.6%	D
T-48-4	T	6.5E-03	6.4E-03	1.8E-03	No	-2.7E-04	0.28	99.1%	D
T-54-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-58	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-60-1	T	2.0E-03	2.0E-03	7.1E-05	No	-1.2E-05	0.03	81.8%	S
T-60-3	T	2.0E-03	2.0E-03	6.7E-05	No	-9.1E-06	0.03	100.0%	D
T-61	T	2.1E-03	2.0E-03	3.1E-04	No	-5.7E-05	0.15	88.0%	S
T-62-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-63-1	T	4.8E-03	4.7E-03	2.6E-03	No	-3.3E-04	0.54	94.3%	PD
T-64-2	T	6.4E-03	6.8E-03	3.7E-03	No	-1.6E-04	0.58	75.1%	S
T-64-3	T	2.3E-03	2.0E-03	5.8E-04	No	-5.4E-04	0.26	94.5%	PD
T-8-1	S	2.5E-02	3.3E-02	1.8E-02	No	1.7E-04	0.70	62.7%	NT
T-8-2	S	2.8E-02	2.5E-02	1.4E-02	No	-9.4E-05	0.50	69.4%	S
T-98	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
CHLOROBENZENE									
HA-10-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-12-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-13-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-14	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-4-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-5-A	T	1.3E-01	1.3E-01	1.7E-02	No	-4.9E-05	0.13	88.3%	S
HA-5-C	T	1.0E-01	1.0E-01	1.7E-02	No	-9.9E-06	0.16	100.0%	D
HA-7-B	T	4.3E-03	4.1E-03	2.7E-03	No	-1.1E-04	0.62	51.8%	S
HA-9-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-100-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-12-1	S	7.3E-02	6.7E-02	2.9E-02	No	-1.0E-04	0.40	78.3%	S
T-12-3	S	7.7E-02	8.1E-02	1.4E-02	No	4.0E-04	0.18	91.7%	PI
T-13-1	S	4.9E-02	4.8E-02	1.7E-02	No	1.9E-04	0.36	96.6%	I
T-13-2	S	6.8E-02	7.2E-02	3.1E-02	No	2.1E-04	0.45	87.3%	NT
T-13-3	S	6.7E-02	5.2E-02	4.2E-02	No	4.9E-04	0.63	99.0%	I
T-19-1	S	1.5E-02	1.4E-02	8.5E-03	No	-1.8E-04	0.58	56.3%	S
T-19-3	S	1.3E-02	1.0E-02	1.2E-02	No	2.5E-03	0.94	99.0%	I
T-24-1	S	2.2E-01	1.8E-01	1.2E-01	No	-1.4E-04	0.56	77.3%	S
T-25-1	S	7.5E-02	7.0E-02	4.7E-02	No	2.7E-04	0.63	85.1%	NT
T-25-2	S	9.6E-03	8.9E-03	4.0E-03	No	-3.8E-04	0.41	70.0%	S
T-27-1	S	2.3E-02	2.3E-02	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-32-3	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-33-1	S	1.3E-02	1.1E-02	8.4E-03	No	-6.2E-04	0.67	100.0%	D
T-33-2	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-34-1	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-42-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-44-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND

Project: Gilson Road **User Name:** MV

Location: Overburden **State:** New Hampshire

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
CHLOROBENZENE									
T-47	T	7.8E-03	3.9E-03	7.8E-03	No	-3.1E-04	1.00	73.9%	S
T-48-2	T	7.0E-02	7.4E-02	2.7E-02	No	-3.3E-04	0.39	98.3%	D
T-48-3	T	7.9E-02	8.5E-02	3.2E-02	No	-1.8E-04	0.40	91.9%	PD
T-48-4	T	8.4E-02	9.1E-02	2.4E-02	No	-1.1E-04	0.28	83.2%	S
T-54-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-58	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-60-1	T	3.6E-02	3.3E-02	1.3E-02	No	-7.4E-05	0.36	73.5%	S
T-60-3	T	3.0E-02	2.3E-02	1.5E-02	No	-9.6E-05	0.50	75.0%	S
T-61	T	3.4E-02	2.9E-02	1.5E-02	No	-1.2E-04	0.43	81.8%	S
T-62-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-63-1	T	8.2E-02	6.9E-02	2.7E-02	No	-9.7E-05	0.33	79.0%	S
T-64-2	T	7.2E-02	7.6E-02	3.1E-02	No	2.2E-04	0.43	87.4%	NT
T-64-3	T	1.6E-02	1.7E-02	6.6E-03	No	-1.4E-03	0.42	99.9%	D
T-8-1	S	2.6E-02	2.0E-02	2.9E-02	No	5.1E-04	1.10	89.7%	NT
T-8-2	S	2.1E-02	1.9E-02	7.5E-03	No	8.1E-05	0.35	72.0%	NT
T-98	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
LEAD									
HA-10-A	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-10-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-10-C	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-11-A	T	3.3E-03	3.2E-03	2.2E-03	No	-3.5E-04	0.66	90.9%	PD
HA-11-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-11-C	T	2.0E-03	1.6E-03	1.6E-03	No	-3.8E-04	0.79	97.9%	D
HA-12-A	T	1.0E-03	1.0E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
HA-12-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-C	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-13-B	T	1.3E-03	1.0E-03	6.2E-04	No	1.6E-04	0.47	93.6%	PI
HA-14	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-4-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-5-A	T	1.0E-03	1.0E-03	3.2E-05	No	-7.8E-06	0.03	100.0%	D
HA-5-C	T	1.0E-03	1.0E-03	2.3E-19	Yes	0.0E+00	0.00	100.0%	ND
HA-7-B	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-9-A	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-100-1	T	5.6E-03	1.0E-03	1.1E-02	No	4.6E-04	1.99	83.6%	NT
T-12-1	S	3.8E-03	1.2E-03	4.3E-03	No	-6.3E-04	1.12	98.3%	D
T-12-3	S	1.2E-02	1.0E-02	7.3E-03	No	-1.5E-03	0.64	80.7%	S
T-13-1	S	2.6E-02	1.0E-03	3.0E-02	No	-1.6E-03	1.17	99.8%	D
T-13-2	S	4.5E-03	1.0E-03	4.8E-03	No	-4.6E-04	1.07	90.8%	PD
T-13-3	S	1.2E-03	1.0E-03	3.7E-04	No	6.8E-06	0.31	100.0%	I
T-18-1	S	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-19-1	S	2.8E-03	2.6E-03	1.8E-03	No	-4.4E-04	0.65	98.3%	D
T-19-3	S	1.7E-02	4.2E-03	3.0E-02	No	3.4E-04	1.79	76.3%	NT
T-24-1	S	4.0E-03	1.0E-03	5.4E-03	No	-6.9E-04	1.36	98.7%	D
T-25-1	S	1.0E-02	5.5E-03	9.2E-03	No	-2.3E-04	0.92	67.2%	S
T-25-2	S	1.0E-02	5.9E-03	1.1E-02	No	-2.5E-04	1.01	55.1%	NT
T-27-1	S	1.9E-03	1.9E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-32-3	T	1.2E-03	1.0E-03	3.7E-04	No	-9.4E-05	0.31	87.0%	S
T-33-1	S	2.4E-03	1.1E-03	2.3E-03	No	-4.9E-04	0.98	99.0%	D
T-33-2	S	1.3E-02	1.4E-02	7.7E-03	No	-9.5E-04	0.61	99.8%	D

Project: Gilson Road **User Name:** MV

Location: Overburden **State:** New Hampshire

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
LEAD									
T-34-1	S	1.3E-01	3.7E-02	2.7E-01	No	-1.2E-03	2.14	93.5%	PD
T-42-1	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-44-1	T	8.6E-03	8.6E-03	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-47	T	2.7E-03	2.6E-03	1.9E-03	No	-3.8E-04	0.70	91.6%	PD
T-48-2	T	1.7E-03	1.0E-03	1.3E-03	No	5.9E-06	0.73	100.0%	I
T-48-3	T	1.2E-03	1.0E-03	2.7E-04	No	1.9E-05	0.24	60.7%	NT
T-48-4	T	2.4E-03	2.7E-03	1.0E-03	No	4.9E-05	0.42	58.9%	NT
T-54-2	T	3.1E-02	3.1E-02	0.0E+00	No	0.0E+00	0.00	0.0%	N/A
T-58	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-60-1	T	2.5E-03	1.4E-03	1.7E-03	No	-5.4E-04	0.68	99.8%	D
T-60-3	T	3.0E-02	1.7E-02	3.5E-02	No	-1.0E-03	1.17	95.2%	D
T-61	T	5.4E-03	2.6E-03	8.6E-03	No	-3.4E-04	1.59	84.6%	NT
T-62-2	T	3.4E-02	2.9E-02	1.8E-02	No	-1.8E-04	0.52	79.0%	S
T-63-1	T	3.9E-03	1.0E-03	5.0E-03	No	-2.9E-04	1.27	73.6%	NT
T-64-2	T	1.2E-03	1.0E-03	4.5E-04	No	-5.1E-05	0.39	66.4%	S
T-64-3	T	1.3E-03	1.0E-03	6.9E-04	No	-1.8E-04	0.54	60.6%	S
T-8-1	S	1.9E-02	9.8E-03	2.3E-02	No	-8.5E-04	1.22	96.6%	D
T-8-2	S	1.0E-03	1.0E-03	1.2E-04	No	8.3E-05	0.12	100.0%	I
T-98	T	1.0E-03	1.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
VINYL CHLORIDE									
HA-10-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-10-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-11-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	8.7E-35	0.00	100.0%	ND
HA-12-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-12-C	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-13-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-14	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-4-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
HA-5-A	T	2.3E-03	2.0E-03	5.1E-04	No	-9.4E-05	0.23	94.8%	PD
HA-5-C	T	2.0E-03	2.0E-03	8.4E-19	No	1.1E-19	0.00	100.0%	I
HA-7-B	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
HA-9-A	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-100-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-12-1	S	2.1E-03	2.0E-03	2.2E-04	No	-4.9E-05	0.11	95.0%	PD
T-12-3	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-13-1	S	2.2E-03	2.0E-03	6.6E-04	No	-8.0E-05	0.29	87.7%	S
T-13-2	S	2.1E-03	2.0E-03	2.7E-04	No	-3.4E-05	0.13	78.3%	S
T-13-3	S	2.7E-03	2.1E-03	8.8E-04	No	1.1E-05	0.33	54.6%	NT
T-19-1	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-19-3	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-24-1	S	3.2E-03	2.0E-03	2.8E-03	No	-2.2E-04	0.89	87.1%	S
T-25-1	S	7.3E-03	2.0E-03	8.7E-03	No	-3.6E-04	1.19	75.6%	NT
T-25-2	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-27-1	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-32-3	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND

Project: Gilson Road **User Name:** MV

Location: Overburden **State:** New Hampshire

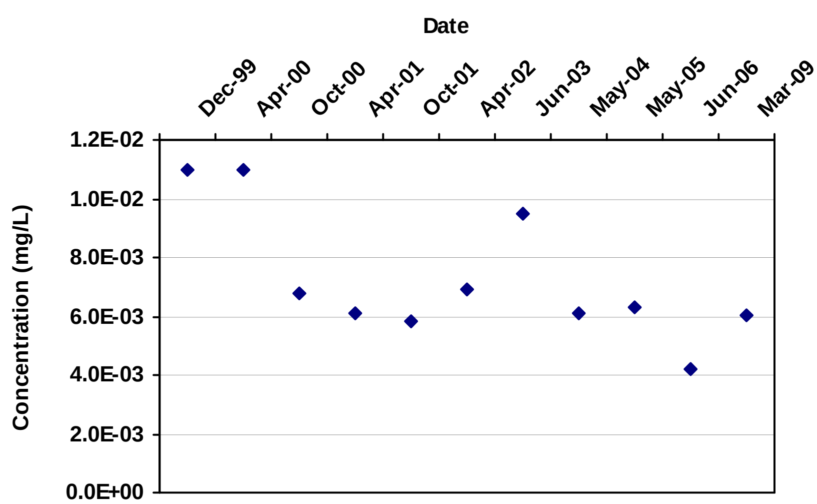
Well	Source/ Tail	Average Conc (mg/L)	Median Conc (mg/L)	Standard Deviation	All Samples "ND" ?	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
VINYL CHLORIDE									
T-33-1	S	2.4E-03	2.0E-03	1.1E-03	No	2.3E-04	0.46	98.6%	I
T-33-2	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-34-1	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-42-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-44-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-47	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-48-2	T	2.1E-03	2.0E-03	3.3E-04	No	-7.4E-06	0.16	100.0%	D
T-48-3	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-48-4	T	2.1E-03	2.0E-03	3.4E-04	No	-3.2E-05	0.16	71.7%	S
T-54-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND
T-58	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-60-1	T	2.2E-03	2.0E-03	3.9E-04	No	-7.6E-05	0.18	93.6%	PD
T-60-3	T	2.1E-03	2.0E-03	1.6E-04	No	-2.7E-05	0.08	87.3%	S
T-61	T	2.1E-03	2.0E-03	1.6E-04	No	-2.7E-05	0.08	87.3%	S
T-62-2	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-63-1	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-64-2	T	5.6E-03	5.0E-03	4.2E-03	No	-4.1E-04	0.74	88.7%	S
T-64-3	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-8-1	S	2.3E-03	2.0E-03	7.6E-04	No	2.1E-04	0.32	99.9%	I
T-8-2	S	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
T-98	T	2.0E-03	2.0E-03	0.0E+00	Yes	0.0E+00	0.00	0.0%	ND

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 Mann-Kendall Statistics Summary

Well: HA-5-A
Well Type: T
COC: BENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -27

Confidence in Trend: 98.0%

Coefficient of Variation: 0.31

Mann Kendall Concentration Trend: (See Note) D

Data Table:

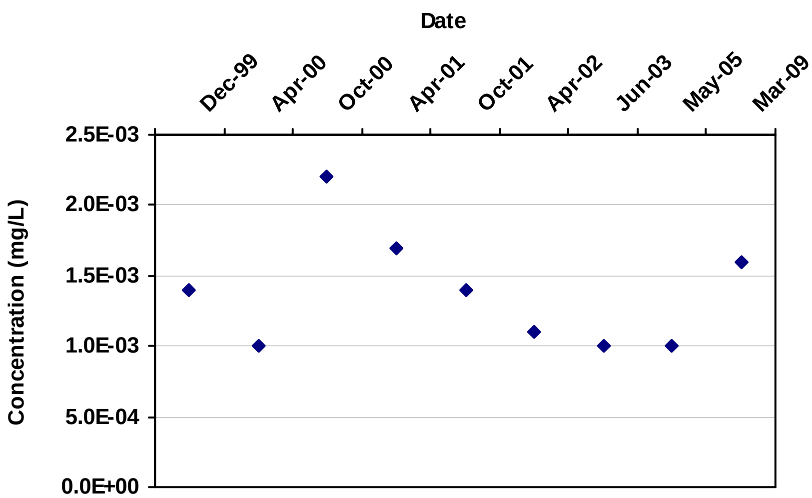
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
HA-5-A	T	12/1/1999	BENZENE	1.1E-02		1	1
HA-5-A	T	4/15/2000	BENZENE	1.1E-02		1	1
HA-5-A	T	10/1/2000	BENZENE	6.8E-03		1	1
HA-5-A	T	4/1/2001	BENZENE	6.1E-03		1	1
HA-5-A	T	10/1/2001	BENZENE	5.8E-03		1	1
HA-5-A	T	4/1/2002	BENZENE	6.9E-03		1	1
HA-5-A	T	6/15/2003	BENZENE	9.5E-03		2	2
HA-5-A	T	5/1/2004	BENZENE	6.1E-03		1	1
HA-5-A	T	5/1/2005	BENZENE	6.3E-03		1	1
HA-5-A	T	6/1/2006	BENZENE	4.2E-03		1	1
HA-5-A	T	3/1/2009	BENZENE	6.0E-03		2	2

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: HA-10-A
Well Type: T
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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: 0.30

Mann Kendall Concentration Trend: (See Note) S

Data Table:

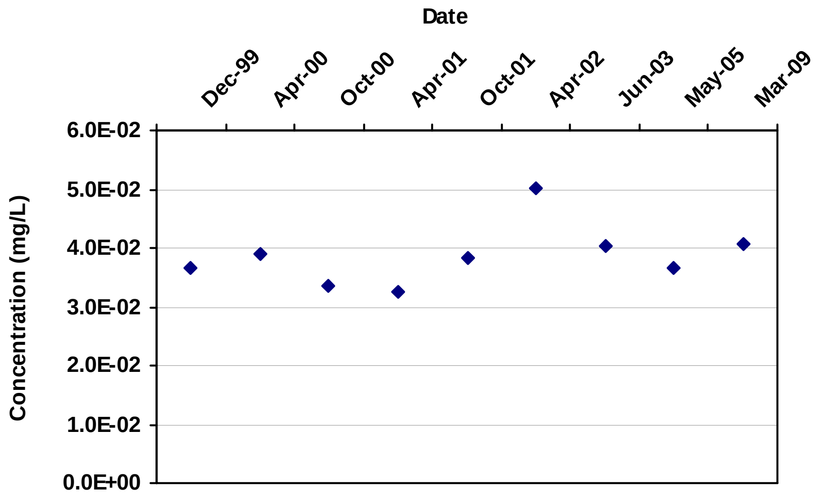
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
HA-10-A	T	12/1/1999	ARSENIC	1.4E-03		1	1
HA-10-A	T	4/15/2000	ARSENIC	1.0E-03	ND	1	0
HA-10-A	T	10/1/2000	ARSENIC	2.2E-03		1	1
HA-10-A	T	4/1/2001	ARSENIC	1.7E-03		1	1
HA-10-A	T	10/1/2001	ARSENIC	1.4E-03		1	1
HA-10-A	T	4/1/2002	ARSENIC	1.1E-03		1	1
HA-10-A	T	6/15/2003	ARSENIC	1.0E-03	ND	2	0
HA-10-A	T	5/1/2005	ARSENIC	1.0E-03		1	1
HA-10-A	T	3/1/2009	ARSENIC	1.6E-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: HA-10-C
Well Type: T
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 12

Confidence in Trend: 87.0%

Coefficient of Variation: 0.13

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

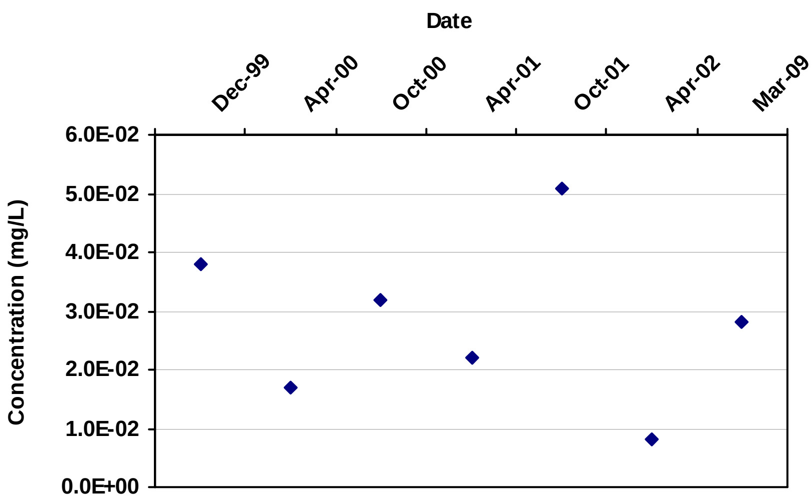
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
HA-10-C	T	12/1/1999	ARSENIC	3.6E-02		1	1
HA-10-C	T	4/15/2000	ARSENIC	3.9E-02		1	1
HA-10-C	T	10/1/2000	ARSENIC	3.4E-02		2	2
HA-10-C	T	4/1/2001	ARSENIC	3.3E-02		1	1
HA-10-C	T	10/1/2001	ARSENIC	3.8E-02		1	1
HA-10-C	T	4/1/2002	ARSENIC	5.0E-02		1	1
HA-10-C	T	6/15/2003	ARSENIC	4.1E-02		2	2
HA-10-C	T	5/1/2005	ARSENIC	3.7E-02		1	1
HA-10-C	T	3/1/2009	ARSENIC	4.1E-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: T-25-1
Well Type: S
COC: BENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -3

Confidence in Trend: 61.4%

Coefficient of Variation: 0.50

Mann Kendall Concentration Trend: (See Note) S

Data Table:

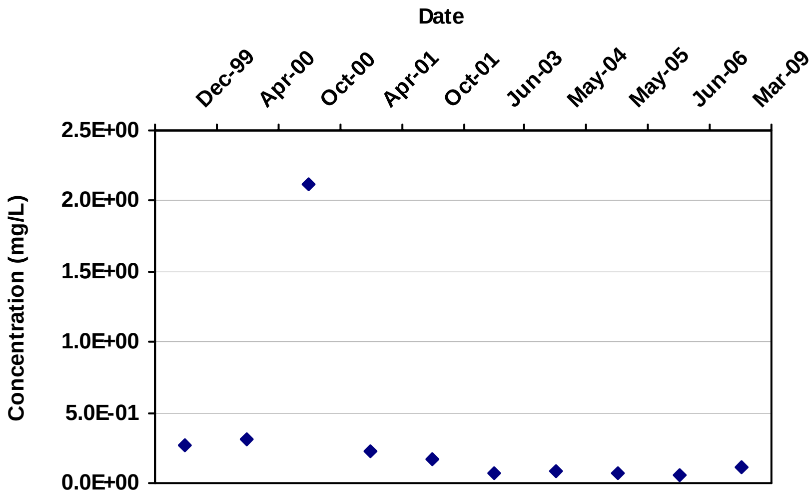
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-25-1	S	12/1/1999	BENZENE	3.8E-02		1	1
T-25-1	S	4/15/2000	BENZENE	1.7E-02		2	2
T-25-1	S	10/1/2000	BENZENE	3.2E-02		1	1
T-25-1	S	4/1/2001	BENZENE	2.2E-02		1	1
T-25-1	S	10/1/2001	BENZENE	5.1E-02		1	1
T-25-1	S	4/1/2002	BENZENE	8.1E-03		1	1
T-25-1	S	3/1/2009	BENZENE	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: T-34-1
Well Type: S
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -29

Confidence in Trend: 99.5%

Coefficient of Variation: 1.81

Mann Kendall Concentration Trend: (See Note) D

Data Table:

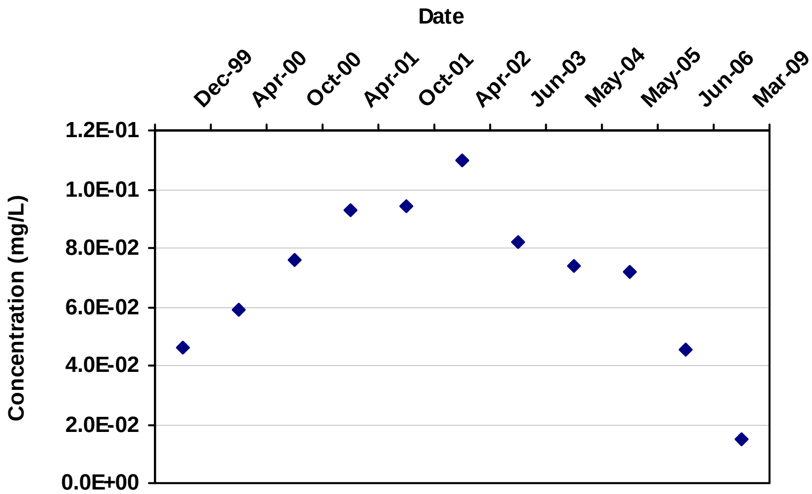
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-34-1	S	12/1/1999	ARSENIC	2.7E-01		1	1
T-34-1	S	4/15/2000	ARSENIC	3.1E-01		1	1
T-34-1	S	10/1/2000	ARSENIC	2.1E+00		2	2
T-34-1	S	4/1/2001	ARSENIC	2.3E-01		1	1
T-34-1	S	10/1/2001	ARSENIC	1.6E-01		1	1
T-34-1	S	6/15/2003	ARSENIC	6.6E-02		2	2
T-34-1	S	5/1/2004	ARSENIC	8.6E-02		1	1
T-34-1	S	5/1/2005	ARSENIC	6.5E-02		1	1
T-34-1	S	6/1/2006	ARSENIC	5.0E-02		1	1
T-34-1	S	3/1/2009	ARSENIC	1.2E-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: T-48-2
Well Type: T
COC: CHLOROBENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -11

