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Fort Lewis Washington

FINAL
LOGISTICS CENTER (FTLE-33) REMEDIAL ACTION MONITORING NETWORK OPTIMIZATION REPORT

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ACRONYMS AND ABBREVIATIONS

AFCEE	Air Force Center for Environmental Excellence
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Cost Effective Sampling
COC	contaminant of concern
COV	coefficient of variation
DCE	cis-1,2-dichloroethylene
DNAPL	dense non-aqueous phase liquid
DQO	Data Quality Objective
EGDY	East Gate Disposal Yard
EPA	U.S. Environmental Protection Agency
I-5	Interstate 5
lbs/month	pounds per month
LNAPL	light non-aqueous phase liquid
LOE	line of evidence
LTM	long-term monitoring
MAMC	Madigan Army Medical Center
MAROS	Monitoring and Remediation Optimization System
NAPL	non-aqueous phase liquid
PCE	tetrachloroethene
PRG	Preliminary Remediation Goal
RAM	remedial action monitoring
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROC	rate of change
ROD	Record of Decision
S	Mann-Kendall Statistic
SARA	Superfund Amendments and Reauthorization Act
TCA	1,1,1-trichloroethane
TCE	trichloroethylene
ug/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
VC	vinyl chloride
VOC	volatile organic compound

EXECUTIVE SUMMARY

This report presents the results of a remedial action monitoring network optimization conducted for the groundwater extraction and treatment system in operation at the Logistics Center, Fort Lewis, Washington in Spring of 2001. As of September 2000 groundwater quality and water level monitoring as part of the pump and treat system remedial action monitoring have been conducted at the Logistics Center for 20 consecutive quarters beginning in December 1995. Since the preparation of the draft version of this report, previously unavailable data from the time period between the Logistics Center remedial investigation and the operation of the pump and treat system (1990 to 1995) have become available. These data and subsequent monitoring data collected during the time interval between the preparation of the draft and final versions of the RAM Optimization Report (December 2000 to March 2002; the 21st through 26th quarters) have been added to the plates for this final version of this report. Additionally, five new multiport Sea Level Aquifer wells have been installed since the draft report and are now included in the RAM network. The MAROS trend analyses were not updated using the 1990 to 1995 data or the post September 2000 data.

The primary contaminant of concern and the focus of this report is trichloroethylene (TCE). As of May 2001 (prior to the optimization effort) there were 58 monitoring wells and 21 groundwater extraction wells sampled as part of the remedial action monitoring network. All of these locations were sampled on a quarterly basis, which accounted for a total of 316 analytical samples per year. These figures do not include two surface water sample locations and eight associated analytical samples.

The available analytical data set for TCE at each monitored well was analyzed to see if a reduction in sample frequency to semi-annually or annually was warranted. Reductions were considered on a well by well basis and not on a site-wide basis. Concentration versus time data were analyzed using linear regression and the Mann-Kendall Test to check for trends. Additionally, quarterly data sets were filtered into annual data sets by considering only analytical data from a single quarterly event (i.e., all March data, for example). Quarterly and annual data sets for each well were compared to see if a trend could still be ascertained if sampling was reduced from quarterly to annually. It was determined that 76% of the time, a trend could still be ascertained by sampling annually instead of quarterly. Only 1% of the time did a trend actually reverse direction by sampling annually instead of quarterly.

Sample location analysis consisted of a non-statistical determination of which monitoring wells are best suited for remedial action monitoring based on a synthesis of spatial uniqueness with average TCE concentration uniqueness. None of the extraction wells were considered for elimination from the remedial action monitoring network. TCE concentrations from the latest available quarter prior to evaluation at each particular monitoring well (usually the 20th quarter) were plotted and contoured, and locations were removed and added in an iterative process to determine the ideal network of monitoring wells capable of adequately depicting the TCE plume's extent and concentration. The final recommended analytical monitoring network now consists of 51 Vashon Aquifer wells (29 sampled quarterly, 3 semi-annually, 19 annually), 26 Sea Level Aquifer wells (16 quarterly, 10 annually), and all 21 extraction wells (6 quarterly, 15 annually).

Monitoring and Remediation Optimization System (MAROS) Software developed by the Air Force Center for Environmental Excellence was utilized for statistical analyses and network optimization. Results from MAROS were compared to manually-derived network optimization results. The MAROS and manual recommendations were generally comparable.

As of May 2001, 156 wells were used to define groundwater, as well as contaminant transport, flow directions and gradients. These data were collected quarterly. Because these data are relatively easy and inexpensive to obtain, no significant change to the groundwater level measurement network is recommended. By deleting wells known to be lost, abandoned, or providing duplication in water level data from the same aquifer, and through addition of new wells to the proposed sampling network, the total number of wells proposed rose by 21 to 177, and will remain on a quarterly schedule.

Based on our current understanding of the TCE contaminant plume (USACE 2002a), an additional sampling location on Murray Creek was added (SW-MC-6) where the TCE plume intersects Murray Creek southwest of the EGDY. TCE has never been detected at background sampling location SW-MC-1; therefore a reduction in sample frequency from quarterly to annually is recommended at this location.

The Data Quality Objectives for the Logistics Center remedial action monitoring have been developed to insure that the remedial action project goals continue to be achieved. The remedial action monitoring network optimization described in this report will continue to meet the DQOs established.

Caution must be used when considering the overall meaning of the TCE contaminant trends discussed in this report. First, all non-stable contaminant trends that can be determined are very slight. Second, the inherent error built in to the sample collection and analysis process will produce natural data scatter that will affect the results of statistical trend analysis. Third, the rate at which the COCs move in groundwater on site is sufficiently slow so as to not significantly change between quarterly periods. When put into proper perspective, it makes intuitive sense to monitor more locations (optimize spatially) but less frequently (optimize temporally) over the duration of a long-term monitoring program anticipated to last 40 plus years.

A small-scale increase in the overall number of remedial action monitoring wells and surface water locations sampled (increase of 20 locations), coupled with a reduction in the frequency at which samples are collected for a number of wells, is expected to result in a significant time and cost savings over the course of the RAM program at the Logistics Center while providing technically defensible data. In each of the first two years after implementation of the recommendations set forth in this report, a cost savings of approximately $31,000 per year is likely to be achieved. After re-evaluation of those wells initially proposed for sampling on a quarterly or semi-annual basis after eight quarters (two years), the potential cost savings per year may be as much as $71,000. These estimates assume $400 per sample for sample collection by a field technician and $100 per sample in laboratory costs for a total of $500 per sample. The estimated savings does not include potential cost savings due to simplification and/or reduction in scope of quarterly reporting.

1. INTRODUCTION

This report presents the results of a remedial action monitoring network optimization conducted for the groundwater extraction and treatment system in operation at the Logistics Center, Fort Lewis, Washington. Section 1 of the report contains general introductory information concerning site background, geology, hydrogeology, remedial action project description and project goals. Section 2 states the Data Quality Objectives set forth for the remedial action monitoring at the Logistics Center. Section 3 discusses the statistical and non-statistical evaluations performed on analytical data from all monitoring wells associated with the remedial action monitoring network. Section 4 discusses the evaluation of groundwater level measurement data. Section 5 briefly discusses the surface water quality monitoring being conducted as part of the remedial action monitoring program. Section 6 discusses the conclusions drawn based on data evaluation, particularly with respect to how the Data Quality Objectives will be met given the recommended changes to the remedial action monitoring network, which are then discussed in Section 7.

1.1. BACKGROUND

A Remedial Investigation (RI) was conducted at the Fort Lewis Logistics Center (Figure 1.1) in 1988 to define the nature and extent of contamination present at the site. The initial phase of the investigation concluded that the shallow, unconfined aquifer beneath the Logistics Center is contaminated with volatile organic compounds, primarily trichloroethylene (TCE) with lesser amounts of cis-1,2-dichloroethene (DCE), which present a risk to human health and the environment (USACE 1988).

The Fort Lewis Logistics Center was included on the National Priorities List in December 1989, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. An installation-wide Federal Facilities Agreement between the U.S. Army, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology became effective January 29, 1990. The agreement established the procedural framework for agency coordination and a schedule for all CERCLA and Resource Conservation and Recovery Act (RCRA) corrective activities at Fort Lewis (US Dept. of Army 1990).

Interim groundwater monitoring occurred between the RI and the start up of the pump and treat system (1990 to 1995). Investigation and groundwater monitoring subsequent to the RI revealed that the deeper aquifer present has also been affected by TCE (USACE 1993). The Record of Decision (ROD) for the Logistics Center Operable Unit selected groundwater extraction and treatment by air stripping as the remedy for groundwater contamination. The U.S. Army Corps of Engineers (USACE) completed the remedial design for the installation of two pump-and-treat facilities to implement the remedy required by the ROD in 1995 (USACE 2000). An East Gate Disposal Yard (EGDY) Expanded Site Investigation was conducted in 1998 (USACE 1999) in which buried metal drums and debris was located and DNAPL and LNAPL were detected in the saturated and unsaturated zones of the EGDY. The EGDY Phase II RI was completed in the Spring of 2002 (USACE 2002a) and, in addition to determining the nature and extent of non-aqueous phase liquid (NAPL) contamination, further defined the limits of the dissolved-phase contaminant plume to the southwest of the EGDY source area.

1.2.GEOLOGY/HYDROGEOLOGY

For a detailed description of site geology and hydrogeology, the reader is referred to Section 5 - Conceptual Site Model of the EGDY Phase II Remedial Investigation (USACE 2002a). A brief overview is presented here to aid the reader in understanding the geologic and hydrogeologic units discussed in this report. The geologic units are subdivided, from youngest to oldest (and from shallowest to deepest), into: Upper Vashon Recessional Outwash (Qvr), Vashon Till (Qvt) and Vashon Glacio-lacustrine deposits (Qvl), and Vashon Advance Outwash (Qva) which, together, comprise the Vashon Drift Stratigraphic Unit (Qv); Olympia non-glacial deposits (Qob), Pre-Olympia Drift (Qpog), Second Non-Glacial deposits (Qpon); and Third Glacial Drift ($Qpog_2$).

Hydrogeologically, all of the Vashon Drift, Olympia Non-glacial deposits, and Pre-Olympia Drift geologic units are regionally considered a single unconfined aquifer, although the TCE above five micrograms per liter (ug/l) is less extensive within the Pre-Olympia drift compared to the overlying Vashon deposits. Additionally, the Pre-Olympia Drift is absent between well LC-137 (near the EGDY) and LC-41 (See Plate 1 for well locations). Therefore, the Vashon aquifer has been subdivided into an Upper Vashon Aquifer (Qv and Qob generally above 190 to 210 feet NGVD29) and a Lower Vashon Aquifer (Qpog generally between 110 to 210 feet NGVD 29) in this report to provide further vertical characterization of the Vashon Aquifer.

The Second Non-glacial deposits act as a regional aquitard, separating the Vashon Aquifer from the confined Sea Level Aquifer. Evidence from borings suggest this aquitard is absent in the center of the site near monitoring well LC-41. Evidence from boring logs also suggest the advance and recessional outwash deposits of the Third Glacial Drift unit are not hydrogeologically isolated from one another because the till is also discontinuous in the LC-41 area.

1.3.REMEDIAL ACTION PROJECT DESCRIPTION

The remedial action includes shallow groundwater (Vashon Aquifer) extraction, treatment, and recharge of treated groundwater back into the Vashon Aquifer. Startup of the treatment systems occurred on August 31, 1995. The objective of the remediation is to restore the Vashon Aquifer to drinking water standards by reducing the TCE contaminant plume concentration to less than 5 ug/l within 30 to 40 years (USACE 1994).

Before construction on the Vashon Aquifer treatment system began, a plume of dissolved phase TCE contamination was identified in the Sea Level Aquifer. Contamination of the Sea Level Aquifer has been attributed to contaminated groundwater migrating from the Vashon Aquifer through permeable zones in the Non-glacial Aquitard to the Sea Level Aquifer. Monitoring of contaminant concentration in the Sea Level Aquifer was therefore included as a component of long-term monitoring at Fort Lewis to aid in the determination of an appropriate remedy (USACE 1994).

The Interstate 5 (I-5) system and the East Gate system are the two extraction well systems and associated treatment plant and recharge systems that have been constructed at the Logistics Center. The I-5 system is designed to halt further flow of contaminated groundwater in the Vashon Aquifer across the installation boundary, while the East Gate system is designed to remove contaminant mass from the Vashon Aquifer directly downgradient from the source area in the former East Gate Disposal Yard. The I-5 well field contains a line of 15 extraction wells (LX-1 through LX-15) located between 150th Avenue and the south end of Tacoma Drive. Four infiltration galleries have been constructed approximately 1,200 feet northwest (hydraulically downgradient) of the well field. The East Gate well field is divided into primary and secondary extraction fields and a recharge field. The primary well field consists of extraction wells LX-17, LX-18, LX-19, and LX-21 located near the intersection of Rainier Drive and East Lincoln Drive. The secondary well field consists of extraction wells LX-16 and RW-1, located 1,500 feet downgradient of the primary extraction field. The recharge field contains two recharge wells, LR-1 and LR-2, and two recharge trenches, located approximately 1,000 feet upgradient of the primary extraction well field (USACE 2002b).

The volatile organic compounds (VOCs) of concern as defined by the ROD are: TCE, DCE, tetrachloroethene (PCE), 1,1,1-trichloroethane (TCA), and vinyl chloride (VC). All of these compounds can be treated using air stripping. TCE, DCE, and TCA have been consistently detected in many wells in a number of sampling rounds, although DCE and TCA have been detected at much lower concentrations when compared to TCE. PCE and VC have been detected in only a few wells (USACE 2002b).

Remedial action monitoring as of May 2001 was being conducted in accordance with the Fort Lewis Logistics Center Remedial Action Monitoring Revised Addendum Management Plan (USACE 2000). As of May 2001, a remedial action monitoring (RAM) network of wells was established and sampled for 20 quarters (5 years) dating back to December 1995. A pre-system startup round of analytical sampling occurred in February 1995. Additionally, a more comprehensive monitoring well network has been established for water level monitoring as part of the RAM.

1.4.REMEDIAL ACTION PROJECT GOALS

The project goals established for the groundwater pump-and-treat system in operation at the Logistics Center are the short-term and long-term issues to be addressed and resolved at the site. The project goals for the Logistics Center remedial action are:

a) To hydraulically isolate the source area NAPL plume,

b) To prevent the expansion of the Vashon Aquifer dissolved phase contaminant plume in the source area as well as downgradient of the source area, and

c) To reduce the contaminant concentrations in groundwater to less than clean up goals in the Vashon Aquifer downgradient of the source area

Hydraulic isolation of the source area NAPL plume was addressed through the installation of the source area primary extraction well field. The prevention of the spread of contamination and the reduction in contaminant concentrations were addressed through the installation of the pump-and-treat system as a whole. The primary EGDY well field was designed to prevent down-gradient migration of the TCE plume past the source area, while the secondary well field was designed to prevent migration of the TCE plume downgradient of the secondary well field. Finally, the I-5 well field was designed to prevent off-site downgradient migration of TCE past the I-5 system.