Confidence in Trend: 77.7%

Coefficient of Variation: 0.39

Mann Kendall Concentration Trend: (See Note) S

Data Table:

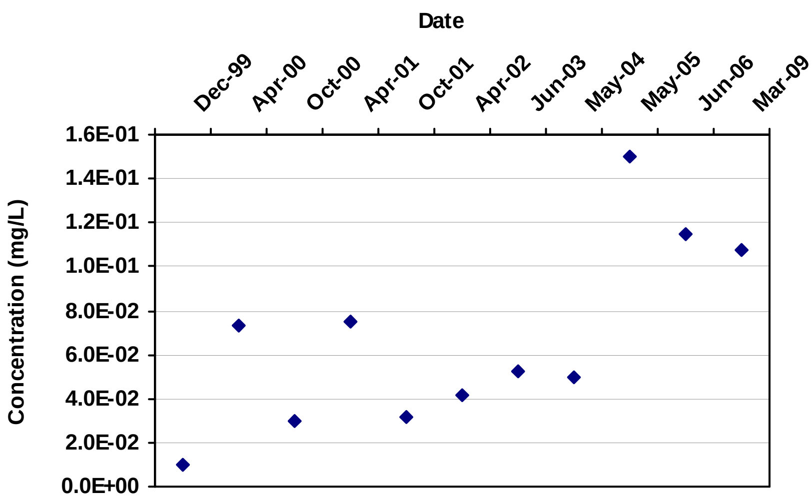
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-48-2	T	12/1/1999	CHLOROBENZENE	4.6E-02		1	1
T-48-2	T	4/15/2000	CHLOROBENZENE	5.9E-02		1	1
T-48-2	T	10/1/2000	CHLOROBENZENE	7.6E-02		1	1
T-48-2	T	4/1/2001	CHLOROBENZENE	9.3E-02		1	1
T-48-2	T	10/1/2001	CHLOROBENZENE	9.4E-02		1	1
T-48-2	T	4/1/2002	CHLOROBENZENE	1.1E-01		1	1
T-48-2	T	6/15/2003	CHLOROBENZENE	8.2E-02		2	2
T-48-2	T	5/1/2004	CHLOROBENZENE	7.4E-02		1	1
T-48-2	T	5/1/2005	CHLOROBENZENE	7.2E-02		1	1
T-48-2	T	6/1/2006	CHLOROBENZENE	4.6E-02		2	2
T-48-2	T	3/1/2009	CHLOROBENZENE	1.5E-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: T-13-3
Well Type: S
COC: CHLOROBENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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: 0.63

Mann Kendall Concentration Trend: (See Note) I

Data Table:

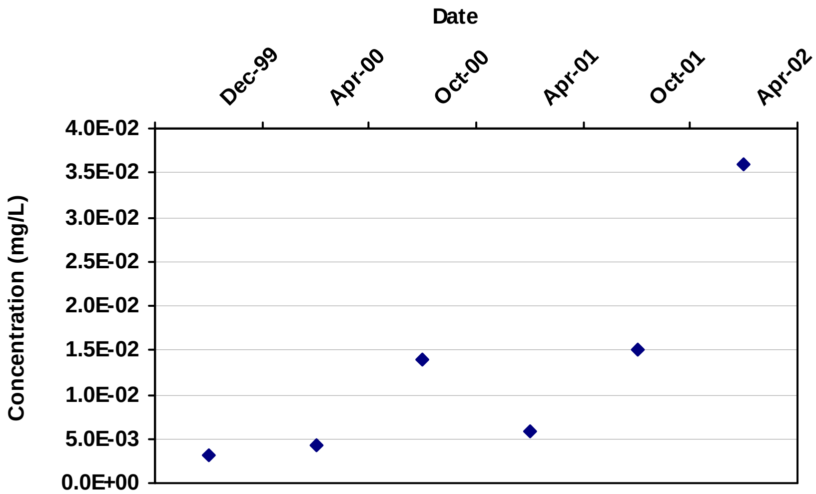
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-13-3	S	12/1/1999	CHLOROBENZENE	1.0E-02		1	1
T-13-3	S	4/15/2000	CHLOROBENZENE	7.3E-02		1	1
T-13-3	S	10/1/2000	CHLOROBENZENE	3.0E-02		1	1
T-13-3	S	4/1/2001	CHLOROBENZENE	7.5E-02		1	1
T-13-3	S	10/1/2001	CHLOROBENZENE	3.2E-02		1	1
T-13-3	S	4/1/2002	CHLOROBENZENE	4.2E-02		1	1
T-13-3	S	6/15/2003	CHLOROBENZENE	5.2E-02		2	2
T-13-3	S	5/1/2004	CHLOROBENZENE	5.0E-02		1	1
T-13-3	S	5/1/2005	CHLOROBENZENE	1.5E-01		1	1
T-13-3	S	6/1/2006	CHLOROBENZENE	1.2E-01		3	3
T-13-3	S	3/1/2009	CHLOROBENZENE	1.1E-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

Well: T-19-3
Well Type: S
COC: CHLOROBENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 13

Confidence in Trend: 99.2%

Coefficient of Variation: 0.94

Mann Kendall Concentration Trend: (See Note) I

Data Table:

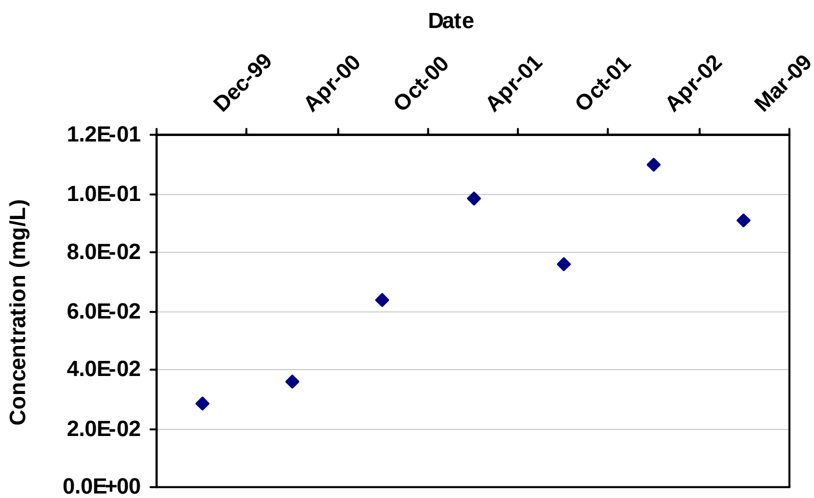
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-19-3	S	12/1/1999	CHLOROBENZENE	3.2E-03		1	1
T-19-3	S	4/15/2000	CHLOROBENZENE	4.3E-03		1	1
T-19-3	S	10/1/2000	CHLOROBENZENE	1.4E-02		1	1
T-19-3	S	4/1/2001	CHLOROBENZENE	5.9E-03		1	1
T-19-3	S	10/1/2001	CHLOROBENZENE	1.5E-02		1	1
T-19-3	S	4/1/2002	CHLOROBENZENE	3.6E-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: T-64-2
Well Type: T
COC: CHLOROBENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 15

Confidence in Trend: 98.5%

Coefficient of Variation: 0.43

Mann Kendall Concentration Trend: (See Note) I

Data Table:

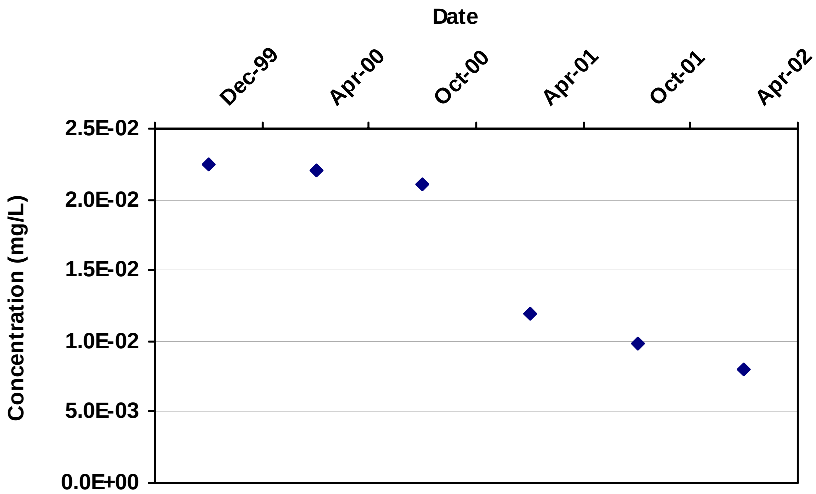
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-64-2	T	12/1/1999	CHLOROBENZENE	2.9E-02		2	2
T-64-2	T	4/15/2000	CHLOROBENZENE	3.6E-02		1	1
T-64-2	T	10/1/2000	CHLOROBENZENE	6.4E-02		1	1
T-64-2	T	4/1/2001	CHLOROBENZENE	9.8E-02		1	1
T-64-2	T	10/1/2001	CHLOROBENZENE	7.6E-02		1	1
T-64-2	T	4/1/2002	CHLOROBENZENE	1.1E-01		1	1
T-64-2	T	3/1/2009	CHLOROBENZENE	9.1E-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: T-64-3
Well Type: T
COC: CHLOROBENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -15

Confidence in Trend: 99.9%

Coefficient of Variation: 0.42

Mann Kendall Concentration Trend: (See Note) D

Data Table:

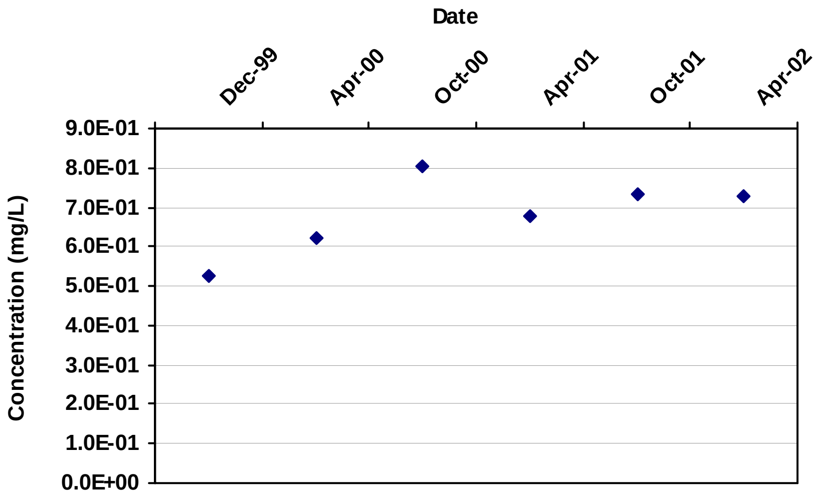
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-64-3	T	12/1/1999	CHLOROBENZENE	2.3E-02		2	2
T-64-3	T	4/15/2000	CHLOROBENZENE	2.2E-02		1	1
T-64-3	T	10/1/2000	CHLOROBENZENE	2.1E-02		1	1
T-64-3	T	4/1/2001	CHLOROBENZENE	1.2E-02		1	1
T-64-3	T	10/1/2001	CHLOROBENZENE	9.9E-03		1	1
T-64-3	T	4/1/2002	CHLOROBENZENE	8.0E-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: T-25-2
Well Type: S
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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: 0.14

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

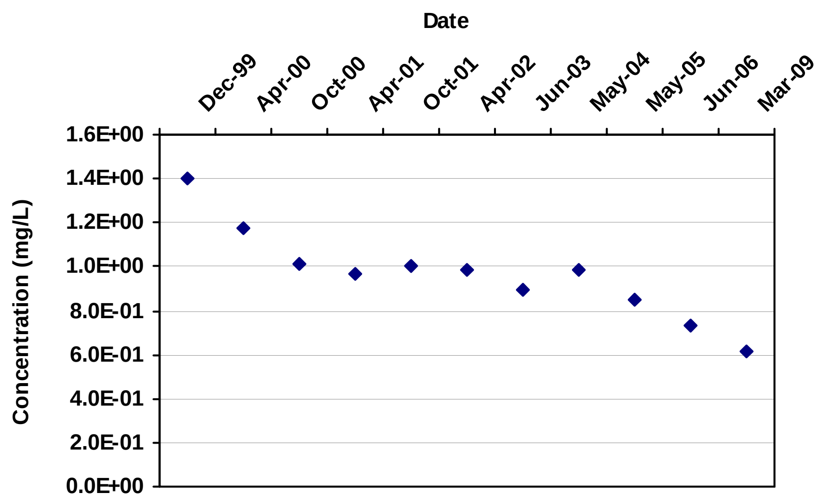
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-25-2	S	12/1/1999	ARSENIC	5.3E-01		1	1
T-25-2	S	4/15/2000	ARSENIC	6.2E-01		1	1
T-25-2	S	10/1/2000	ARSENIC	8.1E-01		2	2
T-25-2	S	4/1/2001	ARSENIC	6.8E-01		1	1
T-25-2	S	10/1/2001	ARSENIC	7.3E-01		1	1
T-25-2	S	4/1/2002	ARSENIC	7.3E-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: T-13-3
Well Type: S
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -45

Confidence in Trend: 100.0%

Coefficient of Variation: 0.22

Mann Kendall Concentration Trend: (See Note) D

Data Table:

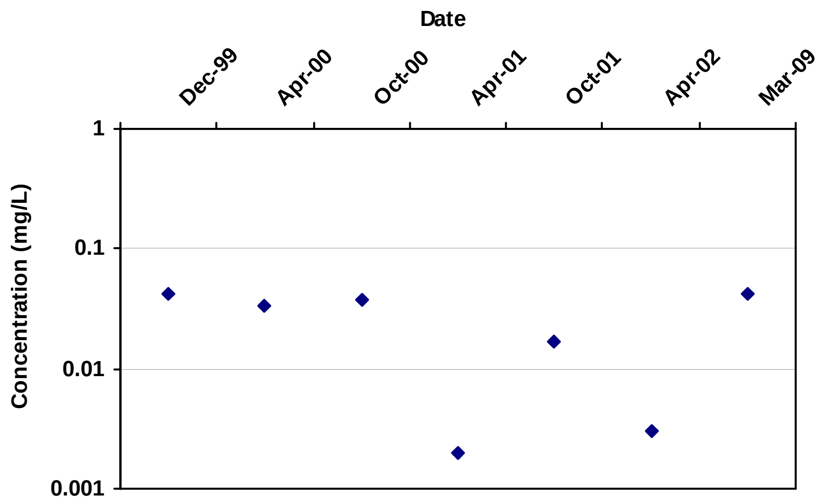
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-13-3	S	12/1/1999	ARSENIC	1.4E+00		1	1
T-13-3	S	4/15/2000	ARSENIC	1.2E+00		1	1
T-13-3	S	10/1/2000	ARSENIC	1.0E+00		2	2
T-13-3	S	4/1/2001	ARSENIC	9.6E-01		1	1
T-13-3	S	10/1/2001	ARSENIC	1.0E+00		1	1
T-13-3	S	4/1/2002	ARSENIC	9.9E-01		1	1
T-13-3	S	6/15/2003	ARSENIC	9.0E-01		2	2
T-13-3	S	5/1/2004	ARSENIC	9.9E-01		1	1
T-13-3	S	5/1/2005	ARSENIC	8.5E-01		1	1
T-13-3	S	6/1/2006	ARSENIC	7.3E-01		3	3
T-13-3	S	3/1/2009	ARSENIC	6.1E-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

Well: T-8-1
Well Type: S
COC: BENZENE

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -4

Confidence in Trend: 66.7%

Coefficient of Variation: 0.70

Mann Kendall Concentration Trend: (See Note) S

Data Table:

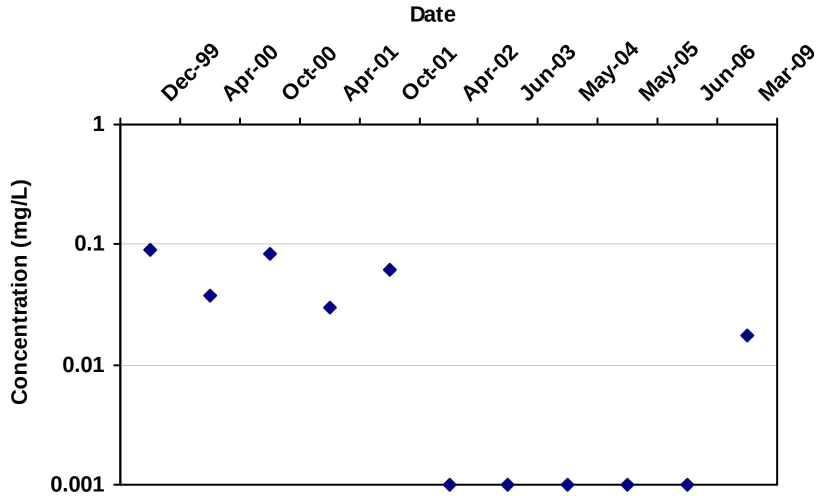
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-8-1	S	12/1/1999	BENZENE	4.2E-02		1	1
T-8-1	S	4/15/2000	BENZENE	3.3E-02		1	1
T-8-1	S	10/1/2000	BENZENE	3.8E-02		1	1
T-8-1	S	4/1/2001	BENZENE	2.0E-03	ND	1	0
T-8-1	S	10/1/2001	BENZENE	1.7E-02		1	1
T-8-1	S	4/1/2002	BENZENE	3.0E-03		1	1
T-8-1	S	3/1/2009	BENZENE	4.2E-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: T-60-3
Well Type: T
COC: LEAD

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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:
1.17

Mann Kendall Concentration Trend: (See Note)
D

Data Table:

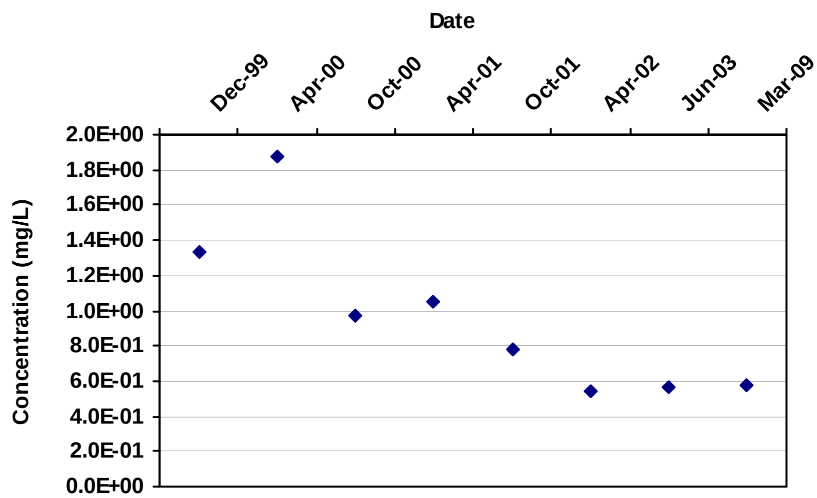
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-60-3	T	12/1/1999	LEAD	8.9E-02		1	1
T-60-3	T	4/15/2000	LEAD	3.8E-02		1	1
T-60-3	T	10/1/2000	LEAD	8.5E-02		2	2
T-60-3	T	4/1/2001	LEAD	3.0E-02		1	1
T-60-3	T	10/1/2001	LEAD	6.1E-02		1	1
T-60-3	T	4/1/2002	LEAD	1.0E-03	ND	1	0
T-60-3	T	6/15/2003	LEAD	1.0E-03	ND	2	0
T-60-3	T	5/1/2004	LEAD	1.0E-03	ND	1	0
T-60-3	T	5/1/2005	LEAD	1.0E-03	ND	1	0
T-60-3	T	6/1/2006	LEAD	1.0E-03	ND	1	0
T-60-3	T	3/1/2009	LEAD	1.7E-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: T-63-1
Well Type: T
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -18

Confidence in Trend: 98.4%

Coefficient of Variation: 0.48

Mann Kendall Concentration Trend: (See Note) D

Data Table:

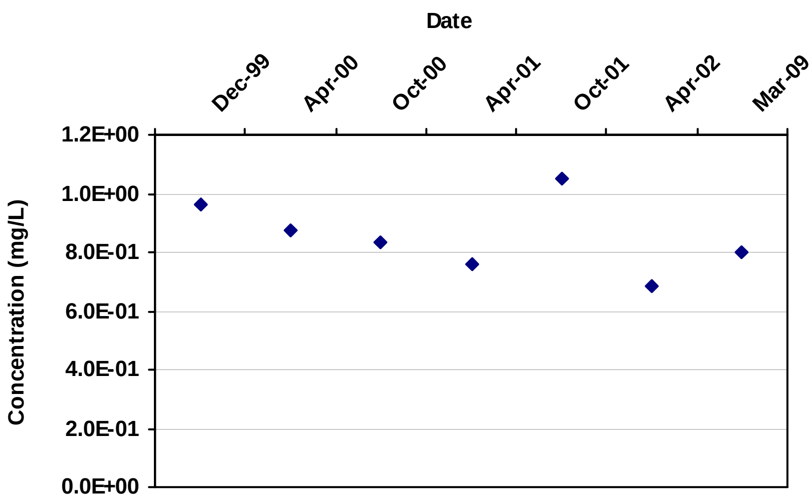
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-63-1	T	12/1/1999	ARSENIC	1.3E+00		1	1
T-63-1	T	4/15/2000	ARSENIC	1.9E+00		1	1
T-63-1	T	10/1/2000	ARSENIC	9.7E-01		2	2
T-63-1	T	4/1/2001	ARSENIC	1.1E+00		1	1
T-63-1	T	10/1/2001	ARSENIC	7.8E-01		1	1
T-63-1	T	4/1/2002	ARSENIC	5.5E-01		1	1
T-63-1	T	6/15/2003	ARSENIC	5.6E-01		2	2
T-63-1	T	3/1/2009	ARSENIC	5.8E-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: T-64-2
Well Type: T
COC: ARSENIC

Time Period: 12/1/1999 **to** 3/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -9

Confidence in Trend: 88.1%

Coefficient of Variation: 0.15

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
T-64-2	T	12/1/1999	ARSENIC	9.6E-01		1	1
T-64-2	T	4/15/2000	ARSENIC	8.8E-01		1	1
T-64-2	T	10/1/2000	ARSENIC	8.3E-01		2	2
T-64-2	T	4/1/2001	ARSENIC	7.6E-01		1	1
T-64-2	T	10/1/2001	ARSENIC	1.1E+00		1	1
T-64-2	T	4/1/2002	ARSENIC	6.9E-01		1	1
T-64-2	T	3/1/2009	ARSENIC	8.0E-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 Zeroth Moment Analysis