It should be noted that the remediation of the Sea Level Aquifer contamination is not a pump-and-treat project goal. However, meeting pump-and-treat goals will help the Sea Level Aquifer indirectly by cutting off the contaminant source to this aquifer. Remedial action monitoring of wells in the Sea Level Aquifer is included in the overall RAM network to determine if this subsidiary goal is being achieved.

2. DATA QUALITY OBJECTIVES

The purpose of this remedial action monitoring network optimization is to reduce the redundancy in data that is being collected from the RAM well network at the Logistics Center while at the same time insuring that all RAM Data Quality Objectives (DQOs) are met. All monitoring wells being sampled as of May 2001 in the RAM as well as East Gate and I-5 groundwater extraction wells were considered for sampling frequency reduction. Monitoring wells that contribute overlapping or redundant chemical data may be eliminated from the monitoring network. All extraction wells will continue to be monitored; however, the frequency at which monitoring occurs will be evaluated and alternative recommendations made, where appropriate. Both East Gate and I-5 treatment system combined influent and combined effluent streams will continue to be sampled on their current monthly schedule for regulatory purposes and are not discussed in this report.

Remedial action monitoring has been implemented to evaluate the effectiveness of the treatment systems at meeting the aforementioned project goals. Data quality objectives are detailed, site-specific statements that describe how project goals are to be met. The following DQOs have been developed to achieve the remedial action project goals for the pump-and-treat system in operation at the Logistics Center:

- Determine if the primary EGDY well field is capturing all source area dissolved contaminants of concern (COCs),

- Determine if the secondary EGDY well field is capturing high contaminant concentration (>200 ug/l) Vashon Aquifer groundwater between the primary and secondary EGDY well fields,

- Determine if the I-5 well field is capturing and reducing the Vashon Aquifer contaminant plume upgradient of the I-5 well field and between the I-5 well field and the I-5 infiltration gallery,

- Determine if the Vashon Aquifer contaminant plume downgradient of the I-5 infiltration gallery is dispersing to less than clean-up goals (<5 ug/l TCE in groundwater),

- Determine the lateral and vertical extent and concentration of the COCs and whether or not they are changing with time in both the Vashon and Sea Level Aquifers,

- Determine if the treatment system insures contaminant levels in Murray Creek (See Plate 1 for location) remain below clean-up goals for COCs (<80 ug/l TCE in surface water),

- Determine if extraction wells are removing COCs from groundwater and are necessary for hydraulic containment of contaminants,

- Determine mass removal rate and total mass removal of COCs by each of the treatment system components (primary and secondary EGDY well fields, and I-5 well field),

- Determine if atmospheric discharges of airborne COCs via treatment system components meet regulatory limits (TCE emission limits: 75 lbs/month for I-5 system, 325 lbs/month for East Gate), and

- Determine the operating efficiency of treatment system component air strippers.

In order to achieve the DQOs defined above, the following DQO methods are being used:

- Sampling of groundwater will occur at strategically positioned monitoring wells in order to accurately define the horizontal and vertical extent and concentrations of COCs. Dedicated ¾-inch bladder pumps and the low-flow groundwater sampling technique will be utilized to collect groundwater samples from monitoring wells. Samples will be analyzed for VOCs by EPA Method 8260, and a detection limit of 0.2 ug/l or less shall be maintained for TCE.

- Monitoring of groundwater pieziometric elevations will occur at strategically positioned monitoring wells to determine groundwater flow gradients and contaminant transport flow paths. Groundwater level measurements used to determine groundwater elevations will be to the nearest hundredth of a foot.

- Sampling of groundwater will occur at each extraction well for VOCs. Samples will be analyzed for VOCs by EPA Method 8260, and a detection limit of 0.2 ug/l or less shall be maintained for TCE.

- Sampling of treatment plant influent and effluent streams will be conducted for both the EGDY plant and the I-5 plant. Samples will be analyzed for VOCs by EPA Method 8260, and a detection limit of 0.2 ug/l or less shall be maintained for TCE.

- Sampling the surface water in Murray Creek will occur at strategically located points within the stream. Samples will be analyzed for VOCs by EPA Method 8260, and a detection limit of 0.2 ug/l or less shall be maintained for TCE.

3. GROUNDWATER QUALITY MONITORING

In this report the first 20 rounds of quarterly sample data for the remedial action monitoring program at the Logistics Center were analyzed for groundwater quality and groundwater level optimization. The first 20 rounds encompassed December 1995 to September 2000 data. Because of the lag between draft and final versions of this report, data collected during subsequent sampling rounds (21^{st} through 28^{th} quarters/December 2000 through September 2002) were not analyzed as part of this report; however, Plates 1 through 3 include TCE concentration data up to the 26^{th} quarter (March 2002) sampling round. In addition to the data from the first 20 sampling rounds, data associated with a pre-startup sampling round that was conducted February 1995 is also considered in this report. The groundwater treatment system became operational in August 1995.

Chemical data are also available from the RI and from the post-RI and pre-pump and treat RAM. Like the quarterly data from rounds 21 though 28, these data are presented on Plates 1 through 3, but were not used for the statistical calculations of trends. RAM data only were used for statistical trend analyses to evaluate trends during extraction conditions. This section describes sample frequency and location evaluation performed on the RAM TCE chemical data set. Only TCE has been considered in this report because it has the greatest spatial extent and the highest concentration of any contaminant of concern on site. To a much lesser degree, DCE, PCE, TCA, and VC are contaminants of concern, as defined in the Record of Decision (ROD); however, these organic compounds are generally present at much lower concentrations and to a lesser extent than TCE.

It should be noted that, starting June 1999 (15^{th} Quarter), a low-flow sampling technique was instituted for all RAM sampling. Prior to June 1999, all Vashon Aquifer wells and some Sea Level Aquifer wells were sampled by purging a minimum of three well volumes through the use of either a pump or bailer and collecting a sample with a dedicated bailer. Most Sea Level

Aquifer wells were sampled by first purging three well volumes and then sampled with dedicated Hydrostar piston pumps. The change to the low flow procedure had no significant affect on TCE concentration trends or data variability at most monitored wells, as can be seen on the graphs embedded in Plates 1 through 3. Wells LC-40d, LC-64b, LC-66d, LC-72d, LC-73d, and LC-137c, however, show offsets in plotted concentration versus time data in mid-1999. Wells LC-40d, LC-66d, LC-72d, and LC-73d had dedicated piston style pumps. In well LC-66d the pump intake was positioned 22 feet above the well screen likely resulting in the sampling of groundwater that had stagnated inside the well casing and that was not representative of the formation. This oversight likely caused contaminant results that were biased low between the 15th and 20th quarters (June 1999 to September 2000). The three other Sea Level aquifer well pumps (in wells LC-40d, LC-72d, and LC-73d) may also have been positioned high above the well screens, but the depth of their pump intakes were not confirmed when these pumps were removed and replaced with properly placed dedicated bladder pumps in March 2001. Despite this uncertainty, the TCE data from wells LC-66D, LC-72D, LC-73D, and LC-40D during the period of Hydrostar low flow sampling (June 1999 - December 2000) are considered biased low and nonrepresentative due to the possibility of misplaced pump intakes and the anomalously low concentrations produced during the Hydrostar low flow sampling period. Data collected since March 2001 confirm the downward concentration trends in these Sea Level Aquifer wells assuming that the bladder pump data is equivalent to the previous purge three well volume with a piston style pump collection method.

The other offsets in plotted concentration versus time for wells LC-64b and LC-137c appear to be real expressions of a long term declining trend measured at these wells with an apparent sudden change in concentration that is coincident with a changed sample collection methodology. The position of the dedicated bladder pumps within these wells was confirmed to be within the well screens. All piston style pumps in Sea Level Aquifer wells were replaced with dedicated bladder pumps and all pump intakes were positioned at the center of each respective well screen in early 2001.

3.1.SAMPLE FREQUENCY STATISTICAL EVALUATION

As of May 2001, a total of 58 monitoring wells and 21 groundwater extraction wells were being sampled on a quarterly schedule for a grand total of 316 samples per year (two quarterly surface water locations and eight associated samples are not included in this total). Included in this total number of monitoring wells are 40 Vashon Aquifer wells and 18 Sea Level Aquifer wells. See Plates 1 through 3 for well locations and historical analytical results of all monitored wells at the Logistics Center in the Upper and Lower Vashon units and the Sea Level Aquifer. These plates illustrate the spatial relationship between wells and the concentrations of TCE over time in each sampled well. See Plate 4 for an illustration of which wells were historically sampled for remedial action monitoring prior to this optimization report.

Concentration versus time data from extraction wells and Vashon and Sea Level monitoring wells sampled under the RAM program were analyzed using statistical methods to determine if data trends could be established. First, the complete, 20-quarter monitoring well data set was analyzed, then reduced data sets were analyzed. Reduced data sets were created by considering only data taken during a given month. Hence, there were four reduced data sets containing annual sampling data: one for each of the months of March, June, September, and December. In this way, the annual sampling trends determined for each season could be compared to the quarterly sampling trends to see which, if any, seasons showed particularly good or poor fit with the quarterly sampling data. The 20-quarter data set began with baseline sampling in February 1995 and continued up to the September 2000 quarterly sampling event. For the complete extraction well data set, a total of 28 sampling rounds were considered, since extraction well sampling occurred at a more frequent interval than monitoring well sampling during the first year of system start-up. The first sampling round for the extraction well system occurred in September 1995. The four reduced data sets for extraction and monitoring wells are annual data from the March, June, September, and December quarterly sampling rounds.

Two statistical methods were employed as part of this optimization; Mann-Kendall and Linear Regression trend analyses. Results from the two techniques were combined for both the quarterly data and annual data sets and then compared to each other to determine if significant trend information would be lost by reducing RAM sampling frequency from quarterly to annual. In cases where the trend became obscured or reversed, semiannual sampling was considered. Also, in cases where not enough quarterly data were collected to assess annual trends, recommendations were made for continued quarterly sampling for eight more quarters (two more years), at which time the frequency will be re-evaluated.

Monitoring and Remediation Optimization System (MAROS) Software (Beta Version 1.0) developed by the Air Force Center for Environmental Excellence (AFCEE) was utilized to perform the Linear Regression and Mann-Kendall Analyses. The software is a Microsoft Access® database application developed to assist users with (1) groundwater data trend analysis and (2) long-term monitoring (LTM) optimization at contaminated groundwater sites (MAROS Users Guide 2000). The LTM optimization routines were run when possible and are discussed later in Section 3.3. MAROS was primarily used, however, as a means of generating trend analysis results that were then manually evaluated.

3.1.1. Linear Regression

Linear Regression is a parametric statistical procedure that is typically used for analyzing trends in data over time. This technique interprets the log slope of a least squares, best-fit regression line fitted to the concentration versus time data of a particular well. A regression line with a negative log slope and high confidence in trend is indicative of a decreasing trend, whereas a positive log slope coupled with high confidence in trend corresponds to an increasing trend.

Confidence intervals can be constructed on the slope of the log-transformed data. Using this type of analysis, a higher degree of data scatter simply corresponds to a wider (i.e., larger) confidence interval about the average log-slope. Assuming the sign (either positive or negative) of the estimated log slope is correct, a level of confidence that the slope is not zero can be determined. Thus, despite a poor goodness of fit, the overall trend in the data may still be ascertained, where low levels of confidence (<90%) correspond to “Stable” or “No Trend” conditions (depending on the degree of scatter) and higher levels of confidence indicate the stronger likelihood of a trend. The coefficient of variation (COV), defined as the standard deviation divided by the average, is used as a measure of scatter to distinguish between “Stable” or “No Trend” conditions for negative slopes (MAROS Users Guide 2000). A COV less than one corresponds to data with little scatter and hence a stable trend, whereas a COV greater than one indicates greater scatter and hence no trend. The Linear Regression analysis is designed for analyzing a single groundwater constituent such as TCE concentration over time. The concentration trend for each well is determined according to the rules presented in Table 3.1.

Linear regression plots for Vashon Aquifer wells, extraction wells, and a linear regression statistics summary for all wells analyzed using quarterly data are provided in Appendix A.1 (Quarterly RAM Data). Linear regression plots for Vashon Aquifer wells, extraction wells, and a linear regression statistics summary for all wells analyzed using annual data from the March sampling events are provided in Appendix A.2 (Annual RAM Data, March). Linear regression plots for annual data from the June, September, and December sampling events were not constructed, although regression statistics summaries are provided in Appendices A.3, A.4, and A.5, respectively. Appendix A.6 contains regression statistics summaries for wells in which semiannual sampling was considered based on poor fit of the annual sampling data.

3.1.2. Mann-Kendall Test

The Mann-Kendall test is a non-parametric statistical procedure that analyzes trends in data over time. This test does not require any assumptions as to the statistical distribution of the data (e.g. normal, lognormal, etc.) and can be used with data sets that include irregular sampling intervals and missing data. The Mann-Kendall test is designed for analyzing a single groundwater constituent such as TCE concentration over time.

With concentration versus time data in sequential order for a particular well, the first step in the Mann-Kendall analysis is to determine the sign of the difference between consecutive sample results. The Mann-Kendall Statistic (S) is defined as the sum of the number of positive differences minus the number of negative differences. A negative S indicates a negative trend whereas a positive S indicates a positive trend, provided that the confidence in trend is high (>90%). The greater the magnitude of S, the stronger the trend is. The confidence on the Mann-Kendall Statistic can be measured by assessing the S result along with the number of samples, n, to find the Confidence in Trend by using a Kendall probability table (MAROS Users Guide 2000). The Confidence in Trend combined with the S for data from a particular well yields a Concentration Trend, as shown in Table 3.2.

Mann-Kendall Statistic summaries for quarterly data are included in Appendix A.1, while Mann-Kendall Statistic summaries for March, June, September, and December annual data sets, as well as the June/December semi-annual data set, are included in Appendices A.2, A.3, A.4, A.5, and A.6, respectively.

3.1.3. Combined Lines of Evidence

The trend results using Linear Regression and the Mann-Kendall Test were combined in equal proportions to create a combined Line of Evidence (LOE) trend result for each well and for each data set, as shown in Figure 3.1. These two techniques were combined to incorporate the ease of use and wide application of Linear Regression with the non-parametric capabilities of Mann-Kendall (to account for the possibility of non-normally distributed chemical data) to create a more versatile and applicable trend analysis. The combined LOE technique is the default means of trend analysis within MAROS, and is considered applicable to the Logistics Center data set.