Project: Overburden

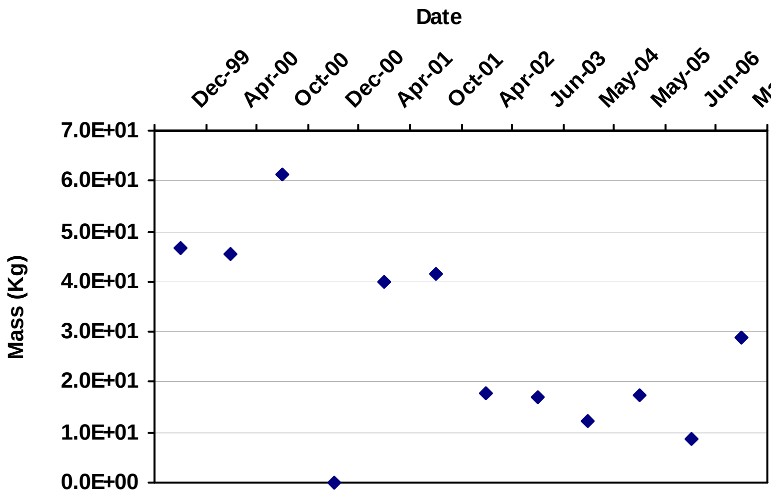
User Name: MV

Location: Nashua

State: New Hampshire

COC: ARSENIC

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Uniform: 20 ft

Mann Kendall S Statistic:

-30

Confidence in Trend:

97.8%

Coefficient of Variation:

0.66

Zeroth Moment Trend:

D

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
12/1/1999	ARSENIC	4.7E+01	21
4/15/2000	ARSENIC	4.5E+01	21
10/1/2000	ARSENIC	6.1E+01	22
12/1/2000	ARSENIC	0.0E+00	1
4/1/2001	ARSENIC	4.0E+01	23
10/1/2001	ARSENIC	4.1E+01	22
4/1/2002	ARSENIC	1.8E+01	15
6/15/2003	ARSENIC	1.7E+01	16
5/1/2004	ARSENIC	1.2E+01	13
5/1/2005	ARSENIC	1.7E+01	14
6/1/2006	ARSENIC	8.8E+00	15
3/1/2009	ARSENIC	2.9E+01	33

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 Spatial Moment Analysis Summary

Project: Gilson Road

Location: Overburden   Select Wells Exterior of Slurry Wall

User Name: MV

State: New Hampshire

Effective Date	0th Moment Estimated Mass (Kg)	1st Moment (Center of Mass) Xc (ft)	Yc (ft)	Source Distance (ft)	2nd Moment (Spread) Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
ARSENIC							
7/1/1999	1.1E+01	1,021,724	80,808	1,625	22,811	39,911	12
7/1/2000	8.4E+00	1,021,749	80,737	1,564	24,195	26,596	14
7/1/2001	9.4E+00	1,021,768	80,759	1,561	25,533	35,735	14
7/1/2002	6.3E+00	1,021,704	80,680	1,571	16,381	8,358	12
7/1/2003	6.1E+00	1,021,748	80,732	1,562	30,337	21,252	11
7/1/2004	1.4E+00	1,021,933	80,916	1,532	16,479	18,536	8
7/1/2005	4.0E+00	1,021,732	80,724	1,570	28,482	27,045	10
7/1/2006	1.5E+00	1,021,877	80,854	1,532	10,904	36,330	9
7/1/2009	6.2E+00	1,021,721	80,714	1,574	21,389	23,450	14
BENZENE							
7/1/1999	0.0E+00						4
7/1/2000	3.2E-01	1,021,763	80,966	1,692	40,684	63,066	14
7/1/2001	3.5E-01	1,021,746	80,955	1,698	41,647	63,456	14
7/1/2002	3.4E-01	1,021,757	80,966	1,696	40,258	61,672	13
7/1/2003	3.1E-01	1,021,809	80,991	1,674	38,200	59,866	11
7/1/2004	2.4E-01	1,021,912	81,092	1,672	8,820	36,086	8
7/1/2005	3.4E-01	1,021,791	80,991	1,688	36,318	57,069	10
7/1/2006	1.9E-01	1,021,905	81,121	1,699	8,431	37,510	8
7/1/2009	2.8E-01	1,021,782	81,002	1,702	37,775	63,050	13
CHLOROBENZENE							
7/1/1999	3.9E-01	1,021,772	80,981	1,695	3,953	43,416	7
7/1/2000	1.2E+00	1,021,776	80,917	1,650	30,861	77,509	14
7/1/2001	1.5E+00	1,021,791	80,926	1,645	31,305	73,216	14
7/1/2002	1.4E+00	1,021,756	80,853	1,626	29,161	61,130	13
7/1/2003	1.4E+00	1,021,827	80,908	1,605	36,485	59,764	11
7/1/2004	8.3E-01	1,021,920	81,019	1,613	12,598	40,778	8
7/1/2005	1.1E+00	1,021,809	80,920	1,628	36,601	62,146	10
7/1/2006	6.8E-01	1,021,915	81,042	1,634	12,347	46,335	8
7/1/2009	1.3E+00	1,021,764	80,896	1,646	29,060	72,217	13
LEAD							
7/1/1999	3.7E-01	1,021,694	81,070	1,813	33,289	27,225	12
7/1/2000	5.6E-01	1,021,725	81,098	1,808	24,418	30,063	14
7/1/2001	3.9E-01	1,021,747	81,072	1,775	29,592	33,508	14
7/1/2002	1.2E-01	1,021,630	81,054	1,851	6,687	13,562	9
7/1/2003	2.1E-01	1,021,803	81,094	1,750	29,159	47,720	11

Project: Gilson Road

Location: Overburden

User Name: MV

State: New Hampshire

Effective Date	0th Moment Estimated Mass (kg)	1st Moment (Center of Mass) Xc (ft)	Yc (ft)	Source Distance (ft)	2nd Moment (Spread) Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
LEAD							
7/1/2004	6.7E-02	1,021,693	81,038	1,792	3,167	26,836	7
7/1/2005	2.8E-01	1,021,814	81,100	1,746	26,871	41,055	10
7/1/2006	1.5E-01	1,021,836	81,091	1,724	17,404	33,268	9
7/1/2009	4.8E-01	1,021,788	81,147	1,797	35,893	30,366	14
VINYL CHLORIDE							
7/1/1999	0.0E+00						1
7/1/2000	3.1E-01	1,021,763	81,003	1,716	44,131	61,074	14
7/1/2001	3.0E-01	1,021,750	80,991	1,718	44,543	59,756	14
7/1/2002	2.5E-01	1,021,787	81,037	1,722	43,139	56,670	13
7/1/2003	2.5E-01	1,021,787	81,035	1,720	35,995	59,405	11
7/1/2004	1.7E-01	1,021,902	81,140	1,715	7,797	35,875	8
7/1/2005	2.5E-01	1,021,787	81,037	1,722	34,440	58,123	10
7/1/2006	1.7E-01	1,021,902	81,141	1,716	7,710	35,560	8
7/1/2009	2.5E-01	1,021,787	81,037	1,722	37,014	59,337	13

Project: Gilson Road

Location: Overburden

User Name: MV

State: New Hampshire

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	ARSENIC	0.55	-22	98.8%	D
	BENZENE	0.43	-6	69.4%	S
	CHLOROBENZENE	0.35	-4	61.9%	S
	LEAD	0.58	-6	69.4%	S
	VINYL CHLORIDE	0.43	-12	87.0%	S
1st Moment: Distance to Source					
	ARSENIC	0.02	-6	69.4%	S
	BENZENE	0.01	6	72.6%	NT
	CHLOROBENZENE	0.02	-8	76.2%	S
	LEAD	0.02	-16	94.0%	PD
	VINYL CHLORIDE	0.00	2	54.8%	NT
2nd Moment: Sigma XX					
	ARSENIC	0.29	-4	61.9%	S
	BENZENE	0.45	-18	98.4%	D
	CHLOROBENZENE	0.48	2	54.0%	NT
	LEAD	0.50	-4	61.9%	S
	VINYL CHLORIDE	0.48	-16	96.9%	D
2nd Moment: Sigma YY					
	ARSENIC	0.38	-4	61.9%	S
	BENZENE	0.21	-12	91.1%	PD
	CHLOROBENZENE	0.23	-4	61.9%	S
	LEAD	0.30	6	69.4%	NT
	VINYL CHLORIDE	0.20	-14	94.6%	PD

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.30 **Saturated Thickness:** Uniform: 20 ft

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 Zeroth Moment Analysis

Project: Gilson Road

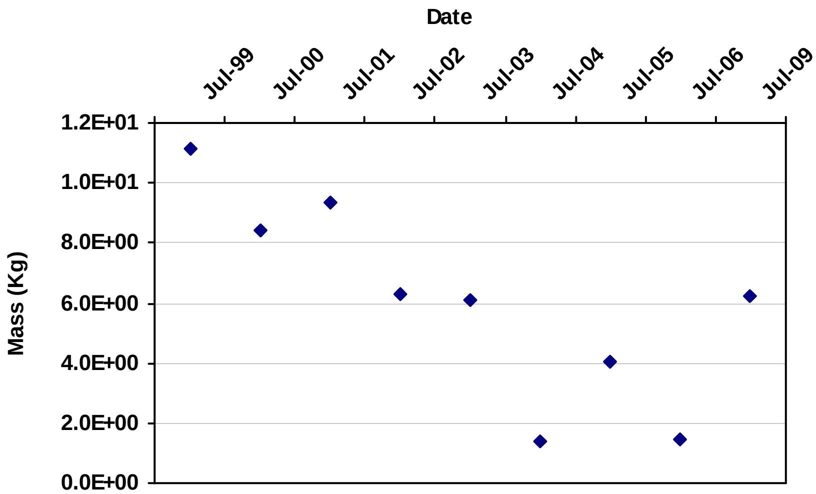
User Name: MV

Location: Overburden Select Wells Exterior of Slurry Wall

State: New Hampshire

COC: ARSENIC

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Uniform: 20 ft

Mann Kendall S Statistic:

-22

Confidence in Trend:

98.8%

Coefficient of Variation:

0.55

Zeroth Moment Trend:

D

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/1999	ARSENIC	1.1E+01	12
7/1/2000	ARSENIC	8.4E+00	14
7/1/2001	ARSENIC	9.4E+00	14
7/1/2002	ARSENIC	6.3E+00	12
7/1/2003	ARSENIC	6.1E+00	11
7/1/2004	ARSENIC	1.4E+00	8
7/1/2005	ARSENIC	4.0E+00	10
7/1/2006	ARSENIC	1.5E+00	9
7/1/2009	ARSENIC	6.2E+00	14

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 Zeroth Moment Analysis

Project: Gilson Road

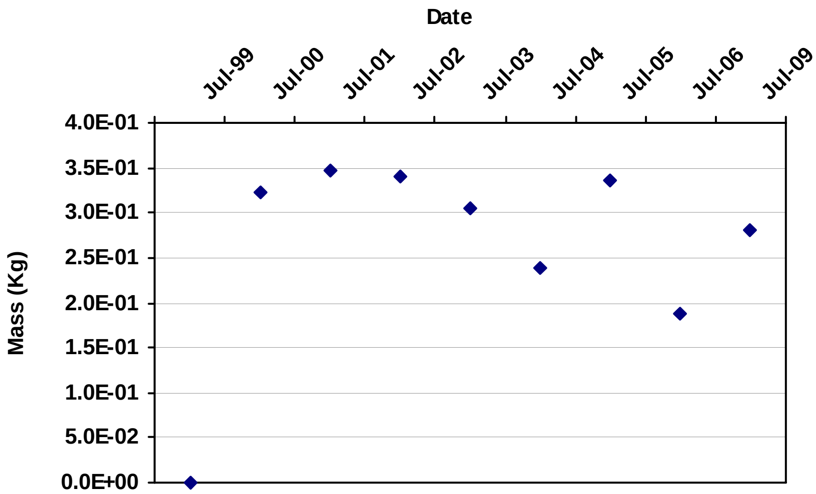
User Name: MV

Location: Overburden Select Wells Exterior of Slurry Wall

State: New Hampshire

COC: BENZENE

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Uniform: 20 ft

Mann Kendall S Statistic:

-6

Confidence in Trend:

69.4%

Coefficient of Variation:

0.43

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/1999	BENZENE	0.0E+00	4
7/1/2000	BENZENE	3.2E-01	14
7/1/2001	BENZENE	3.5E-01	14
7/1/2002	BENZENE	3.4E-01	13
7/1/2003	BENZENE	3.1E-01	11
7/1/2004	BENZENE	2.4E-01	8
7/1/2005	BENZENE	3.4E-01	10
7/1/2006	BENZENE	1.9E-01	8
7/1/2009	BENZENE	2.8E-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 Zeroth Moment Analysis

Project: Gilson Road

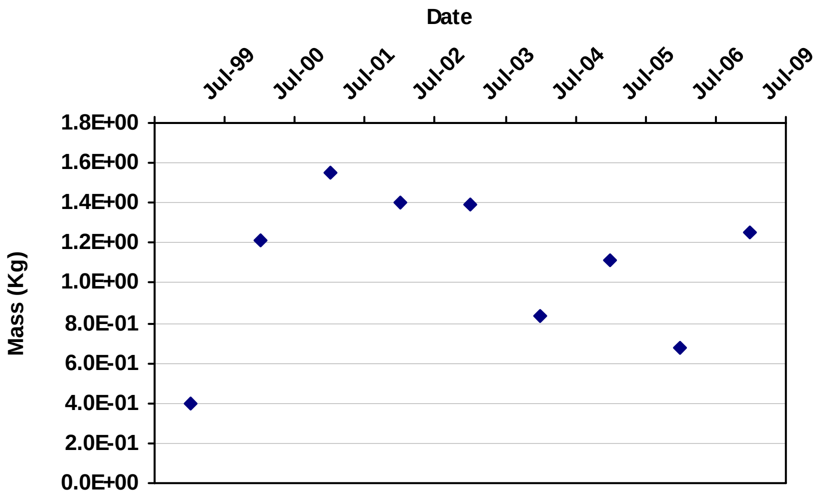
User Name: MV

Location: Overburden Select Wells Exterior of Slurry Wall

State: New Hampshire

COC: CHLOROBENZENE

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Uniform: 20 ft

Mann Kendall S Statistic:

-4

Confidence in Trend:

61.9%

Coefficient of Variation:

0.35

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
7/1/1999	CHLOROBENZENE	3.9E-01	7
7/1/2000	CHLOROBENZENE	1.2E+00	14
7/1/2001	CHLOROBENZENE	1.5E+00	14
7/1/2002	CHLOROBENZENE	1.4E+00	13
7/1/2003	CHLOROBENZENE	1.4E+00	11
7/1/2004	CHLOROBENZENE	8.3E-01	8
7/1/2005	CHLOROBENZENE	1.1E+00	10
7/1/2006	CHLOROBENZENE	6.8E-01	8
7/1/2009	CHLOROBENZENE	1.3E+00	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.

GROUNDWATER MONITORING NETWORK OPTIMIZATION
GILSON ROAD SUPERFUND SITE

Nashua, New Hampshire

APPENDIX B:

Bedrock Aquifer Reports

COC Assessment

Trend Summary Report:

Selected Individual Trend Summary Reports

Zeroth Moment Report: Arsenic

MAROS COC Assessment

Project: Gilson Road Site **User Name:** MV

Location: Bedrock **State:** New Hampshire

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
ARSENIC	4.3E-01	1.0E-02	4216.0%
1,4-DIOXANE (P-DIOXANE)	3.5E-02	3.0E-03	1058.3%
LEAD	2.3E-02	1.5E-02	55.3%
BENZENE	7.3E-03	5.0E-03	46.3%

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
1,4-DIOXANE (P-DIOXANE)	ORG	2	2	100.0%	2
ARSENIC	MET	21	17	81.0%	21
BENZENE	ORG	21	10	47.6%	14
LEAD	MET	21	7	33.3%	18

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
1,4-DIOXANE (P-DIOXANE)	0.000479
BENZENE	0.0984
LEAD	10
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

BENZENE

CHLOROBENZENE

LEAD

CHLOROFORM

MAROS Statistical Trend Analysis Summary

Project: Gilson Road Site

User Name: MV

Location: Bedrock

State: New Hampshire

Time Period: 12/15/1999 **to** 3/5/2009

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: Specified Detection Limit

J Flag Values : Actual Value

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								
HA-4-A	T	1	1	5.6E-01	5.6E-01	No	N/A	N/A
HA-5-B	T	11	11	7.2E-01	6.9E-01	No	D	D
HA-7-A	T	11	11	5.3E-01	5.3E-01	No	D	D
T-100-2	T	9	9	8.3E-03	6.6E-03	No	D	D
T-12-4	S	11	11	8.5E-01	8.4E-01	No	D	D
T-13-4	S	7	7	1.5E+00	1.5E+00	No	S	D
T-19-4	S	11	11	1.6E-01	1.6E-01	No	S	D
T-24-2	S	7	7	8.3E-01	9.1E-01	No	PD	D
T-24-3	S	7	7	8.4E-02	8.9E-02	No	D	D
T-25-3	S	6	6	8.9E-01	8.3E-01	No	S	S
T-29-3	S	6	6	3.5E-01	3.4E-01	No	S	D
T-32-4	T	10	10	8.3E-03	7.7E-03	No	PD	S
T-33-4	S	9	9	1.6E-02	1.5E-02	No	I	I
T-38-2	T	1	1	1.1E-02	1.1E-02	No	N/A	N/A
T-44-2	T	1	1	1.0E-03	1.0E-03	No	N/A	N/A
T-48-5	T	8	8	8.5E-01	8.3E-01	No	D	D
T-54-3	T	1	1	4.2E-01	4.2E-01	No	N/A	N/A
T-62-3	T	7	3	3.9E-02	1.0E-03	No	NT	NT
T-64-4	T	8	8	5.7E-01	4.5E-01	No	D	D
T-8-3	S	10	10	6.9E-01	6.7E-01	No	S	S
T-99	T	1	1	2.1E-03	2.1E-03	No	N/A	N/A
BENZENE								
HA-4-A	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
HA-5-B	T	11	11	7.1E-03	6.9E-03	No	D	D
HA-7-A	T	11	4	2.1E-03	2.0E-03	No	S	S
T-100-2	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-12-4	S	11	11	9.5E-03	8.8E-03	No	D	D
T-13-4	S	7	7	2.8E-02	2.9E-02	No	D	D
T-19-4	S	7	0	2.0E-03	2.0E-03	Yes	ND	ND
T-24-2	S	6	6	1.4E-02	1.2E-02	No	S	S
T-24-3	S	7	6	1.8E-02	1.6E-02	No	D	D
T-25-3	S	6	6	9.9E-03	8.2E-03	No	D	D
T-29-3	S	7	7	8.6E-03	7.7E-03	No	S	S
T-32-4	T	11	5	2.6E-03	2.0E-03	No	PD	PD

MAROS Statistical Trend Analysis Summary

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
BENZENE								
T-33-4	S	9	1	2.2E-03	2.0E-03	No	S	PD
T-38-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-44-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-48-5	T	8	8	6.6E-03	6.4E-03	No	PD	S
T-54-3	T	1	1	2.4E-02	2.4E-02	No	N/A	N/A
T-62-3	T	7	0	2.0E-03	2.0E-03	Yes	ND	ND
T-64-4	T	8	4	3.5E-03	2.9E-03	No	S	S
T-8-3	S	11	11	1.2E-02	9.3E-03	No	D	PD
T-99	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
CHLOROBENZENE								
HA-4-A	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
HA-5-B	T	11	11	1.2E-01	1.2E-01	No	PD	D
HA-7-A	T	11	11	2.9E-02	3.2E-02	No	D	D
T-100-2	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-12-4	S	11	11	9.2E-02	9.1E-02	No	PD	PD
T-13-4	S	6	6	5.3E-02	4.5E-02	No	S	I
T-19-4	S	7	1	3.3E-03	2.0E-03	No	NT	NT
T-24-2	S	6	6	1.6E-02	1.7E-02	No	S	S
T-24-3	S	5	1	3.8E-03	2.0E-03	No	NT	NT
T-25-3	S	6	6	8.7E-03	9.0E-03	No	NT	NT
T-29-3	S	6	6	8.1E-03	7.7E-03	No	S	PD
T-32-4	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-33-4	S	8	0	2.0E-03	2.0E-03	Yes	ND	ND
T-38-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-44-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-48-5	T	8	8	9.3E-02	1.0E-01	No	NT	D
T-54-3	T	1	1	1.5E-02	1.5E-02	No	N/A	N/A
T-62-3	T	7	0	2.0E-03	2.0E-03	Yes	ND	ND
T-64-4	T	8	8	4.9E-02	4.9E-02	No	NT	I
T-8-3	S	11	11	1.7E-02	1.6E-02	No	D	PD
T-99	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
CHLOROFORM								
HA-4-A	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
HA-5-B	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND
HA-7-A	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-100-2	T	9	1	2.1E-03	2.0E-03	No	S	S
T-12-4	S	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-13-4	S	5	0	2.0E-03	2.0E-03	Yes	ND	ND
T-19-4	S	7	0	2.0E-03	2.0E-03	Yes	ND	ND
T-24-2	S	4	0	2.0E-03	2.0E-03	Yes	ND	ND
T-24-3	S	5	0	2.0E-03	2.0E-03	Yes	ND	ND
T-25-3	S	4	0	2.0E-03	2.0E-03	Yes	ND	ND
T-29-3	S	5	0	2.0E-03	2.0E-03	Yes	ND	ND
T-32-4	T	9	0	2.0E-03	2.0E-03	Yes	ND	ND

MAROS Statistical Trend Analysis Summary

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
CHLOROFORM								
T-33-4	S	8	0	2.0E-03	2.0E-03	Yes	ND	ND
T-38-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-44-2	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-48-5	T	6	0	2.0E-03	2.0E-03	Yes	ND	ND
T-54-3	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
T-62-3	T	7	0	2.0E-03	2.0E-03	Yes	ND	ND
T-64-4	T	6	0	2.0E-03	2.0E-03	Yes	ND	ND
T-8-3	S	9	0	2.0E-03	2.0E-03	Yes	ND	ND
T-99	T	1	0	2.0E-03	2.0E-03	Yes	ND	ND
LEAD								
HA-4-A	T	1	0	1.0E-03	1.0E-03	Yes	ND	ND
HA-5-B	T	10	1	1.1E-03	1.0E-03	No	S	S
HA-7-A	T	10	0	1.0E-03	1.0E-03	Yes	ND	ND
T-100-2	T	9	1	1.1E-03	1.0E-03	No	S	S
T-12-4	S	11	2	1.2E-03	1.0E-03	No	S	PD
T-13-4	S	7	6	7.2E-03	7.2E-03	No	S	S
T-19-4	S	10	4	1.7E-03	1.0E-03	No	S	S
T-24-2	S	7	5	1.3E-02	1.7E-02	No	S	S
T-24-3	S	7	6	2.3E-02	2.4E-02	No	S	S
T-25-3	S	6	5	1.2E-01	1.2E-01	No	NT	S
T-29-3	S	6	5	2.5E-03	1.8E-03	No	NT	S
T-32-4	T	10	10	2.1E-02	1.3E-02	No	D	D
T-33-4	S	9	7	2.9E-03	1.5E-03	No	D	D
T-38-2	T	1	1	3.1E-03	3.1E-03	No	N/A	N/A
T-44-2	T	1	1	2.9E-02	2.9E-02	No	N/A	N/A
T-48-5	T	8	5	3.5E-02	2.8E-02	No	NT	D
T-54-3	T	1	1	4.1E-03	4.1E-03	No	N/A	N/A
T-62-3	T	8	8	1.9E-01	1.0E-02	No	NT	NT
T-64-4	T	8	5	2.2E-02	2.7E-02	No	S	NT
T-8-3	S	10	5	3.3E-03	2.8E-03	No	PD	S
T-99	T	1	0	1.0E-03	1.0E-03	Yes	ND	ND