Using combined lines of evidence, the following results were obtained from the quarterly sample data. For all Vashon Aquifer monitoring wells in which trends were statistically determined (a total of 44 wells), 23% were increasing trends, 41% decreasing, and 36% stable/no trends. For all Sea Level Aquifer monitoring wells in which trends were determined (a total of 13 wells), 8% were increasing, 54% decreasing, and 38% stable/no trends. For all extraction wells in which trends were determined (a total of 21 wells), 14% were increasing, 76% decreasing, and 10% stable/no trends. The combined results of all Vashon and Sea Level monitoring wells and extraction wells (a total of 78 wells) were: 18% increasing, 53% decreasing, and 29% stable/no trends. The results presented above indicate that the majority of wells with trends discerned thus far through quarterly groundwater monitoring at the Logistics Center are showing declining TCE concentrations over time at the 90% confidence level.

Consistency between trends of quarterly and annual sampling at any one particular well indicate this well can likely be sampled annually instead of quarterly without a significant loss in quantifiable information. For example, quarterly data from well LC-136a show an increasing combined LOE trend, as does the annual data collected in the month of March (see Appendix B, Fort Lewis Log Center RAM Network Optimization, Annual Shallow Data – March Summary Sheet). This means that if the June, September, and December sample data are not considered (or not sampled in the future), the increasing concentration trend at well LC-136a could still be ascertained. Because LC-136a is located in a dynamic area of EGDY associated with drum removal as well as future NAPL thermal treatment, this well is scheduled for continued quarterly monitoring despite historical data suggesting a reduced sample frequency may be warranted. It should be noted that a minimum of three annual sampling results for any given month of interest (March, June, September, or December) between February 1995 and September 2000 were required to perform an annual trend evaluation. In most instances, a total of six annual sampling results for any given month of interest were used for annual trend evaluation.

The similarity in results between quarterly trends and annual trends was generally quite favorable. Comparing quarterly data against annual data for a particular well made for a total of 279 trend comparisons (156 Vashon, 44 Sea Level, and 79 extraction well trends). For example, four trend comparisons can be made at a single well: quarterly data to March annual data, quarterly data to June annual data, quarterly data to September annual data, and quarterly data to December annual data. The trend summary sheets can be seen in Appendix B, which summarize the output of the MAROS software statistical analyses of Appendix A. The last column of each summary sheet in Appendix B indicates whether the quarterly combined line of evidence agrees ("Y" for yes) or disagrees ("N" for no) with the annual combined line of evidence for the annual sampling round of interest (March, June, September, or December) shown at the top of each page.

Of the 279 comparisons between quarterly and annual trends, 211 (76%) were matching and 68 (24%) were non-matching (combined Vashon, Sea Level, and extraction well statistics). A matching trend was defined as when both quarterly and annual trends increased or decreased, or both had stable or no trends. Of the 211 matching trends, 17% were increasing, 64% decreasing, and 19% stable/no trends. Any increasing or decreasing trend with a confidence in trend greater than 90% was considered absolute. That is, a trend considered by MAROS to be "Probably Increasing" based on a confidence in trend between 90-95% was subsequently defined as "Increasing." These definitions allowed for easier comparisons and conclusions to be made without a significant loss of information. A non-matching trend was defined as when one quarterly or annual trend increased or decreased, while the other either showed stability, no trend or an opposite trend. An opposite trend was defined as having one quarterly or annual trend increased while the other decreased. Only four analyses out of 279, or 1%, produced an opposite trend by reducing the sample frequency from quarterly to annually. These were at wells LC-06 for September data, LC-74d for September data, LC-126 for December data, and RW-1 for June data.

The cause for the vast majority of non-matching TCE concentration trends between quarterly and annual data appears to be the fact that some trends are very slight and may not be discernable by simply viewing the data on a log-concentration versus time graph (Plates 1 through 3). In this case, one or two rejected data points from a given quarterly data set may be enough of a factor to shift a "probably decreasing trend" to show "no trend" or vice versa.

For each monitoring well in the statistical data set, the total number of non-matching combined LOE trends between quarterly and annual data was summed. Since annual data from four separate sampling time frames (March, June, September, and December) were compared to the quarterly data set, the maximum number of non-matches reported per well would be four. Significant disagreement between quarterly and annual data occurred at seven Vashon wells exhibiting three or four non-matches in trend. The following Vashon Aquifer wells reported four non-matches: LC-06, LC-73a, and T-08. The following wells reported three non-matches: LC-03, LC-108, LC-134, and T-13b. Well LC-134 was abandoned in December 2000 since it was in the way of source removal trenching operations at the EGDY and hence will not be considered further. Since the six remaining wells showed poor trend matches when data was reduced to annual sampling, consideration was made to keep sampling these wells quarterly, or to sample them semiannually. No Sea Level wells or extraction wells had significant disagreement between quarterly and annual sampling trend data.

The six wells in which annual trends disagreed significantly with quarterly trends were chosen to undergo evaluation of semiannual sampling analysis. Each well considered the baseline-sampling event (February 1995), June, and December sample data in the semiannual data set. Combined June and December data were chosen over March and September due to the better overall agreement in trends with the quarterly data. See Appendix A.6 for MAROS-generated semiannual RAM data analysis. Results indicated June and December semiannual data trends agreed with quarterly data trends for LC-108, LC-06, T-13b, and T-08. Although the overall TCE concentrations were low (on the order of 1 ug/l), trends disagreed for wells LC-73a (quarterly stable, semiannually probably decreasing) and LC-03 (quarterly increasing, semiannually no trend). With these frequency results in mind, wells recommended for quarterly sampling are LC-03 and LC-73a, while wells recommended for semiannual sampling are LC-108, LC-06, T-13b, and T-08. Subsequent to the recommended June/December semiannual sample schedule, it was recognized that overall March annual data correlated best with quarterly data, hence it was agreed to that semiannual sampling follow a March/September sample schedule to coincide with the March annual sampling. At that point in time when the annual sampling round is conducted, all wells undergoing RAM sampling (including those on a quarterly or semi-annual schedule) will be sampled.

3.2.SAMPLE LOCATION EVALUATION

A non-statistical approach was used to evaluate Logistics Center groundwater sample locations. The determination of which monitoring wells are best suited for remedial action monitoring of the contaminant plume at the Logistics Center consists of integrating spatial uniqueness with average TCE concentration uniqueness. A well is considered geographically important to the RAM network if there are no other wells nearby that monitor the same hydrologic unit. A well may also be considered important if its associated analytical data demonstrate either a uniquely high or low average concentration. Conversely, if a well is in close proximity to another well that monitors the same aquifer at approximately the same elevation and if historical analytical results between the two wells in question are similar, then one of the two wells can theoretically be eliminated from the RAM network. No extraction wells were considered for elimination from the RAM monitoring network.

An additional test of geographic importance was made by plotting the September 2000 TCE concentration data set for the proposed RAM wells and then observing in detail the shape of the isocontour map. If the map closely resembles the current understanding of the contaminant plume configuration (both shape and concentration for each respective aquifer and zone), then well coverage may be considered sufficient. If, in any one or more areas, the contoured plume does not resemble our current understanding of the plume configuration, then an additional well or wells is needed to fully characterize the plume extent and concentration, as required in the DQOs stated in Section 2. Proposed sampling and water level monitoring at wells NEW-1 though NEW-5, along with existing well LC-182, are aimed at filling in data gaps for both TCE concentration and groundwater elevation, particularly along the plume's southern lobe and downgradient of the I-5 extraction wells. The TCE plume configuration is shown on Plates 1 through 3 and is based on a synthesis of data from all wells sampled at the Logistics Center since 1985. The most recent TCE data available for each well sampled was used to draw the plume configurations (shown on Plates 1 through 3). The vast majority of data points used for contouring were from the March 2002 RAM data set.

As of May 2001, a total of 58 monitoring wells were being sampled on a quarterly schedule at the Logistics Center, including 40 Vashon wells and 18 Sea Level wells. Two surface water locations were also being sampled on a quarterly schedule. See Plates 1 through 3 for well locations (and surface water locations) and historical analytical results of all monitored points at the Logistics Center in the Upper and Lower Vashon units and the Sea Level Aquifer.

Table 3.3 summarizes the evaluation of pre May 2001 RAM network wells for the Vashon Aquifer. The table also includes recommendations for additional existing wells and proposed new wells to add to the RAM network to fill in current spatial data gaps, with justification for keeping, eliminating or adding the well as noted. From Table 3.3, it can be seen that the overall number of Vashon wells sampled would be increased by 11 wells, from 40 to 51. The proposed new arrangement accounts for the elimination of 13 wells currently being monitored and the addition of 19 existing and five proposed new wells currently not being monitored, primarily within the shallow, Upper Vashon unit.

To better define the Sea Level Aquifer TCE contaminant plume, especially with respect to the downgradient limits, additional Sea Level Aquifer monitoring points were installed. The USACE, in cooperation with the U.S. Geological Survey, installed five new Sea Level Aquifer multiport monitoring wells during the 2001-2002 field season. These wells are: LC-79d, LC-80d, LC-81d, LC-82d, and LC-83d, and are located along the down gradient edge of the Sea Level Aquifer TCE plume (Plate 3). These new multiport wells each contain four sampling ports generally corresponding to the four most permeable intervals within the upper Sea Level Aquifer. Since these five wells are new, they were not included in the statistical evaluation discussed in this report. It is envisioned that these new Sea Level Aquifer wells will be included into the RAM network for quarterly sampling for two years (all four ports sampled initially, then only one port per well sampled subsequent quarters), at which time the frequency may be reevaluated.

As shown in Table 3.4, two Sea Level Aquifer wells are recommended for elimination from the RAM network, and ten wells are recommended for addition. Well LC-166d, which is situated approximately one mile northwest (downgradient) of the leading edge of the Sea Level Aquifer TCE plume is recommended to be deleted from the sampling network because analytical results for TCE at LC-166d have been non-detect since monitoring began in December 1995, and based upon the most recent conceptual model of TCE transport in the lower aquifer (USACE 2002a), well LC-166D is no longer considered a down-gradient sentinel well. Well LC-41d is recommended to be deleted and replaced by well LC-69d since well LC-69d has slightly higher historical TCE concentrations than LC-41d and may, therefore, be more representative of the maximum TCE concentration entering the Sea Level Aquifer. Four of the additional wells recommended for inclusion into the Sea Level Aquifer monitoring network are: LC-70d, MAMC 3, MAMC 4, and PS 13. LC-70d is located within the highest-concentration area of the Sea Level Aquifer TCE plume, while wells MAMC 3, MAMC 4, and PS 13 are located on and will help to define the western fringe of the plume. Five of the additional wells are the newly installed multiport wells discussed previously. By implementing this recommendation, the total number of monitored Sea Level Aquifer wells would increase by eight, from 18 to 26. Combining the results from Sea Level and Vashon Aquifer optimization (Tables 3.3 and 3.4), the total number of monitoring wells for the proposed RAM sampling network is increased by 19, from 58 to 77 wells.

3.3.MAROS SAMPLING OPTIMIZATION RESULTS

As stated in Section 3.1, MAROS was utilized both for the statistical trend analysis capabilities and for its long-term monitoring (LTM) network sampling optimization capabilities. Note that the terminology LTM is used within MAROS and is equivalent to RAM for this project. Trend analysis was the primary use of the software and is discussed in Section 3.1. The LTM optimization routines within MAROS were considered, but limitations in the beta version of the software hindered usability. It should be noted that MAROS provides recommendations for RAM optimization that are to be used as a "strawman," or basis for discussion (MAROS Users Guide 2000), since the software can not consider all relevant, site-specific aspects of a project that may be at the decision maker's disposal. Sampling optimization consists of two parts; sampling frequency analysis and sample location analysis, which are both discussed below.

At first glance, the quarterly sample data appears to be relatively stable over time when plotted on a log-concentration versus time scale (shown on Plates 1 though 3). This preliminary look at the data suggests that quarterly sampling may be at too great a frequency. MAROS considers user-defined "recent sampling periods" combined with all sampling events to recommend a sampling frequency for each well in the data set based on the Modified Cost Effective Sampling (Modified CES) method (adopted from Cost Effective Sampling by Ridley at al. 1995). The use of recent sampling periods in trends analysis allows more recent data a higher weighting in trend formulation. Recent sampling periods were defined as being the most recent six quarters of data. Incidentally, the earliest quarter considered in the recent sampling period (15^{th} quarter) corresponds to the first sampling round after the low flow sampling technique was instituted for the site. Results for the quarterly data set are shown in Appendix A.1 (Quarterly RAM Data) under "Summary – Final Recommendation for Sampling Frequency." Of the 42 Vashon Aquifer wells in the quarterly sampled data set, 10 wells were recommended for continued quarterly sampling, four wells were recommended for semiannual sampling, 21 for annual sampling, and seven for biennial (once every 24 months) sampling. Of the 17 Sea Level Aquifer wells (analyzed separately from Vashon wells but also included in Appendix A.1), one well was recommended for quarterly sampling, one for semiannual, 10 for annual, and five for biennial.

It should be noted that the primary means of frequency determination in the Modified CES method within MAROS is through the use of Rate of Change (ROC) parameters assigned either by the user, or from the default Preliminary Remediation Goal (PRG) for the particular contaminant of concern (COC). The ROC is simply the slope of the fitted line of concentration versus time by linear regression and is in units of milligrams per liter per year (mg/l/yr). Low, medium, and high ROC multipliers are used to assess if the COC concentrations change slowly or quickly over the course of a year. The low, medium, and high ROC multipliers used were 0.005, 0.01, and 0.025 and correspond to the PRG (5 ug/l), twice the PRG, and five times the PRG, respectively. MAROS results indicate the majority of both Vashon and Sea Level Aquifer RAM wells (73%) are recommended for either annual or biennial sampling.

The sampling location determination program within MAROS optimizes sampling locations by the Delaunay Method, which is used to remove redundant sampling locations from the monitoring network based on analysis of spatial sampling data. The spatial sampling data is considered redundant if one sample location is within close proximity to another and both locations show small rate of change in contaminant concentrations over time. Results for the quarterly data set are shown in Appendix A.1 (Quarterly RAM Data) under "Summary – Final Recommendation for Sampling Locations." Of the 42 Vashon Aquifer wells in the quarterly sampled data set, the MAROS analysis recommended the elimination of 14 of these wells from the RAM program. Two of these wells (LC-19a and LC-49), however, are being used to monitor the effectiveness of the East Gate extraction well system and should not be eliminated. Additionally, two wells (LC-41a and LC-66b) recommended for elimination from the monitoring program help to define the window where TCE apparently sinks down from the Vashon to the Sea Level Aquifer and should be retained.

Version 1.0 is a beta version of the MAROS software and several bugs were discovered which did not allow full use of the RAM network sampling optimization capabilities, especially with respect to the sample location analysis. Due to computer system lock-up, location analyses could not be run on the reduced, annual data sets. This limitation in the sampling optimization module of MAROS was considered when weighing these results alongside those obtained from the manual quarterly versus annual statistical frequency analysis and manually determined redundant sample locations. It should be emphasized, however, that the non-functionality of the sample optimization routines within the MAROS software version had no bearing on the recommendations of this report. This is because professional hydrogeologic judgment based on knowledge of conceptual site geology and statistical evaluation outside the software itself were ultimately used to determine the optimum well network.

4. GROUNDWATER LEVEL MONITORING

Groundwater level monitoring is an essential part of a remedial action monitoring program. A sufficient number of water levels in representative wells from each aquifer of concern are necessary to map the groundwater flow direction(s) and gradient(s). As detailed in the Draft Remedial Action Monitoring Sixth Annual Monitoring Report (USACE 2002a), groundwater gradients vary between EGDY source area, downgradient of the I-5 extraction system, and near the Madigan Army Medical Center (MAMC) in the Vashon Aquifer. Additionally, the potentiometric gradient of the Sea Level Aquifer is fairly flat near the EGDY, increases in the central portion of the Logistics Center near well LC-41D, and then becomes less steep toward the I-5 extraction system. Subtleties in these gradient variations may not be discernable through dramatic reduction in measurement monitoring points; therefore, a dramatic reduction is not appropriate. As of May 2001, 156 wells were being monitored each quarter for water levels (as shown on Table 4.1 and Plate 4). The water level monitoring is currently being conducted on a quarterly basis.

MAROS was not used for water level data analysis. Instead, Surfer contouring software (Version 7.0, Golden Software, Inc.) was utilized to evaluate groundwater flow and monitoring well inclusion into the RAM network. Water levels from September 2000 at the wells proposed for RAM water quality monitoring were plotted and contoured to see how well the resulting contour map compared to our current understanding of groundwater flow directions and gradients on site for each of the respective aquifers and zones. The results for both Vashon and Sea Level Aquifers from these 58 wells alone agreed in a general sense with the existing shallow and deep contour maps considering all 156 wells currently measured for water level. Some gaps in water level elevation occurred, for example, in the areas of Madigan Army Medical Center (MAMC), and to the southwest of the EGDY source area. This exercise shows that water level monitoring needs to occur in more wells besides those scheduled for analytical sampling to capture subtleties in groundwater flow.

5. SURFACE WATER MONITORING

Two surface water samples from Murray Creek have been collected during each quarter of RAM monitoring for VOC analysis. The first sample location (SW-MC-1) is located on the uppermost reach of Murray Creek to the south-southwest of the EGDY (See Plate 4 for historical surface water monitoring locations). Location SW-MC-1 is upstream of the point where the shallow TCE plume intersects the creek bed and is therefore believed to be a background location. The second sample location was designated SW-MC-2 and was located on the downstream side of the Jackson Avenue Bridge, just west of the western lobe of the shallow, Upper Vashon TCE contaminant plume. Samples were collected at SW-MC-2 for the first 10 quarters of RAM monitoring. Beginning with the 11th Quarter (June 1998), the second sampling location was moved upstream, where the South F Street Bridge crosses Murray Creek, and was renamed SW-MC-4. The location was moved in order to better intercept the western lobe of the shallow, Vashon TCE contaminant plume. However, Murray Creek is a losing stream along the reach above the shallow TCE plume and therefore this location may not be monitoring true plume/creek interaction in this area. The shallow TCE plume does intersect the creek bed in an area where Murray Creek is a gaining stream to the southwest of EGDY and a new sampling location in this area, SW-MC-6 (adjacent to LC-180), has been added to the surface water monitoring program. Chemical sampling at the two Murray Creek locations have been on a quarterly basis since the start of the RAM in December 1995. SW-MC-6 is to be monitored quarterly for a minimum of eight quarters (two years).

6. CONCLUSIONS

Taken as a whole, the TCE contaminant plume's areal extent in both the Vashon and Sea Level Aquifers can be considered stable. This is because very few of the wells defining the plume perimeter show increasing concentrations of TCE over time. Based upon the MAROS analysis, more monitoring and extraction wells show decreasing TCE trends (53%) than increasing trends (18%) or stable/no trends (29%).

For the Vashon Aquifer monitoring wells, no major grouping of wells in any area can be considered to be increasing or decreasing with respect to TCE concentration. In other words, there appears to be no consistent pattern of locations where concentration trends agree. By contrast, six of the seven farthest downgradient Sea Level Aquifer wells analyzed showed statistically significant decreasing trends (LC-71d, LC-72d, LC-73d, LC-40d, LC-66d, and LC-126). The only Salmon Spring well that showed an increasing TCE trend was LC-74d, located southwest (and somewhat downgradient) of the permeable window between the Lower Vashon and Sea Level Aquifers and in an area that may also be influenced hydraulically by extraction wells associated with MAMC and PS 13. Well PS 13 was shut down in 2001 and therefore should no longer influence plume behavior. All EGDY extraction wells exhibited either a decrease or stability/no trend in TCE concentration over time. For the I-5 extraction system, data from 11 of 15 wells showed decreased TCE concentrations over time, indicating a reduction in TCE mass within the Vashon Aquifer. Three I-5 extraction wells showed increasing trends (LX-13, LX-14, and LX-15), all of which were located at the northernmost end of the well field. The cause for the increasing TCE concentrations at the north end of the I-5 well field is unknown; however, the latest round of sampling considered in this report (September 2000) indicates TCE concentrations for LX-13, LX-14, and LX-15 are low (5.3, 5.8, and 2.9 ug/l, respectively).

While trends are useful in our understanding of the TCE plume behavior, caution must be used, however, when considering the overall meaning of the TCE contaminant trends discussed in this report. First, all non-stable contaminant trends that can be determined, whether increasing or decreasing, are very slight (as shown on the embedded graphs in Plates 1 through 3), of which many can not even be discerned with the naked eye. Second, the inherent error built in to the sample collection and analysis process, no matter how well devised and implemented, will produce natural data scatter that will affect the results of statistical trend analysis. Third, the rate at which the COCs move in groundwater on site is sufficiently slow relative to the length of the travel paths so as to not significantly change between quarterly periods. When put into proper perspective, it makes intuitive sense to monitor more locations (optimize spatially) but less frequently (optimize temporally) over the duration of a long-term monitoring program anticipated to last on the order of 40 plus years.

The Data Quality Objectives and methods used to achieve those objectives for the remedial action monitoring at the Logistics Center must not be compromised in the process of optimizing the RAM network. The following paragraphs demonstrate how the proposed addition in number of monitoring wells and reduction in sample frequency will not adversely impact the RAM DQOs listed in Section 2, and how they will actually enhance DQOs that were not previously being met.

Determination of whether or not the primary EGDY well field is capturing all source area dissolved COCs can still be made through continued VOC sampling and analysis of extraction wells LX-17, LX-18, LX-19, and LX-21 and monitoring wells LC-137b, LC-136a, LC-136b, LC-64a, LC-53, LC-57, FL-2, LC-182 and NEW-1. Continued groundwater level measurements at these and all other EGDY monitoring wells will be sufficient to construct a groundwater flow map capable of illustrating groundwater flow directions in the EGDY vicinity that will be used to evaluate the effective capture zone of the pump and treat system.

Determination of whether or not the secondary EGDY well field is capturing high contaminant (>200 ug/l) groundwater between primary and secondary EGDY well fields can still be made through continued VOC sampling and analysis of extraction wells LX-16 and RW-1 and monitoring wells LC-19a and LC-49. Continued groundwater level measurements at these and all other nearby monitoring wells will be sufficient to construct a groundwater flow map capable of showing effective radial influence of the secondary EGDY extraction well field.

Determination of whether or not the I-5 well field is capturing and reducing the contaminant plume upgradient of the I-5 well field and between the I-5 well field and the I-5 infiltration gallery can still be made through continued VOC sampling and analysis of extraction wells LX-1 through LX-15 and monitoring wells LC-05, LC-66b, and FL6 (upgradient of extraction wells), as well as monitoring wells LC-167, FL3, and LC-14a (between extraction wells and infiltration gallery). Continued groundwater level measurements at these and all other nearby monitoring wells will be sufficient to construct a groundwater flow map capable of showing effective radial influence of the I-5 extraction well field.

Determination of whether or not the contaminant plume downgradient of the I-5 infiltration gallery is dispersing to less than clean-up goals can still be made through continued VOC sampling and analysis of monitoring wells LC-61b, T-04, T-08, T-11b, T-12b, T-13b, T-06, and NEW-3. The downgradient direction can still be determined based on water level measurements in these wells and other nearby wells.

Determination of the lateral and vertical extent and concentration of the COCs and whether or not they are changing with time in both the Vashon and Sea Level Aquifers can still be made through VOC sampling and analysis of all proposed wells.

Determination of whether or not extraction wells are removing COCs from groundwater and are necessary for hydraulic containment of contaminants can still be made through the continued periodic sampling of all extraction wells and through the construction of groundwater contour maps showing radial influence of each extraction well field.

Sampling with respect to surface water sample location SW-MC-4 along Murray Creek remains unchanged at this time. The reported TCE concentration at location SW-MC-1 has been below detection limits for all 20 quarters and can be considered a background location. Because there is no reason to suspect future detections at this location, SW-MC-1 could be sampled less frequently. Based on our current understanding of the extent of the TCE contaminant plume (USACE 2002a), an additional sampling location (SW-MC-6) on Murray Creek was added where the TCE plume intersects Murray Creek southwest of the EGDY (Plate 5). Monitoring location SW-MC-6 is located where TCE entering Murray Creek is likely at its highest concentration. Therefore, this new sampling location will be used to evaluate whether the surface water DQO is met. SW-MC-6 is to be sampled quarterly for a minimum of eight quarters, at which time the frequency will be reevaluated.

Current sampling protocol with respect to mass removal rates and total mass removal of COCs by each treatment system is to analyze influent and effluent on a monthly basis for TCE. This results in the collection and analysis of 48 samples per year. The use of a real-time field analytical test kit for volatile organic halides specifically calibrated to TCE was investigated, however, the associated cost savings was minimal and therefore was not pursued further.

7. RECOMMENDATIONS

The recommendations presented here aim to optimize the overall spatial and temporal RAM groundwater quality monitoring and water level monitoring networks. The networks will be optimized by reduction in sampling frequency, and also by changes in sampling and groundwater level locations resulting in a slight net increase in number of monitoring wells sampled.

7.1.GROUNDWATER QUALITY MONITORING

Overall, both the frequency and location of groundwater quality analysis results from MAROS were somewhat similar to the results determined manually using trend analysis and location optimization outside the MAROS software. MAROS recommended that the majority of RAM monitoring wells be sampled no more than once per year (73%) as did the manual trend analysis in which 72% of monitoring wells are recommended for sampling once per year. These figures are not directly comparable since wells proposed for addition to the RAM network were included in the manual analysis (and automatically assigned quarterly sampling frequency) but were not included in the MAROS analysis. For location analysis, MAROS recommended 14 monitoring wells for RAM elimination while manual analysis recommends 18 monitoring wells could be eliminated from the RAM network. Nine wells recommended for elimination were contained in both MAROS and manual elimination lists. More wells were eliminated manually because several are to be replaced in the RAM network by alternate existing wells and proposed new wells to better define the limits of the plume.

Table 7.1 summarizes final well location and sample frequency recommendations for the RAM network optimization at the Fort Lewis Logistics Center. The final recommendations were made by combining the wells recommended for continued inclusion in the RAM with the recommended well sampling frequencies. March was selected as the month of the most comprehensive sampling quarter, when all wells and surface water locations in the network are to be sampled. September was selected as the month for semi-annual sampling.

Five new Upper Vashon wells are proposed for installation (after EGDY RI characterization) and inclusion into the RAM network; one to the southwest of the EGDY, one upgradient and south of the I-5 extraction system, one downgradient and northwest of the I-5 system, one to the east of existing well LC-06, and one to the east of existing well PA-383. These wells are tentatively referred to as NEW-1 through NEW-5 (See Plate 1). These wells are proposed for addition to the RAM network because TCE concentrations and groundwater elevation data gaps exist in these locations. Existing well LC-182, located to the southwest of the EGDY, is also to be included into the quarterly monitoring network to further define the plume extents in that direction.

Based on the recommendations provided in Table 7.1, a total of 254 RAM monitoring well and extraction well samples would be collected per year (See Table 7.2 for further details). This number includes the following: 51 wells at 4 samples/year = 204 samples/year (quarterly), 3 wells at 2 samples/year = 6 samples/year (semi-annual), and 44 wells at 1 sample/year = 44 samples/year (annual). Compared to the current total of 316 samples per year at monitoring and extraction wells, implementing the recommended changes to the RAM network would result in 62 fewer samples the first two years each after implementation while still adequately monitoring the TCE contaminant plume currently present at the Logistics Center. See Plate 5 for a complete depiction of the revised sampling network.

7.2.GROUNDWATER LEVEL MONITORING

The overall proposed groundwater level monitoring locations are depicted in Table 7.3. The removal of 16 monitoring wells and the addition of 37 wells to the RAM groundwater level monitoring network is proposed, as shown in Table 7.4. All wells proposed for removal from water level monitoring are Vashon wells, and reasons for exclusion are either because (1) the well has been abandoned or destroyed, (2) the well is to be abandoned, or (3) the water level data at that well duplicates that of another well. Of the 36 proposed wells for addition to the RAM network for water level measurement, all except MAMC 3, MAMC 4, PS 13, 88-1-SS, LF4-MW2C, LF4-MW9B, LF4-MW12B, LF4-MW16B, and SRC-MW1B are Vashon wells. Reasons to add these wells are either because (1) the well has been added to the RAM analytical network, (2) well is located west of the EGDY, where the groundwater gradient is not well defined, (3) well is located near MAMC, where the groundwater gradient is not well defined, and/or (4) well is Sea Level Aquifer well located on North Fort Lewis where groundwater data is sparse.

Since obtaining groundwater levels in wells is a relatively straightforward and inexpensive task, and since gradients vary considerable over the site and between aquifers, the overall magnitude of the RAM water level measurement network should not change. Through implementation of the stated recommendations, the total number of wells for inclusion into the water level monitoring program will increase by 21 from 156 to 177. Water level measurements in wells are recommended on a continued quarterly basis. See Plate 5 for a complete depiction of the revised water level monitoring network.

7.3.SURFACE WATER MONITORING

Based on the results of the EGDY RI, surface water location SW-MC-6 has been added to the monitoring network for initial quarterly monitoring. The fact that no TCE has ever been detected at surface water monitoring location SW-MC-1 is evidence to reduce the frequency of sample collection and analysis at this location from quarterly to annually. The current schedule of quarterly sampling is recommended at surface water monitoring location SW-MC-4. See Table 7.1 and Plate 5 for a complete listing and depiction of the revised surface water sampling network.

7.4.MONITORING FREQUENCY UPDATES

After a two year period (eight quarters of additional analytical data) from the implementation of the new RAM network monitoring schedule, all 54 wells and both surface water locations sampled either semiannually or quarterly will be re-evaluated. At that time, locations that currently do not have enough quarterly data to evaluate trends will have sufficient data for evaluation. Trend evaluation at that time likely will result in a further reduction of total number of samples per year due to some frequency reductions of the 54 monitoring wells proposed for either quarterly or semiannual sampling. As shown in Table 7.2, if 75% of the wells proposed for quarterly sampling during the first eight quarters could be reduced to annual sampling, this would result in 81 fewer samples than that currently being collected.

Because sampling for many wells is now proposed to be conducted less frequently than quarterly, abrupt changes in concentration at a given location may not be detected for up to a year. In some cases in the past, analytical results for some wells have been well outside the historical range of concentrations for a given location. These sudden changes in concentration have typically been found to be anomalous and likely due to some error based upon subsequent sampling data. However, some sudden changes in concentration at sample locations have been the result of changes in the concentration trends at a given well. If a well that is not being sampled quarterly experiences a sudden change in concentration that is different than historical concentrations at that location, then a determination will need to be made as to whether the data point is anomalous, or if a real change in contaminant trend is being measured. Therefore, a decision strategy was developed to handle abrupt measured changes in contaminant concentration at any given well

Tables 7.5 through 7.8 contain analytical TCE data acceptance ranges for each sampling location. The acceptance ranges are based upon historical concentration measurements for each well. The upper limit of the acceptance range was generally set at 20% above the maximum measured concentration for a given location. The lower limit of the acceptance range was generally set 20% below the minimum measured concentration for a given location. At some locations the acceptance range was made more restrictive to eliminate bias from early data points that are no longer representative of recent concentration trends. If an analytical result for a given location falls outside the range for that location given in Table 7.5 (Upper Vashon), then that location will be immediately re-sampled to confirm the value. If the value is not confirmed and the re-sampled value is within the acceptance range for that location, then the original anomalous result will be discarded and sampling frequency will not change. If the re-sample result confirms the anomalous data result, then the sampling location will be returned to quarterly until enough data are collected to evaluate the new concentration trend.

8. REFERENCES

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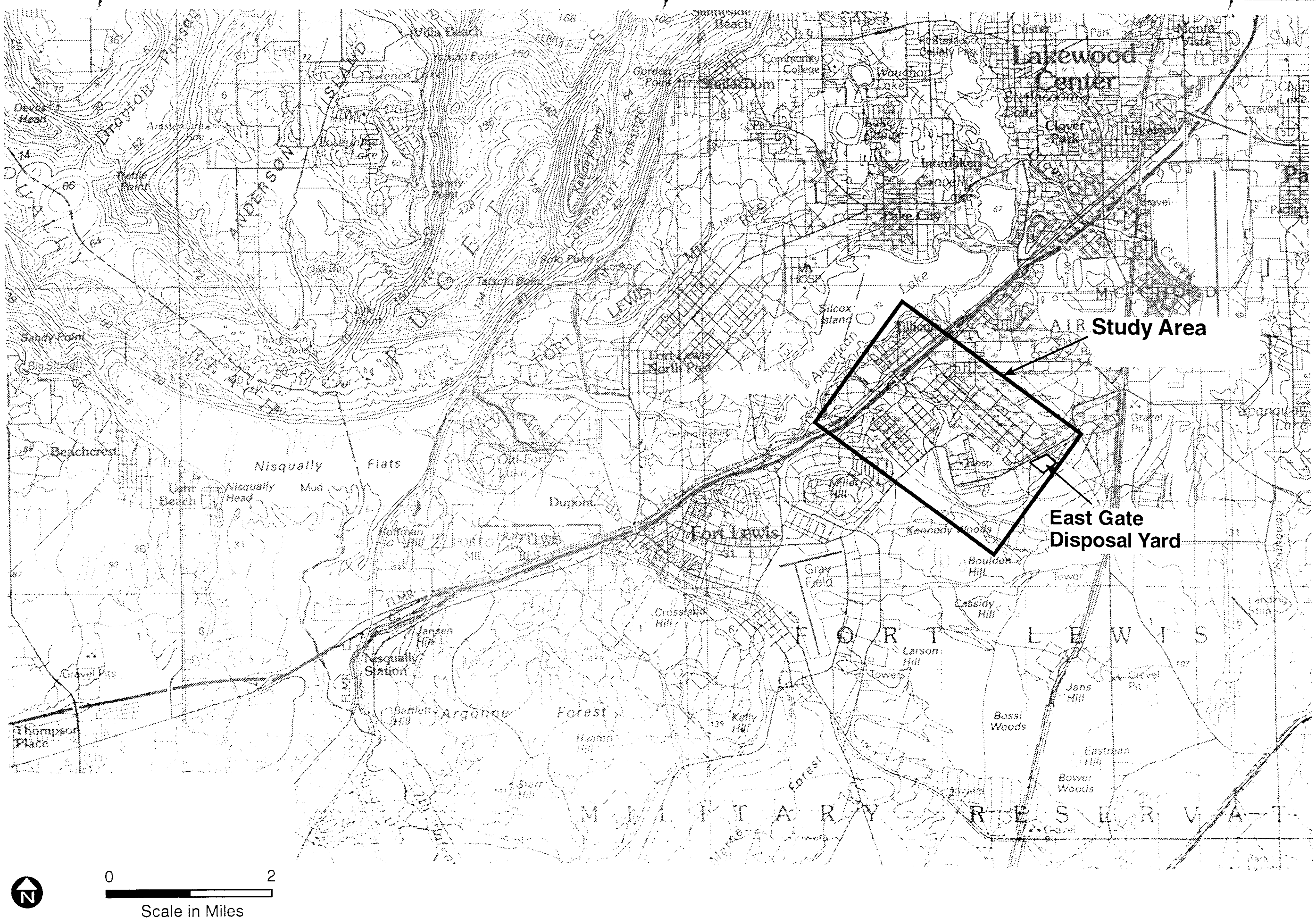
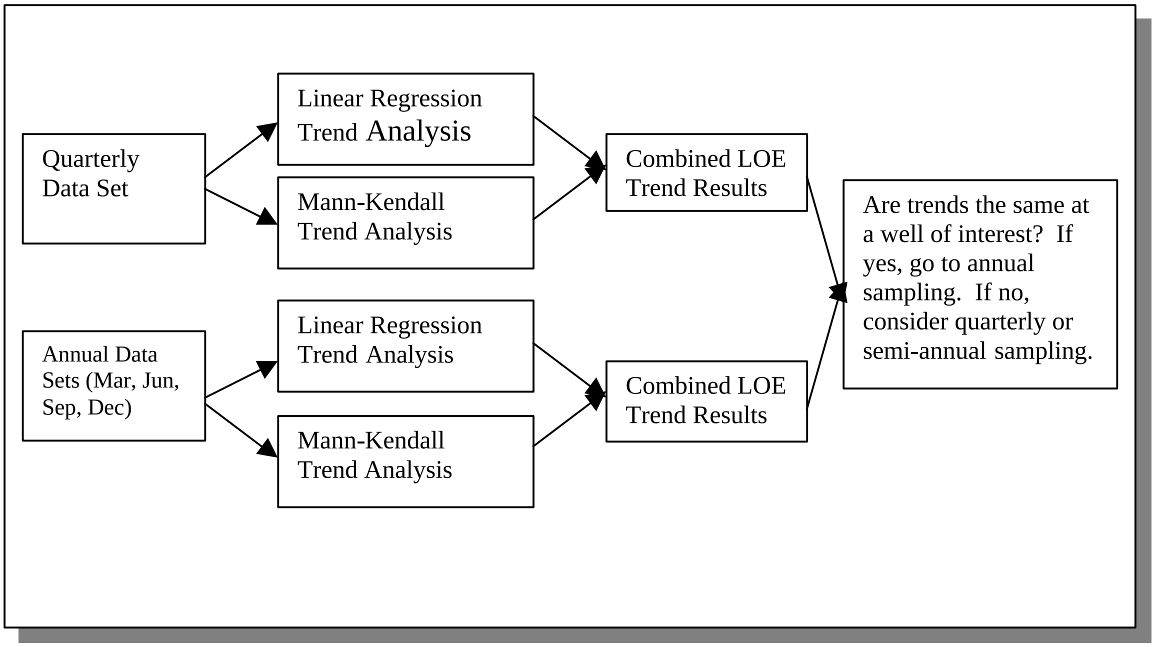
FIGURES



Fort Lewis Logistics Center	Project No. 53F0072289	Locations of Fort Lewis and Logistics Center Remedial Action Monitoring Study Area	Figure 1-1
URS			

Figure 3.1. Sample Frequency Analysis Flow Diagram.



TABLES

Table 3.1. Concentration Trend Determination for Linear Regression.

Confidence in Trend	**Ln slope** **Positive**	**Negative**
<90%	No Trend (NT)	COV < 1 Stable (S) COV > 1 No Trend (NT)
90-95%	Probably Increasing (PI)	Probably Decreasing (PD)
>95%	Increasing (I)	Decreasing (D)

Notes: COV = Coefficient of variation

Table 3.2. Concentration Trend Determination for Mann-Kendall.

Mann-Kendall Statistic	**Confidence in Trend**	**Concentration Trend**
S>0	>95%	Increasing (I)
S>0	90-95%	Probably Increasing (PI)
S>0	<90%	No Trend (NT)
S≤0	<90% and COV ≥ 1	No Trend (NT)
S≤0	<90% and COV < 1	Stable (S)
S<0	90-95%	Probably Decreasing (PD)
S<0	>95%	Decreasing (D)

Notes: COV = Coefficient of variation

Table 3.3. Vashon Aquifer Monitoring Well Status.

Well	Hydro-logic Unit*	Keep, Eliminate, or Add?	Justification
LC-03	UV	Keep	Paired with LC-06 to define plume limits
LC-05	UV	Keep	Upgradient of I-5 extraction wells
LC-06	UV	Keep	Paired with LC-03 to define plume limits
LC-14a	UV	Keep	Downgradient of I-5 extraction system
LC-19a	UV	Keep	Upgradient of RW-1
LC-19b	UV	Eliminate	Duplicates LC-19a
LC-19c	UV	Eliminate	Duplicates LC-19a
LC-26	UV	Keep	Immediately upgradient of source area
LC-41a	UV	Keep	Spatially unique/window to USL
LC-44a	UV	Eliminate	Duplicates LC-06
LC-49	UV	Keep	Downgradient of RW-1
LC-49a	UV	Previously Eliminated	Discontinued sampling Sep 98 (Q12)
LC-51	UV	Eliminate	Duplicates LC-53
LC-53	UV	Keep	Spatially unique
LC-64a	UV	Keep	Source area/paired w/ LC-64b in LV
LC-66a	UV	Eliminate	Duplicates LC-66b
LC-66b	UV	Keep	Shallow point in window area between LV & USL
LC-73a	UV	Eliminate	Replace with FL3 closer to plume
LC-108	UV	Eliminate	Reduce # wells in source area
LC-132	UV	Eliminate	Duplicates LC-05
LC-134	UV	Previously Eliminated	Abandoned Dec 2000
LC-136a	UV	Keep	"Hot spot" in source area
LC-136b	UV	Keep	Defines vertical gradient/source area w/ LC-136a
LC-137a	UV	Eliminate	Duplicates LC-137b
LC-137b	UV	Keep	Source area
LC-144a	UV	Previously Eliminated	Discontinued sampling Sep 98 (Q12)
LC-144b	UV	Previously Eliminated	Abandoned, Discontinued Sep 98
LC-149c	UV	Keep	Background/upgradient of source
LC-149d	UV	Eliminate	Duplicates LC-149c
LC-162	UV	Previously Eliminated	Reduce # wells in source area; abandoned
LC-165	UV	Eliminate	Replace with LC-167 closer to plume
PA-381	UV	Keep	Paired with PA-383 to define plume limits
PA-383	UV	Keep	Paired with PA-381 to define plume limits
T-01	UV	Eliminate	Away from plume; obstructed as of Dec 99
T-04	UV	Keep	Near downgradient edge of plume
T-08	UV	Keep	Near downgradient edge of plume
T-12b	UV	Keep	Near downgradient edge of plume
T-13b	UV	Keep	Defines downgradient extent of plume
LC-16	UV	Add	Define transverse limits of plume
LC-20	UV	Add	Define transverse limits of plume

Table 3.3. Vashon Aquifer Monitoring Well Status (Continued).

Well	Hydro-logic Unit*	Keep, Eliminate, or Add?	Justification
LC-24	UV	Add	Define transverse limits of plume
LC-34	UV	Add	Define transverse limits of plume
LC-57	UV	Add	Define transverse limits of plume
LC-61b	UV	Add	Define downgradient extent of plume
LC-167	UV	Add	Replaces LC-165 closer to plume
FL2	UV	Add	Close to Madigan Housing Area
FL3	UV	Add	Replaces LC-73a closer to plume
FL4B	UV	Add	Define transverse limits of plume
FL6	UV	Add	Define southern extent of plume at I-5 system
T-06	UV	Add	Define downgradient extent of plume
T-11b	UV	Add	Define downgradient extent of plume
NEW-1	UV	Add	Define transverse limits of plume
NEW-2	UV	Add	Define transverse limits of plume
NEW-3	UV	Add	Define transverse limits of plume
NEW-4	UV	Add	Define downgradient limits of plume
NEW-5	UV	Add	Define transverse limits of plume
LC-182	UV	Add	Define transverse limits of plume
LC-64b	LV	Keep	Source Area
LC-111b	LV	Keep	Monitor lower I-5 extraction system
LC-116b	LV	Keep	Monitor lower I-5 extraction system
LC-122b	LV	Keep	Monitor lower I-5 extraction system
LC-128	LV	Keep	Downgradient of I-5 extraction system
LC-137a	LV	Keep	Downgradient of source area
LC-41b	LV	Add	Window between UV & USL
FL4A	LV	Add	Define transverse limits of plume
T-10	LV	Add	Downgradient of I-5 extraction system
MAMC 1	LV	Add	Limited data at MAMC area
MAMC 6	LV	Add	Limited data at MAMC area

Notes: *UV = Upper Vashon, LV = Lower Vashon, USL = Upper Sea Level;
"New-X" indicates proposed well location but not proposed well name

Table 3.4. Sea Level Aquifer Monitoring Well Status.

Well	Hydro-logic Unit*	Keep, Eliminate, or Add?	Justification
LC-21c	USL	Keep	Limited wells in USS
LC-26c	USI	Keep	Limited wells in USS/Upgradient of sourc
LC-35d	USL	Keep	Limited wells in USS
LC-40c	USI	Keep	Limited wells in USS
LC-41d	USL	Eliminate	Replace with LC-69d
LC-47c	USI	Keep	Limited wells in USS
LC-50d	USL	Keep	Limited wells in USS
LC-66c	USI	Keep	Limited wells in USS/Window area
LC-67d	USL	Keep	Limited wells in USS/Window area
LC-72c	USI	Keep	Limited wells in USS/Window area
LC-73d	USL	Keep	Limited wells in USS/Window area
LC-75c	USI	Keep	Limited wells in USS/Define limits of plun e
LC-76c	USI	Keep	Limited wells in USS/Define limits of plun e
LC-77c	USI	Keep	Limited wells in USS/window area
LC-126	USL	Keep	Limited wells in USS/paired w/ LC-71d
LC-16€ l	USI	Eliminate	Too far (approx. 1 mile) from TCE plume
LC-69d	USL	Add	Replaces well LC-41d
LC-70c	USI	Add	Limited wells in USS/window area
LC-79d	USL	Add	Define downgradient edge of plume
LC-80c	USI	Add	Define downgradient edge of plume
LC-81d	USL	Add	Define downgradient edge plume/Wtr level
LC-82c	USI	Add	Define downgradient edge of plume
LC-83d	USL	Add	Define downgradient edge of plume
MAMC 3	USI	Add	Limited data in MAMC area
PS 13	USL	Add	Limited data in MAMC area
LC-71c	LSI	Keep	Limited wells in LSS/paired w/ LC-126
LC-74c	LSI	Keep	Limited wells in LSS/window area
MAMC 4	LSI	Add	Limited data in MAMC area

Notes: *USL = Upper Sea Level, LSL = Lower Sea Level

Table 4.1. Historical Groundwater Level Monitoring Locations Well Data.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) (NGVD 29) Ground	Top of Steel	Top of PVC	Diam (inch)	Material	Scrn Depth (ft bgs) Top	Bottom
Monitoring Wells												
LC-01	Nov-84	Cable tool	61.0	656710	1494588	274.65	276.85		4	PVC	20.0	60.0
LC-03	Dec-84	Cable tool	61.0	657303	1493904	273.67	275.97		4	PVC	20.0	60.0
LC-05	Dec-84	Cable tool	61.0	657293	1490857	276.44	278.74		4	PVC	19.0	59.6
LC-06	Jan-84	Cable tool	61.0	655896	1493994	284.58	287.28	286.20	4	PVC	20.0	60.0
LC-11	Feb-85	Cable tool	61.0	654752	1495289	287.29	289.69		4	PVC	20.0	60.0
LC-12	Feb-85	Cable tool	61.0	659054	1490087	276.62	279.10	278.24	4	PVC	20.0	60.0
LC-13	Mar-85	Cable tool	61.0	658940	1491704	277.51	280.14	278.98	4	PVC	19.0	59.0
LC-14A	Sep-85	H-S Auger	52.5	658337	1489560	263.40		265.15	2	PVC	42.5	52.5
LC-18	Apr-85	H-S Auger	59.2	653005	1494115	282.54	283.94		2	PVC	32.0	40.0
LC-19A	Apr-85	H-S Auger	56.5	653095	1495139	289.20	290.53	290.52	2	PVC	45.0	55.0
LC-19B	Apr-85	H-S Auger	36.0	653093	1495135	289.20	290.70		2	PVC	25.0	35.0
LC-19C	Apr-85	H-S Auger	78.7	653099	1495138	289.18	290.48		2	PVC	65.0	75.0
LC-20	Apr-85	H-S Auger	47.5	653842	1495824	290.09	291.06		2	PVC	37.5	47.5
LC-21	Apr-85	H-S Auger	43.0	652756	1496445	279.50	280.22	280.27	2	PVC	27.2	42.2
LC-21C*	Mar-87	Cable tool	150.2	652743	1496426	279.70		282.00	2	PVC	138.9	143.9
LC-24	Apr-85	H-S Auger	47.0	652819	1497577	285.39	286.69		2	PVC	26.0	46.0
LC-26	Apr-85	H-S Auger	36.5	651895	1497563	275.81	277.11		2	PVC	11.5	36.0
LC-26D*	Jul-91	Air rotary	179.0	651917	1497564		278.08	277.28	4	PVC	139.0	149.0
LC-27	May-85	H-S Auger	42.5	651871	1496425	278.34	279.54		2	PVC	20.5	30.5
LC-29	Dec-85	H-S Auger	54.0	656471	1489826	265.30	266.59	266.48	2	PVC	14.0	54.0
LC-30	Jan-86	H-S Auger	51.0	656692	1489872	270.90	272.34	272.21	2	PVC	15.0	51.0
LC-32	Jan-86	H-S Auger	37.5	656661	1489700	267.60	268.97	268.88	2	PVC	15.0	35.0
LC-35D*	Jul-91	AirRotary	219.0	653530	1494905		290.11	289.27	4	PVC	195.0	205.0
LC-37	Jan-86	H-S Auger	79.5	659309	1480348	279.27	281.76	281.33	2	PVC	53.4	58.2
LC-38	Jan-86	H-S Auger	83.0	657963	1490378	270.92	273.04	272.41	2	PVC	78.0	82.6
LC-38A	Feb-86	H-S Auger	29.8	657955	1490389	271.11	272.98	272.96	2	PVC	23.3	28.3
LC-39	Feb-86	H-S Auger	44.0	657485	1489063	268.60		270.15	2	PVC	39.0	44.0
LC-40D*	Oct-93	Air rotary	179.0	656927	1490263	277.30	280.16	279.74	2	PVC	168.0	178.0
LC-41A	Nov-92	Air rotary	98.0	655151	1491874	282.50	284.75	283.54	2	PVC	84.7	93.9
LC-41D*	Feb-88	Cable tool	302.0	655154	1491859	281.80		282.56	2	PVC	192.7	202.7
LC-44A	Feb-86	H-S Auger	32.0	656872	1493248	270.70	271.77	271.51	2	PVC	17.0	32.0
LC-47D*	Aug-91	AirRotary	269.0	655176	1493403		282.11	281.16	2	PVC	209.2	219.2
LC-49	Jan-86	H-S Auger	48.1	654135	1493877	283.90	287.09	285.99	2	PVC	43.0	47.5
LC-49A	Feb-86	H-S Auger	28.5	654135	1493887	284.40	285.39	285.13	2	PVC	23.0	28.0
LC-50	Jan-86	H-S Auger	32.0	652191	1495527	271.70	273.64	272.56	2	PVC	26.5	31.5
LC-50D*	Jul-91	AirRotary	208.0	652150	1495547		273.78	272.80	2	PVC	150.3	160.3
LC-51	Jan-86	H-S Auger	32.5	651777	1495357	274.12	274.22		2	PVC	26.5	32.0
LC-53	Jan-86	H-S Auger	32.5	651926	1494335	276.40	277.59		2	PVC	26.5	31.5
LC-55D*	Feb-88	Cable tool	300.0	653766	1497114	289.60		291.12	2	PVC	220.0	230.0
LC-60A	Feb-87	H-S Auger	41.0	658740	1489532	276.70		278.58	2	PVC	33.5	38.5
LC-62A	Feb-87	H-S Auger	41.0	658008	1488828	263.40		264.83	2	PVC	35.0	40.0
LC-64A	Mar-87	H-S Auger	55.0	652433	1496588	276.20		278.10	2	PVC	25.0	30.0
LC-64B	May-87	Odex	79.0	652424	1496580	276.50		277.81	2	PVC	74.0	79.0
LC-66A	Feb-87	H-S Auger	41.0	656886	1492166	280.70		282.20	2	PVC	34.5	39.5
LC-66B	Feb-87	H-S Auger	80.0	656883	1492172	280.40		282.17	2	PVC	68.0	73.0
LC-66D*	Oct-93	Air rotary	189.0	656900	1492176	281.20	284.81	283.89	2	PVC	175.9	185.9
LC-67D*	Jul-91	Air rotary	179.0	655739	1490344		265.62	264.93	4	PVC	148.0	158.0
LC-68D*	Jul-91	AirRotary	259.0	653737	1492566		282.72	281.75	2	PVC	240.6	250.6
LC-69D*	Nov-92	AirRotary	205.0	655128	1491985	282.20	284.11	283.37	2	PVC	203.3	203.9
LC-70D*	Nov-92	AirRotary	219.0	655182	1491765	280.70	282.59	281.60	2	PVC	206.4	216.2
LC-71D*	Oct-93	Air rotary	231.6	657746	1489355	269.50	272.44	271.78	2	PVC	221.6	231.6
LC-72D*	Nov-93	Air rotary	194.0	656736	1488749	263.90	267.07	266.33	2	PVC	166.0	176.0
LC-73A	Jul-95	Air rotary	45.0	656104	1488270	269.91		271.98	2	PVC	40.0	45.0
LC-73D*	Nov-93	Air rotary	230.0	656095	1488280	269.60	272.76	271.43	2	PVC	164.0	174.9
LC-74D*	Oct-95	Air rotary	220.0	654744	1487615	274.48		276.99	2	PVC	210.0	220.0
LC-75D*		Air Rotary		652853	1489607	278.60	281.31	281.18	4.0	PVC	173.0	178.0
LC-76D*		Air Rotary		655289	1485410	279.14	282.36	282.06	4.0	PVC	199.0	209.0
LC-77D*		Air Rotary		658818	1490388	275.42	278.33	278.15	4.0	PVC	195.0	205.0
LC-101	Jun-91	Air Rotary	95.4	657962	1490315	270.42	272.83	272.68	1.91	PVC	22.5	82.1
LC-103	Jul-91	Air Rotary	60.4	653688	1495515		291.73	291.62	1.91	PVC	22.3	32.3

Table 4.1. Historical Groundwater Level Monitoring Locations Well Data.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) (NGVD 29) Ground	Top of Steel	Top of PVC	Diam (inch)	Material	Scrn Depth (ft bgs) Top	Bottom
LC-108	Jul-91	Air rotary	98.0	652634	1496487		281.93	**281.20**	2	PVC	60.0	65.5
LC-109	Jun-05	H S Auger	50.0	656774	1489774	268.21	268.21	**267.78**	1.94	PVC	29.50	49.50
LC-110	Jun-05	H S Auger	50.0	656896	1489887	269.80	269.80	**269.31**	1.94	PVC	29.80	49.80
LC-111	Jun-05	H S Auger	50.0	657031	1490010	270.25	270.25	**270.06**	1.94	PVC	24.50	44.50
LC-111B	Jun-05	Air rotary	129.5	657038	1490018	**270.22**			4	PVC	105.0	125.0
LC-112	Jun-05	H S Auger	50.0	657160	1490130	271.76	271.76	**271.14**	1.94	PVC	29.00	49.00
LC-114	Jun-05	H S Auger	50.0	657420	1490360	271.01	271.01	**270.53**	1.94	PVC	28.00	47.60
LC-115	Jun-05	H S Auger	50.0	657550	1490480	270.73	270.73	**270.21**	1.94	PVC	29.20	49.00
LC-116	Jun-05	H S Auger	50.0	657676	1490599	271.31	271.31	**270.49**	1.94	PVC	29.00	48.60
LC-116B	Apr-93	Air rotary	135.0	657663	1490586	**270.56**			4	PVC	107.0	127.0
LC-117	Jun-05	H S Auger	50.0	657788	1490738	272.28	272.78	**271.86**	1.94	PVC	29.00	49.00
LC-118	Jun-05	H S Auger	50.0	657899	1490872	273.73	273.73	**273.31**	1.94	PVC	30.00	49.60
LC-119	Jun-05	H S Auger	50.0	658012	1491008	272.93	272.93	**272.46**	1.94	PVC	29.00	48.60
LC-120	Jun-05	H S Auger	60.0	658123	1491140	270.06	270.06	**269.51**	1.94	PVC	41.00	60.60
LC-121	Jun-05	H S Auger	40.0	658242	1491285	269.40	269.40	**268.89**	1.94	PVC	19.50	39.10
LC-122B	Apr-93	Air rotary	135.0	658353	1491418	**269.91**			4	PVC	112.0	132.0
LC-122	Jun-05	H S Auger	50.0	658347	1491410	269.51	269.51	**269.32**	1.94	PVC	18.00	47.40
LC-123	Jun-05	H S Auger	51.0	658460	1491547	275.62	275.62	**274.90**	1.94	PVC	19.50	48.90
LC-124	Jun-05	H S Auger	50.0	658571	1491679	275.34	275.34	**274.91**	1.94	PVC	20.50	49.90
LC-125	Jun-05	H S Auger	50.0	657196	1489466	269.62	272.17	**271.62**	3.83	PVC	35.00	45.00
LC-126*	Jun-05	Air rotary	180.0	657844	1489441	270.07	272.35	**271.91**	4	PVC	159.8	179.8
LC-127	Jun-05	H S Auger	50.0	658361	1489920	264.61	267.23	**266.64**	3.83	PVC	40.00	49.75
LC-128	Jun-05	Air rotary	162.5	658841	1490374	275.85	279.14	**277.82**	4	PVC	134.0	154.0
LC-129	Jun-05	H S Auger	50.0	659268	1490763	277.68	280.51	**279.75**	3.83	PVC	40.00	59.75
LC-130	Jun-05	H S Auger	50.0	658760	1491469	275.93	278.70	**278.12**	3.83	PVC	40.00	59.75
LC-131	Jun-05	H S Auger	50.0	656418	1490518	273.82	276.59	**275.85**	3.83	PVC	40.00	50.00
LC-132	Jun-05	H-S Auger	50.0	657024	1491411	279.98	282.90	**282.33**	4	PVC	40.0	49.6
LC-133	Jun-05	H S Auger	38.5	652243	1496451	280.09	282.30	**281.78**	3.83	PVC	18.70	38.30
LC-134	Jun-05	H-S Auger	28.0	652374	1496669	276.12	278.53	**277.72**	4	PVC	16.5	27.5
LC-135	Jun-05	H S Auger	37.5	652622	1496727	280.30	282.84	**282.32**	3.83	PVC	24.00	33.50
LC-136A	Jun-05	H-S Auger	43.0	652476	1496352	277.65	280.32	**279.60**	4	PVC	31.0	40.5
LC-136B	Jun-05	H-S Auger	75.0	652486	1496355	277.66	279.96	**279.21**	4	PVC	55.0	74.5
LC-137A	Jun-05	H-S Auger	45.0	652685	1496168	289.32	291.88	**291.46**	4	PVC	35.0	44.5
LC-137B	Jun-05	Air rotary	60.0	652691	1496180	289.05	292.12	**291.26**	4	PVC	40.0	60.0
LC-137C	Jun-05	Air rotary	125.0	652699	1496191	289.19	292.30	**291.48**	4	PVC	115.0	125.0
LC-139	Jun-05	H S Auger	35.0	652480	1496623	276.44	278.88	**278.25**	1.94	PVC	15.00	34.60
LC-140	Jun-05	H S Auger	45.0	653361	1494817	288.90	291.35	**290.39**	1.94	PVC	25.00	44.50
LC-141	Jun-05	H S Auger	50.0	653493	1494933	287.24	290.27	**289.81**	1.94	PVC	28.00	47.50
LC-142	Jun-05	H S Auger	50.0	653624	1495048	287.25	287.25	**286.90**	1.94	PVC	27.00	46.50
LC-143	Jun-05	H S Auger	50.0	653700	1494654	286.26	288.66	**288.30**	3.83	PVC	40.00	49.50
LC-144A	Jun-05	H-S Auger	73.0	653031	1495393	290.06	292.43	**292.00**	4	PVC	41.0	50.5
LC-145	Jun-05	H S Auger	50.0	651831	1497307	279.92	282.27	**281.72**	1.94	PVC	29.00	48.60
LC-146	Jun-05	H S Auger	50.0	651898	1497408	277.59	280.02	**279.56**	1.94	PVC	29.50	49.10
LC-147	Jun-05	H S Auger	50.0	651963	1497496	277.68	280.03	**279.63**	1.94	PVC	29.00	49.00
LC-149A	Jun-05	H S Auger	40.0	651051	1498330	305.87	308.23	**307.67**	3.83	PVC	30.00	39.50
LC-149C	Jun-05	H-S Auger	50.0	651059	1498353	306.12	308.39	**307.86**	4	PVC	38.0	47.9
LC-149D	Jun-05	Air rotary	80.0	651072	1498334	305.89	309.03	**308.19**	4	PVC	60.0	80.0
LC-150	Jun-05	H S Auger	37.0	652559	1496626	279.50	281.91	**280.78**	1.94	PVC	16.00	36.00
LC-151	Jun-05	H S Auger	68.0	653206	1495111	287.49	290.09	**289.46**	1.94	PVC	43.00	63.00
LC-152	Jun-05	Air Rotary	77.0	653429	1494870	287.16	290.14	**289.39**	1.94	PVC	55.00	75.00
LC-153	Jun-05	Air Rotary	38.0	652514	1496647	278.46	281.90	**279.88**	1.94	PVC	27.50	37.50
LC-154	Jun-05	H S Auger	50.0	653154	1495062	288.79	291.32	**290.54**	1.94	PVC	30.00	49.50
LC-155	Jun-05	H S Auger	48.0	652400	1496510	277.16	279.64	**279.05**	1.94	PVC	28.00	47.50
LC-156	Jun-05	Air Rotary	40.0	652357	1496547	276.60	279.08	**278.77**	3.83	PVC	25.00	35.00
LC-157	Jun-05	H S Auger	47.5	653307	1495207	288.26	290.64	**290.10**	1.94	PVC	27.88	47.48
LC-158	Jun-05	H S Auger	33.0	652492	1496561	276.24	278.63	**278.09**	3.83	PVC	21.00	31.00
LC-159	Apr-93	Air Rotary	87.5	652494	1496261	276.93	TBD		3.83	PVC	65.00	85.00
LC-160	Apr-93	Air Rotary	87.0	652435	1496210	276.58	TBD		3.83	PVC	65.00	85.00
LC-161	Jul-93	Rev. Rotary	34.0	652299	1497065	280.36	283.48	**282.62**	4.00	PVC	23.50	33.50
LC-162	Jul-93	Perc.Hammer	33.0	652338	1496882	277.32	280.40	**279.43**	4	PVC	22.4	32.4
LC-163				656563	1490104	272.13		**273.96**				

Table 4.1. Historical Groundwater Level Monitoring Locations Well Data.

			Total			Elevation (feet msl) (NGVD 29)					Scrn Depth (ft bgs)	
Well ID	Date Drilled	Drilling Method	Depth (feet)	Northing (NAD27)	Easting (NAD27)	Ground	Top of Steel	Top of PVC	Diam (inch)	Material	Top	Bottom
LC-165	Jul-95	Air rotary	45.0	659713	1491770	272.44		**273.82**	2	PVC	40.0	45.0
LC-166D*	Jul-95	Air rotary	178.0	657255	1481895	242.32		**244.57**	4	PVC	168.0	178.0
LC-167				658938	1491123	280.84	282.78	**281.83**				
LC-168				658023	1131959	269.47	268.99	**271.72**				
PA-381	Jan-86	H-S Auger	57.5	655045	1490584	268.30	269.10	**269.14**	2	PVC	47.0	57.0
PA-383	Jan-86	H-S Auger	62.5	654112	1490422	268.93	269.93	**269.93**	2	PVC	47.0	57.0
PA-384	Jan-86	H-S Auger	61.5	652865	1489631	278.50	279.50	**279.15**	2	PVC	50.5	60.5
T-04	Jul-86	Air rotary	89.0	660114	1489309	276.70		**276.13**	2	PVC	55.0	65.0
T-08	Jul-86	Air rotary	98.0	658646	1486709	260.70	**263.13**		2	PVC	66.0	76.0
T-12B	Feb-88	H-S Auger	70.0	660206	1490605	274.40		**273.55**	2	PVC	59.1	64.1
T-13B	Mar-88	H-S Auger	80.5	659071	1488281	272.70		**272.13**	2	PVC	75.3	80.3
LR-1	1992	Air Rotary	110.5	651808	1497288	281.73	**284.28**	NA	10.38	S. Steel	78.00	108.00
LR-2	1992	Air Rotary	104.5	651988	1497528	277.96	**280.63**	NA	10.38	S. Steel	68.00	98.00
9700-MW1								**277.68**				
Extraction Wells												
LX-1	Sep-92	Air rotary	94.5	656842	1489833	268.85	**271.43**	NA	8.63	S. Steel	72.5	92.5
LX-2	Aug-92	Air rotary	95.0	656967	1489951	269.80	**272.39**	NA	8.63	S. Steel	70.0	100.0
LX-3	Aug-92	Air rotary	91.0	657095	1490070	270.89	**273.64**	NA	8.63	S. Steel	60.5	88.5
LX-4	Aug-92	Air rotary	96.0	657228	1490193	272.81	**275.35**	NA	8.63	S. Steel	64.0	94.0
LX-5	Aug-92	Air rotary	95.0	657354	1490303	270.93	**274.10**	NA	8.63	S. Steel	54.5	72.0
LX-6	Aug-92	Air rotary	92.0	657487	1490420	271.08	**273.43**	NA	8.63	S. Steel	58.0	88.0
LX-7	Aug-92	Air rotary	105.0	657615	1490540	271.60	**273.84**	NA	8.63	S. Steel	52.0	65.0
LX-8	Aug-92	Air rotary	91.0	657731	1490671	273.56	**275.96**	NA	8.63	S. Steel	58.0	88.0
LX-9	Aug-92	Air rotary	91.0	657843	1490805	272.57	**275.74**	NA	8.63	S. Steel	58.5	88.5
LX-10	Aug-92	Air rotary	91.0	657955	1490940	272.79	**275.44**	NA	8.63	S. Steel	59.0	89.0
LX-11	Aug-92	Air rotary	112.5	658067	1491074	271.09	**274.51**	NA	8.63	S. Steel	67.0	78.0
LX-12	Aug-92	Air rotary	88.4	658179	1491208	269.98	**272.62**	NA	8.63	S. Steel	55.0	85.0
LX-13	Aug-92	Air rotary	102.0	658292	1491343	267.50	**270.35**	NA	8.63	S. Steel	68.5	99.5
LX-14	Aug-92	Air rotary	96.0	658403	1491478	273.75	**276.52**	NA	8.63	S. Steel	62.0	92.0
LX-15	Aug-92	Air rotary	98.0	658515	1491612	275.99	**278.33**	NA	8.63	S. Steel	66.0	96.0
LX-16	Oct-92	Air rotary	75.0	653197	1495105	287.33	**290.08**	NA	10.38	S. Steel	42.0	72.0
LX-17	Oct-92	Air rotary	56.6	652410	1496505	276.81	**279.34**	NA	8.63	S. Steel	34.5	54.5
LX-18	Sep-92	Air rotary	44.0	652569	1496621	279.09	**281.61**	NA	10.38	S. Steel	31.0	41.0
LX-19	Mar-93	Air rotary	87.0	652525	1496253	275.78	**278.72**	NA	10.38	S. Steel	53.0	83.0
LX-21	Jul-91	AR/CT	108.0	652710	1496411	278.94	**284.33**	NA	10.38	S. Steel	51.6	81.8
RW-1	Jan-86	Cable tool	71.3	653561	1494938	287.10	**289.55**	NA	10.38	S. Steel	41.6	66.2

Notes:

* - Sea Level Aquifer well

bold - reference elevation used to calculate groundwater elevation

bgs - below ground surface

NA indicates information not available

msl - mean sea level

TBD - Elevation of steel casing to be determined in field using ground surface elevation and measurement of stickup

Drilling method abbreviations - AR/CT: Air rotary/Cable tool; H-S Auger: Hollow-stem auger; Perc. Hammer: Percussion hammer

Well list current as of 17th Quarter

Information in this table provided by the Seattle District, U.S. Army Corps of Engineers in January, 2000 (LC_NEW.xls)

Monitoring was discontinued during the 12th Quarter in offsite Lower Aquifer well LF4-MW-2C

Wells PA-384 and 9700-MW1 water levels measured beginning in 15th Quarter

Well T-12B replaced T-01 (which was vandalized), and wells LC-75D, LC-76D, and LC-77D were added to list beginning in 17th Quarter

Table 7.1. Final Well and Sample Frequency Recommendations.

Well ID	Hydro-logic Unit	REVISED Sample Frequency	REVISED Sample Schedule Mar	Jun	Sep	Dec
LC-03	UV	Q	x	x	x	x
LC-05	UV	A	x			
LC-06	UV	S	x		x	
LC-14a	UV	A	x			
LC-16	UV	Q	x	x	x	x
LC-19a	UV	Q	x	x	x	x
LC-20	UV	Q	x	x	x	x
LC-24	UV	Q	x	x	x	x
LC-26	UV	A	x			
LC-34	UV	Q	x	x	x	x
LC-41a	UV	A	x			
LC-49	UV	A	x			
LC-53	UV	A	x			
LC-57	UV	Q	x	x	x	x
LC-61b	UV	Q	x	x	x	x
LC-64a	UV	Q	x	x	x	x
LC-66b	UV	A	x			
LC-136a	UV	Q	x	x	x	x
LC-136b	UV	A	x			
LC-137b	UV	Q	x	x	x	x
LC-149c	UV	A	x			
LC-167	UV	Q	x	x	x	x
PA-381	UV	A	x			
PA-383	UV	A	x			
T-04	UV	A	x			
T-06	UV	Q	x	x	x	x
T-08	UV	S	x		x	
T-11b	UV	Q	x	x	x	x
T-12b	UV	Q	x	x	x	x
T-13b	UV	S	x		x	
FL2	UV	A	x			
FL3	UV	Q	x	x	x	x
FL4b	UV	Q	x	x	x	x
FL6	UV	Q	x	x	x	x
"NEW-1"	UV	Q	x	x	x	x
"NEW-2"	UV	Q	x	x	x	x
"NEW-3"	UV	Q	x	x	x	x
"NEW-4"	UV	Q	x	x	x	x
"NEW-5"	UV	Q	x	x	x	x
LC-182	UV	Q	x	x	x	x
LC-41b	LV	Q	x	x	x	x
LC-64b	LV	A	x			
LC-111b	LV	A	x			
LC-116b	LV	A	x			
LC-122b	LV	A	x			
LC-128	LV	A	x			
LC-137c	LV	A	x			
T-10	LV	Q	x	x	x	x
FL4a	LV	Q	x	x	x	x
MAMC1	LV	Q	x	x	x	x
MAMC6	LV	Q	x	x	x	x
LX-1	EW	A	x			
LX-2	EW	A	x			
LX-3	EW	A	x			
LX-4	EW	A	x			
LX-5	EW	A	x			
LX-6	EW	A	x			
LX-7	EW	A	x			

Table 7.1 Final Well and Sample Frequency Recommendations (Continued).

Well ID	**Hydro-logic Unit**	**REVISED Sample Frequency**	**REVISED Sample Schedule**			
			Mar	**Jun**	**Sep**	**Dec**
LX-8	EW	A	x			
LX-9	EW	A	x			
LX-10	EW	A	x			
LX-11	EW	A	x			
LX-12	EW	A	x			
LX-13	EW	A	x			
LX-14	EW	A	x			
LX-15	EW	A	x			
LX-16	EW	Q	x	x	x	x
LX-17	EW	Q	x	x	x	x
LX-18	EW	Q	x	x	x	x
LX-19	EW	Q	x	x	x	x
LX-21	EW	Q	x	x	x	x
RW-1	EW	Q	x	x	x	x
VASHON TOTALS						
Total Quarterly wells:		*35*				
Total Semi-annual wells:		*3*				
Total Annual wells:		*34*				
Total # wells:		***72***	***72***	***35***	***38***	***35***
Total # samples:		***180***	***72***	***35***	***38***	***35***

Table 7.1 Final Well and Sample Frequency Recommendations (Continued).

Well ID	Hydro-logic Unit	REVISED Sample Frequency	REVISED Sample Schedule			
			Mar	Jun	Sep	Dec
LC-21c	USL	A	x			
LC-26d	USL	A	x			
LC-35d	USL	Q	x	x	x	x
LC-40d	USL	A	x			
LC-47d	USL	Q	x	x	x	x
LC-50d	USL	Q	x	x	x	x
LC-66d	USL	A	x			
LC-67d	USL	A	x			
LC-69d	USL	Q	x	x	x	x
LC-70d	USL	Q	x	x	x	x
LC-71d	LSL	A	x			
LC-72d	USL	A	x			
LC-73d	USL	A	x			
LC-74d	LSL	A	x			
LC-75d	USL	Q	x	x	x	x
LC-76d	USL	Q	x	x	x	x
LC-77d	USL	Q	x	x	x	x
LC-79d	USL	Q	x	x	x	x
LC-80d	USL	Q	x	x	x	x
LC-81d	USL	Q	x	x	x	x
LC-82d	USL	Q	x	x	x	x
LC-83d	USL	Q	x	x	x	x
LC-126	USL	A	x			
PS 13	USL	Q	x	x	x	x
MAMC3	USL	Q	x	x	x	x
MAMC4	LSL	Q	x	x	x	x
	SEA LEVEL TOTALS					
	Total Quarterly wells:	*16*				
	Total Semi-annual wells:	*0*				
	Total Annual wells:	*10*				
	Total # wells:	***26***	***26***	***16***	***16***	***16***
	Total # samples:	***74***	***26***	***16***	***16***	***16***

Table 7.1 Final Well and Sample Frequency Recommendations (Continued).

Sample Location ID	Hydro-logic Unit	REVISED Sample Frequency	REVISED Sample Schedule			
			Mar	Jun	Sep	Dec
SW-MC-1	Murray Crk	A	x			
SW-MC-4	Murray Crk	Q	x	x	x	x
SW-MC-6	Murray Crk	Q	x	x	x	x
SURF WTR TOTALS						
Total Quarterly locations:		2				
Total Semi-annual locations:		0				
Total Annual locations:		1				
Total # locations:		**3**	**3**	**2**	**2**	**2**
Total # samples:		**9**	**3**	**2**	**2**	**2**

Notes: Revised sample frequency based on USEPA & USGS comments received on Draft LOGRAM NOR

First round of revised sample frequency conducted Dec 01 except for LC-79d through LC-83d (Dec 02)

"NEW-X" wells have not yet been installed as of Dec 02

Sea Level Aquifer well list now includes newly installed CMT multiport wells LC-79d through LC-83d

SW-MC-6 located SW of EGDY & SE of Madigan Housing adjacent to LC-180, where TCE likely enters creek

UV=Upper Vashon, LV=Lower Vashon, EW=(Vashon) Extraction Well;

USL=Upper Sea Level, LSL=Lower Sea Level;

Q=Quarterly, S=Semi-annually, A=Annually

Table 7.2. Comparison Summary Between Historical and Revised Well Sampling.

7.2a. Historical Yearly Sampling Break-Down

	Upper Vashon	Lower Vashon	Sea Level	Extraction Wells
Wells Sampled Quarterly	35	5	18	21
Wells Sampled Semi-Annually	0	0	0	0
Wells Sampled Annually	0	0	0	0
Subtotal:	*140*	*20*	*72*	*84*

Total Samples: *316*

7.2b. Revised Yearly Sampling Break-Down (Years 1 & 2)

	Upper Vashon	Lower Vashon	Sea Level	Extraction Wells
Wells Sampled Quarterly	24	5	16	6
Wells Sampled Semi-Annually	3	0	0	0
Wells Sampled Annually	13	6	10	15
Subtotal:	*115*	*26*	*74*	*39*

Total Samples: *254*

7.2c. Potential Yearly Sampling Break-Down (Year 3 and beyond)*

	Upper Vashon	Lower Vashon	Sea Level	Extraction Wells
Wells Sampled Quarterly	10	3	7	5
Wells Sampled Semi-Annually	0	0	0	0
Wells Sampled Annually	30	8	19	16
Subtotal:	*70*	*20*	*47*	*36*

*Assumes 75% of wells may be sampled annually; 25% quarterly

This scenario likely represents maximum potential frequency reduction

Total Samples: *173*

Table 7.3. Revised Groundwater Level Monitoring Locations Well Data.

			Total			Elevation (feet msl)					Screen Depth (ft bgs)	
	Date	Drilling	Depth	Northing	Easting	Ground	Top of	Top of	Diameter	Material	Top	Bottom
Well ID	Drilled	Method	(feet)	(NAD27)	(NAD27)	NGVD29	Steel	PVC	(inches)			
Monitoring Wells												
LC-01	Nov-84	Cable tool	61.0	656710	1494588	274.65	**276.85**		4	PVC	20.0	60.0
LC-03	Dec-84	Cable tool	61.0	657303	1493904	273.67	**275.97**		4	PVC	20.0	60.0
LC-05	Dec-84	Cable tool	61.0	657293	1490857	276.44	**278.74**		4	PVC	19.0	59.6
LC-06	Jan-84	Cable tool	61.0	655896	1493994	284.58	287.28	**286.20**	4	PVC	20.0	60.0
LC-11	Feb-85	Cable tool	61.0	654752	1495289	287.29	**289.69**		4	PVC	20.0	60.0
LC-12	Feb-85	Cable tool	61.0	659054	1490087	276.62	279.10	**278.24**	4	PVC	20.0	60.0
LC-13	Mar-85	Cable tool	61.0	658940	1491704	277.51	280.14	**278.98**	4	PVC	19.0	59.0
LC-14A	Sep-85	H-S Auger	52.5	658337	1489560	263.40		**265.15**	2	PVC	42.5	52.5
LC-16	Mar-85	H-S Auger	59.1	658296	1492472	265.41	266.88		2	PVC	18.5	58.5
LC-18	Apr-85	H-S Auger	59.2	653005	1494115	282.54	**283.94**		2	PVC	32.0	40.0
LC-19A	Apr-85	H-S Auger	56.5	653095	1495139	289.20	**290.53**	290.52	2	PVC	45.0	55.0
LC-20	Apr-85	H-S Auger	47.5	653842	1495824	290.09	**291.06**		2	PVC	37.5	47.5
LC-21	Apr-85	H-S Auger	43.0	652756	1496445	279.50	280.22	**280.27**	2	PVC	27.2	42.2
LC-21C*	Mar-87	Cable tool	150.2	652743	1496426	279.70		**282.00**	2	PVC	138.9	143.9
LC-24	Apr-85	H-S Auger	47.0	652819	1497577	285.39	**286.69**		2	PVC	26.0	46.0
LC-26	Apr-85	H-S Auger	36.5	651895	1497563	275.81	**277.11**		2	PVC	11.5	36.0
LC-26D*	Jul-91	Air rotary	179.0	651917	1497564		278.08	**277.28**	4	PVC	139.0	149.0
LC-27	May-85	H-S Auger	42.5	651871	1496425	278.34	**279.54**		2	PVC	20.5	30.5
LC-29	Dec-85	H-S Auger	54.0	656471	1489826	265.30	266.59	**266.48**	2	PVC	14.0	54.0
LC-32	Jan-86	H-S Auger	37.5	656661	1489700	267.60	268.97	**268.88**	2	PVC	15.0	35.0
LC-34	Jan-86	H-S Auger	35	653058	1493427	288.04		289.04	2	PVC	30.0	35.0
LC-35D*	Jul-91	AirRotary	219.0	653530	1494905		290.11	**289.27**	4	PVC	195.0	205.0
LC-37	Jan-86	H-S Auger	79.5	659309	1480348	279.27	281.76	**281.33**	2	PVC	53.4	58.2
LC-38	Jan-86	H-S Auger	83.0	657963	1490378	270.92	273.04	**272.41**	2	PVC	78.0	82.6
LC-38A	Feb-86	H-S Auger	29.8	657955	1490389	271.11	272.98	**272.96**	2	PVC	23.3	28.3
LC-39	Feb-86	H-S Auger	44.0	657485	1489063	268.60		**270.15**	2	PVC	39.0	44.0
LC-40D*	Oct-93	Air rotary	179.0	656927	1490263	277.30	280.16	**279.74**	2	PVC	168.0	178.0
LC-41A	Nov-92	Air rotary	98.0	655151	1491874	282.50	284.75	**283.54**	2	PVC	84.7	93.9
LC-41b	Nov-92	AirRotary	151	655159	1491882	282.6	284.45	283.6	2	PVC	130.1	139.3
LC-41D*	Feb-88	Cable tool	302.0	655154	1491859	281.80		**282.56**	2	PVC	192.7	202.7
LC-47D*	Aug-91	AirRotary	269.0	655176	1493403		282.11	**281.16**	2	PVC	209.2	219.2
LC-49	Jan-86	H-S Auger	48.1	654135	1493877	283.90	287.09	**285.99**	2	PVC	43.0	47.5
LC-49A	Feb-86	H-S Auger	28.5	654135	1493887	284.40	285.39	**285.13**	2	PVC	23.0	28.0
LC-50	Jan-86	H-S Auger	32.0	652191	1495527	271.70	273.64	**272.56**	2	PVC	26.5	31.5
LC-50D*	Jul-91	AirRotary	208.0	652150	1495547		273.78	**272.80**	2	PVC	150.3	160.3
LC-51	Jan-86	H-S Auger	32.5	651777	1495357	274.12	**274.22**		2	PVC	26.5	32.0
LC-52	Jan-86	H-S Auger	32	650532	1496018	274.7	276.29		2	PVC	26.0	31.0
LC-53	Jan-86	H-S Auger	32.5	651926	1494335	276.40	**277.59**		2	PVC	26.5	31.5
LC-55D*	Feb-88	Cable tool	300.0	653766	1497114	289.60		**291.12**	2	PVC	220.0	230.0
LC-57	Feb-86	H-S Auger	45	650865	1496169	284.74	286.45	286.04	2	PVC	29.3	34.3
LC-60A	Feb-87	H-S Auger	41.0	658740	1489532	276.70		**278.58**	2	PVC	33.5	38.5
LC-61b	Feb-87	H-S Auger	80	659151	1489769	277.34	277.44	277.5	2	PVC	55	60
LC-62A	Feb-87	H-S Auger	41.0	658008	1488828	263.40		**264.83**	2	PVC	35.0	40.0
LC-64A	Mar-87	H-S Auger	55.0	652433	1496588	276.20		**278.10**	2	PVC	25.0	30.0
LC-64B	May-87	Odex	79.0	652424	1496580	276.50		**277.81**	2	PVC	74.0	79.0
LC-66B	Feb-87	H-S Auger	80.0	656883	1492172	280.40		**282.17**	2	PVC	68.0	73.0
LC-66D*	Oct-93	Air rotary	189.0	656900	1492176	281.20	284.81	**283.89**	2	PVC	175.9	185.9
LC-67D*	Jul-91	Air rotary	179.0	655739	1490344		265.62	**264.93**	4	PVC	148.0	158.0
LC-68D*	Jul-91	AirRotary	259.0	653737	1492566		282.72	**281.75**	2	PVC	240.6	250.6
LC-69D*	Nov-92	AirRotary	205.0	655128	1491985	282.20	284.11	**283.37**	2	PVC	203.3	203.9
LC-70D*	Nov-92	AirRotary	219.0	655182	1491765	280.70	282.59	**281.60**	2	PVC	206.4	216.2
LC-71D*	Oct-93	Air rotary	231.6	657746	1489355	269.50	272.44	**271.78**	2	PVC	221.6	231.6
LC-72D*	Nov-93	Air rotary	194.0	656736	1488749	263.90	267.07	**266.33**	2	PVC	166.0	176.0

Table 7.3. Revised Groundwater Level Monitoring Locations Well Data.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD29	Top of Steel	Top of PVC	Diameter (inches)	Material	Screen Depth (ft bgs) Top	Bottom
LC-73A	Jul-95	Air rotary	45.0	656104	1488270	269.91		**271.98**	2	PVC	40.0	45.0
LC-73D*	Nov-93	Air rotary	230.0	656095	1488280	269.60	272.76	**271.43**	2	PVC	164.0	174.9
LC-74D*	Oct-95	Air rotary	220.0	654744	1487615	274.48		**276.99**	2	PVC	210.0	220.0
LC-75D*		Air Rotary		652853	1489607	278.60	281.31	281.18	4.0	PVC	173.0	178.0
LC-76D*		Air Rotary		655289	1485410	279.14	282.36	282.06	4.0	PVC	199.0	209.0
LC-77D*		Air Rotary		658818	1490388	275.42	278.33	278.15	4.0	PVC	195.0	205.0
LC-101	Jun-91	Air Rotary	95.4	657962	1490315	270.42	272.83	**272.68**	1.91	PVC	22.5	82.1
LC-110	Jun-05	H S Auger	50.0	656896	1489887	269.80	269.80	**269.31**	1.94	PVC	29.80	49.80
LC-111	Jun-05	H S Auger	50.0	657031	1490010	270.25	270.25	**270.06**	1.94	PVC	24.50	44.50
LC-111B	Jun-05	Air rotary	129.5	657038	1490018	**270.22**			4	PVC	105.0	125.0
LC-112	Jun-05	H S Auger	50.0	657160	1490130	271.76	271.76	**271.14**	1.94	PVC	29.00	49.00
LC-114	Jun-05	H S Auger	50.0	657420	1490360	271.01	271.01	**270.53**	1.94	PVC	28.00	47.60
LC-115	Jun-05	H S Auger	50.0	657550	1490480	270.73	270.73	**270.21**	1.94	PVC	29.20	49.00
LC-116	Jun-05	H S Auger	50.0	657676	1490599	271.31	271.31	**270.49**	1.94	PVC	29.00	48.60
LC-116B	Apr-93	Air rotary	135.0	657663	1490586	**270.56**			4	PVC	107.0	127.0
LC-117	Jun-05	H S Auger	50.0	657788	1490738	272.28	272.78	**271.86**	1.94	PVC	29.00	49.00
LC-118	Jun-05	H S Auger	50.0	657899	1490872	273.73	273.73	**273.31**	1.94	PVC	30.00	49.60
LC-119	Jun-05	H S Auger	50.0	658012	1491008	272.93	272.93	**272.46**	1.94	PVC	29.00	48.60
LC-120	Jun-05	H S Auger	60.0	658123	1491140	270.06	270.06	**269.51**	1.94	PVC	41.00	60.60
LC-121	Jun-05	H S Auger	40.0	658242	1491285	269.40	269.40	**268.89**	1.94	PVC	19.50	39.10
LC-122B	Apr-93	Air rotary	135.0	658353	1491418	**269.91**			4	PVC	112.0	132.0
LC-122	Jun-05	H S Auger	50.0	658347	1491410	269.51	269.51	**269.32**	1.94	PVC	18.00	47.40
LC-123	Jun-05	H S Auger	51.0	658460	1491547	275.62	275.62	**274.90**	1.94	PVC	19.50	48.90
LC-124	Jun-05	H S Auger	50.0	658571	1491679	275.34	275.34	**274.91**	1.94	PVC	20.50	49.90
LC-125	Jun-05	H S Auger	50.0	657196	1489466	269.62	272.17	**271.62**	3.83	PVC	35.00	45.00
LC-126*	Jun-05	Air rotary	180.0	657844	1489441	270.07	272.35	**271.91**	4	PVC	159.8	179.8
LC-127	Jun-05	H S Auger	50.0	658361	1489920	264.61	267.23	**266.64**	3.83	PVC	40.00	49.75
LC-128	Jun-05	Air rotary	162.5	658841	1490374	275.85	279.14	**277.82**	4	PVC	134.0	154.0
LC-129	Jun-05	H S Auger	50.0	659268	1490763	277.68	280.51	**279.75**	3.83	PVC	40.00	59.75
LC-130	Jun-05	H S Auger	50.0	658760	1491469	275.93	278.70	**278.12**	3.83	PVC	40.00	59.75
LC-131	Jun-05	H S Auger	50.0	656418	1490518	273.82	276.59	**275.85**	3.83	PVC	40.00	50.00
LC-133	Jun-05	H S Auger	38.5	652243	1496451	280.09	282.30	**281.78**	3.83	PVC	18.70	38.30
LC-135	Jun-05	H S Auger	37.5	652622	1496727	280.30	282.84	**282.32**	3.83	PVC	24.00	33.50
LC-136A	Jun-05	H-S Auger	43.0	652476	1496352	277.65	280.32	**279.60**	4	PVC	31.0	40.5
LC-136B	Jun-05	H-S Auger	75.0	652486	1496355	277.66	279.96	**279.21**	4	PVC	55.0	74.5
LC-137B	Jun-05	Air rotary	60.0	652691	1496180	289.05	292.12	**291.26**	4	PVC	40.0	60.0
LC-137C	Jun-05	Air rotary	125.0	652699	1496191	289.19	292.30	**291.48**	4	PVC	115.0	125.0
LC-139	Jun-05	H S Auger	35.0	652480	1496623	276.44	278.88	**278.25**	1.94	PVC	15.00	34.60
LC-140	Jun-05	H S Auger	45.0	653361	1494817	288.90	291.35	**290.39**	1.94	PVC	25.00	44.50
LC-141	Jun-05	H S Auger	50.0	653493	1494933	287.24	290.27	**289.81**	