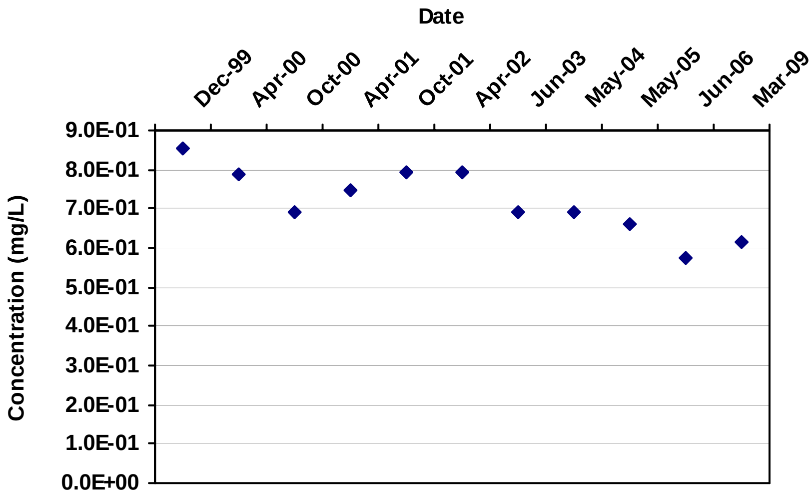
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Well: HA-5-B
Well Type: T
COC: ARSENIC

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -39

Confidence in Trend: 99.9%

Coefficient of Variation: 0.12

Mann Kendall Concentration Trend: (See Note) D

Data Table:

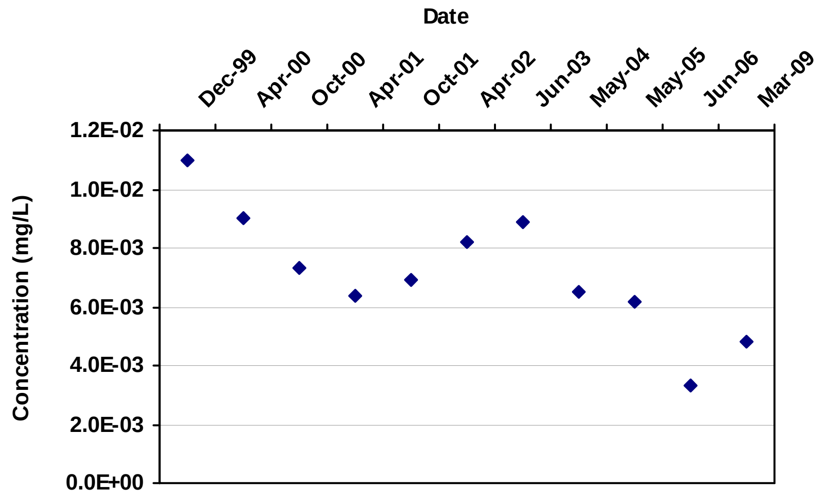
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
HA-5-B	T	12/15/1999	ARSENIC	8.5E-01		1	1
HA-5-B	T	4/15/2000	ARSENIC	7.9E-01		2	2
HA-5-B	T	10/15/2000	ARSENIC	6.9E-01		4	4
HA-5-B	T	4/1/2001	ARSENIC	7.5E-01		1	1
HA-5-B	T	10/1/2001	ARSENIC	7.9E-01		2	2
HA-5-B	T	4/1/2002	ARSENIC	7.9E-01		1	1
HA-5-B	T	6/15/2003	ARSENIC	6.9E-01		2	2
HA-5-B	T	5/1/2004	ARSENIC	6.9E-01		2	2
HA-5-B	T	5/1/2005	ARSENIC	6.6E-01		1	1
HA-5-B	T	6/1/2006	ARSENIC	5.8E-01		1	1
HA-5-B	T	3/5/2009	ARSENIC	6.1E-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

Well: HA-5-B
Well Type: T
COC: BENZENE

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -35

Confidence in Trend: 99.7%

Coefficient of Variation: 0.30

Mann Kendall Concentration Trend: (See Note) D

Data Table:

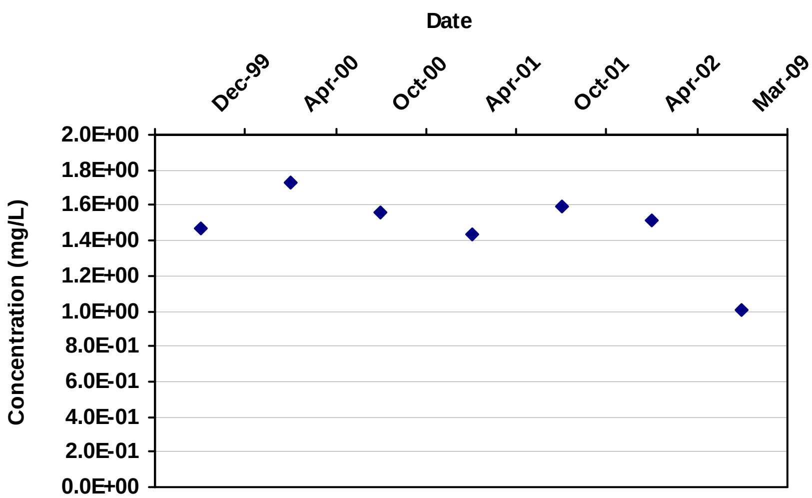
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
HA-5-B	T	12/15/1999	BENZENE	1.1E-02		1	1
HA-5-B	T	4/15/2000	BENZENE	9.0E-03		2	2
HA-5-B	T	10/15/2000	BENZENE	7.3E-03		1	1
HA-5-B	T	4/1/2001	BENZENE	6.4E-03		1	1
HA-5-B	T	10/1/2001	BENZENE	6.9E-03		1	1
HA-5-B	T	4/1/2002	BENZENE	8.2E-03		1	1
HA-5-B	T	6/15/2003	BENZENE	8.9E-03		2	2
HA-5-B	T	5/1/2004	BENZENE	6.5E-03		2	2
HA-5-B	T	5/1/2005	BENZENE	6.2E-03		1	1
HA-5-B	T	6/1/2006	BENZENE	3.3E-03		1	1
HA-5-B	T	3/5/2009	BENZENE	4.8E-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: T-13-4
Well Type: S
COC: ARSENIC

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
-7

Confidence in Trend:
80.9%

Coefficient of Variation:
0.15

Mann Kendall Concentration Trend: (See Note)
S

Data Table:

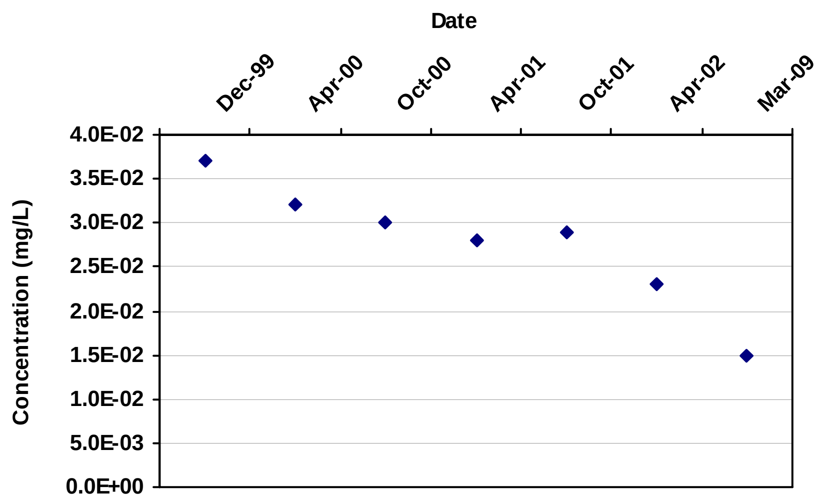
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-13-4	S	12/15/1999	ARSENIC	1.5E+00		1	1
T-13-4	S	4/15/2000	ARSENIC	1.7E+00		1	1
T-13-4	S	10/15/2000	ARSENIC	1.6E+00		2	2
T-13-4	S	4/1/2001	ARSENIC	1.4E+00		1	1
T-13-4	S	10/1/2001	ARSENIC	1.6E+00		1	1
T-13-4	S	4/1/2002	ARSENIC	1.5E+00		2	2
T-13-4	S	3/5/2009	ARSENIC	1.0E+00		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: T-13-4
Well Type: S
COC: BENZENE

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -19

Confidence in Trend: 99.9%

Coefficient of Variation: 0.25

Mann Kendall Concentration Trend: (See Note) D

Data Table:

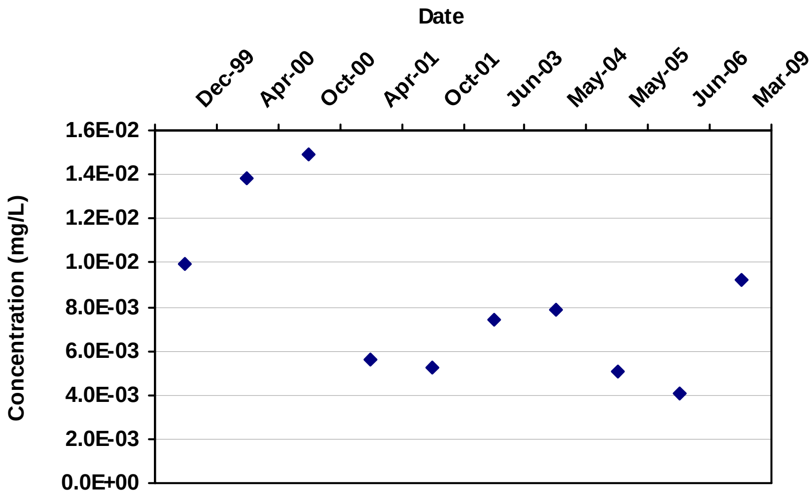
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-13-4	S	12/15/1999	BENZENE	3.7E-02		1	1
T-13-4	S	4/15/2000	BENZENE	3.2E-02		1	1
T-13-4	S	10/15/2000	BENZENE	3.0E-02		1	1
T-13-4	S	4/1/2001	BENZENE	2.8E-02		1	1
T-13-4	S	10/1/2001	BENZENE	2.9E-02		1	1
T-13-4	S	4/1/2002	BENZENE	2.3E-02		1	1
T-13-4	S	3/5/2009	BENZENE	1.5E-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: T-32-4
Well Type: T
COC: ARSENIC

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -17

Confidence in Trend: 92.2%

Coefficient of Variation: 0.44

Mann Kendall Concentration Trend: (See Note) PD

Data Table:

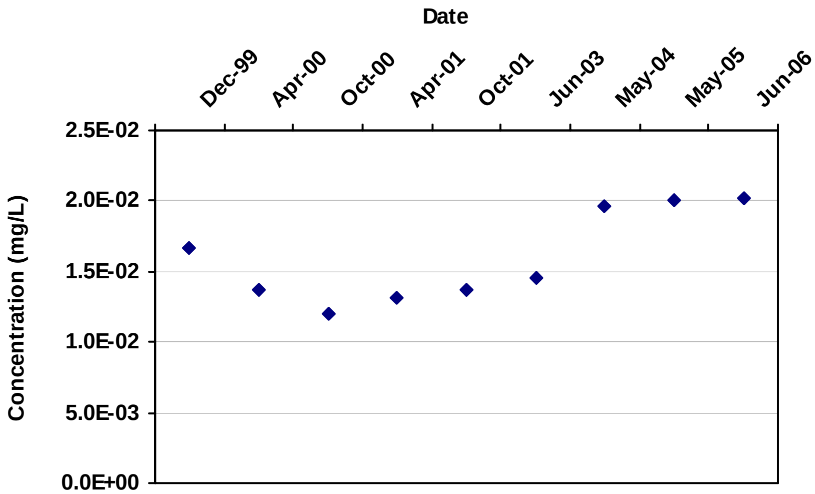
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-32-4	T	12/15/1999	ARSENIC	9.9E-03		1	1
T-32-4	T	4/15/2000	ARSENIC	1.4E-02		1	1
T-32-4	T	10/15/2000	ARSENIC	1.5E-02		2	2
T-32-4	T	4/1/2001	ARSENIC	5.6E-03		1	1
T-32-4	T	10/1/2001	ARSENIC	5.2E-03		1	1
T-32-4	T	6/15/2003	ARSENIC	7.4E-03		2	2
T-32-4	T	5/1/2004	ARSENIC	7.9E-03		1	1
T-32-4	T	5/1/2005	ARSENIC	5.1E-03		2	1
T-32-4	T	6/1/2006	ARSENIC	4.1E-03		1	1
T-32-4	T	3/5/2009	ARSENIC	9.2E-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: T-33-4
Well Type: S
COC: ARSENIC

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 22

Confidence in Trend: 98.8%

Coefficient of Variation: 0.20

Mann Kendall Concentration Trend: (See Note) I

Data Table:

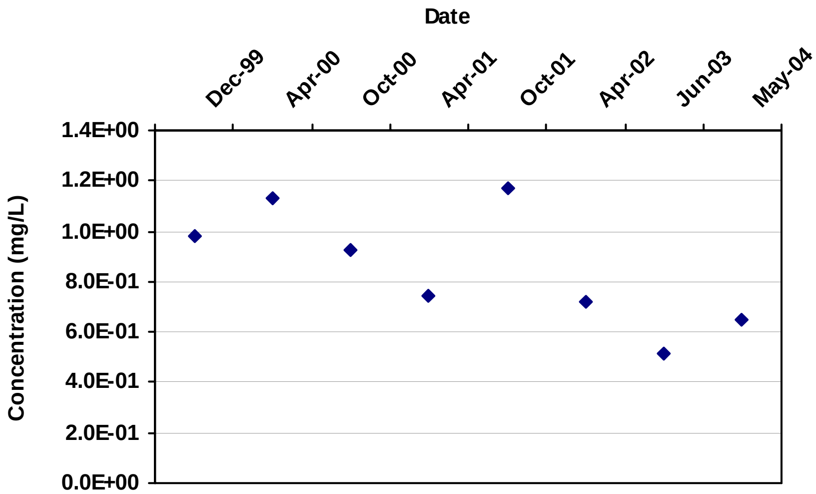
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-33-4	S	12/15/1999	ARSENIC	1.7E-02		2	2
T-33-4	S	4/15/2000	ARSENIC	1.4E-02		1	1
T-33-4	S	10/15/2000	ARSENIC	1.2E-02		2	2
T-33-4	S	4/1/2001	ARSENIC	1.3E-02		1	1
T-33-4	S	10/1/2001	ARSENIC	1.4E-02		2	2
T-33-4	S	6/15/2003	ARSENIC	1.5E-02		2	2
T-33-4	S	5/1/2004	ARSENIC	2.0E-02		1	1
T-33-4	S	5/1/2005	ARSENIC	2.0E-02		1	1
T-33-4	S	6/1/2006	ARSENIC	2.0E-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: T-48-5
Well Type: T
COC: ARSENIC

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -16

Confidence in Trend: 96.9%

Coefficient of Variation: 0.28

Mann Kendall Concentration Trend: (See Note) D

Data Table:

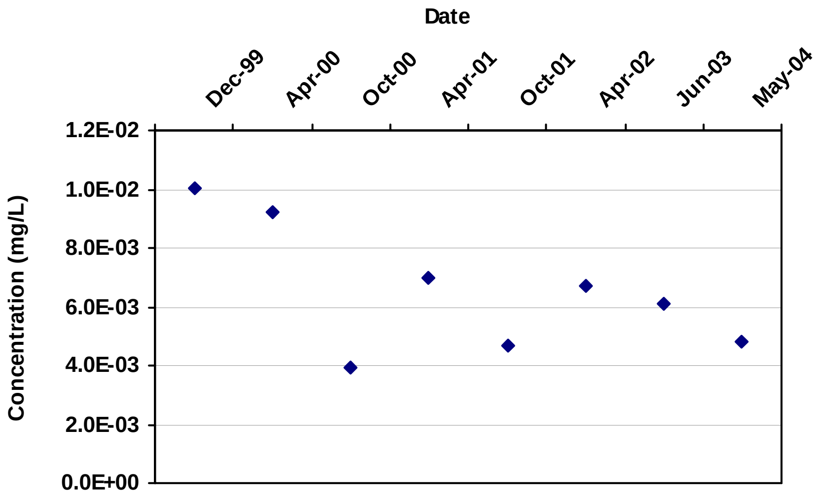
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-48-5	T	12/15/1999	ARSENIC	9.8E-01		1	1
T-48-5	T	4/15/2000	ARSENIC	1.1E+00		1	1
T-48-5	T	10/15/2000	ARSENIC	9.2E-01		2	2
T-48-5	T	4/1/2001	ARSENIC	7.4E-01		1	1
T-48-5	T	10/1/2001	ARSENIC	1.2E+00		1	1
T-48-5	T	4/1/2002	ARSENIC	7.2E-01		1	1
T-48-5	T	6/15/2003	ARSENIC	5.2E-01		2	2
T-48-5	T	5/1/2004	ARSENIC	6.5E-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: T-48-5
Well Type: T
COC: BENZENE

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-12

Confidence in Trend:

91.1%

Coefficient of Variation:

0.33

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

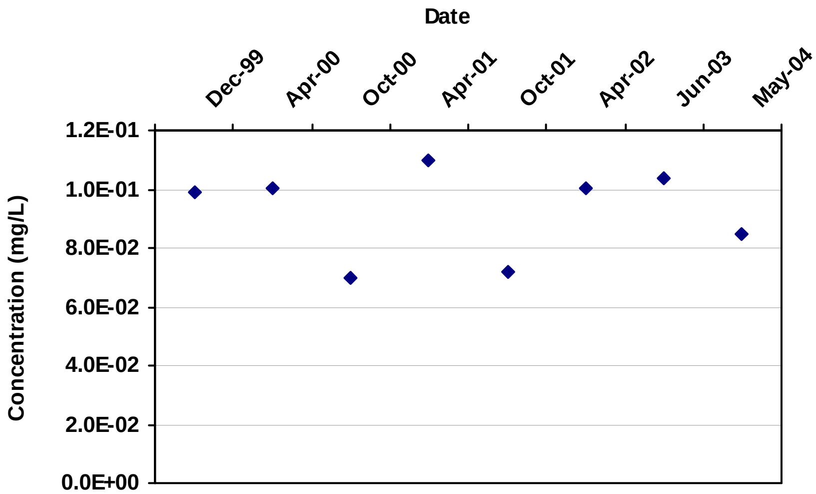
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
T-48-5	T	12/15/1999	BENZENE	1.0E-02		1	1
T-48-5	T	4/15/2000	BENZENE	9.2E-03		1	1
T-48-5	T	10/15/2000	BENZENE	3.9E-03		1	1
T-48-5	T	4/1/2001	BENZENE	7.0E-03		1	1
T-48-5	T	10/1/2001	BENZENE	4.7E-03		1	1
T-48-5	T	4/1/2002	BENZENE	6.7E-03		1	1
T-48-5	T	6/15/2003	BENZENE	6.1E-03		2	2
T-48-5	T	5/1/2004	BENZENE	4.8E-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: T-48-5
Well Type: T
COC: CHLOROBENZENE

Time Period: 12/15/1999 **to** 3/5/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
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: 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
T-48-5	T	12/15/1999	CHLOROBENZENE	9.9E-02		1	1
T-48-5	T	4/15/2000	CHLOROBENZENE	1.0E-01		1	1
T-48-5	T	10/15/2000	CHLOROBENZENE	7.0E-02		1	1
T-48-5	T	4/1/2001	CHLOROBENZENE	1.1E-01		1	1
T-48-5	T	10/1/2001	CHLOROBENZENE	7.2E-02		1	1
T-48-5	T	4/1/2002	CHLOROBENZENE	1.0E-01		1	1
T-48-5	T	6/15/2003	CHLOROBENZENE	1.0E-01		2	2
T-48-5	T	5/1/2004	CHLOROBENZENE	8.5E-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 Zeroth Moment Analysis

Project: Gilson Road Site

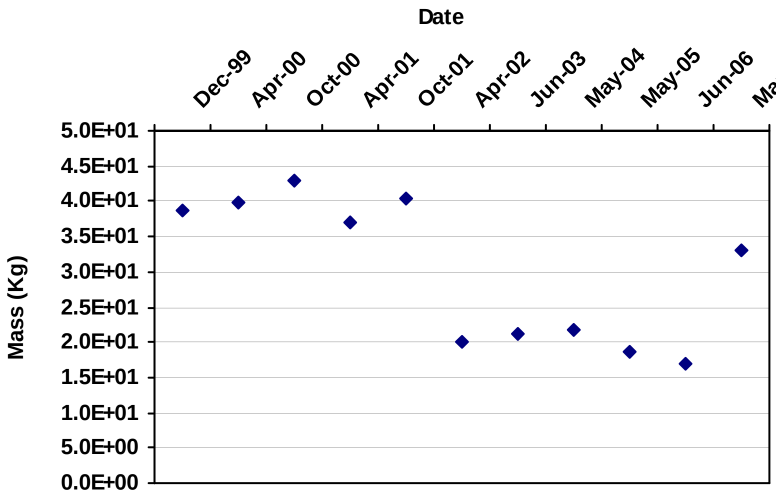
User Name: MV

Location: Bedrock

State: New Hampshire

COC: ARSENIC

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Uniform: 20 ft

Mann Kendall S Statistic:

-27

Confidence in Trend:

98.0%

Coefficient of Variation:

0.34

Zeroth Moment Trend:

D

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
12/15/1999	ARSENIC	3.9E+01	14
4/15/2000	ARSENIC	4.0E+01	14
10/15/2000	ARSENIC	4.3E+01	16
4/1/2001	ARSENIC	3.7E+01	16
10/1/2001	ARSENIC	4.0E+01	15
4/1/2002	ARSENIC	2.0E+01	11
6/15/2003	ARSENIC	2.1E+01	11
5/1/2004	ARSENIC	2.2E+01	10
5/1/2005	ARSENIC	1.9E+01	9
6/1/2006	ARSENIC	1.7E+01	9
3/5/2009	ARSENIC	3.3E+01	18

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.

APPENDIX C:
LIST OF ACRONYMS

ACL	alternative concentration limits
AFCEE	Air Force Center for Engineering and the Environment
AGQS	Ambient Groundwater Quality Standards
AR	area ratio
AWQS	Ambient Water Quality Standards
BGS	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
CES	cost-effective sampling
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	contaminant of concern
CR	concentration ratio
ESD	Explanation of Significant Difference
FS	feasibility study
GIS	geographic information system
GMZ	groundwater management zone
IC	institutional control
LTM	long-term monitoring
LTMO	long-term monitoring optimization
MAROS	Monitoring and Remediation Optimization Software
MCES	modified cost-effective sampling
MCL	Maximum Contaminant Level
MNA	monitored natural attenuation
NPL	National Priorities List
O&M	operation and maintenance

PLSF	preliminary location sampling frequency
P&T	pump and treat
RA	remedial action
RI	remedial investigation
ROD	Record of Decision
SF	slope factor
SROD	Supplemental Record of Decision
SVOC	semivolatile organic compound
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound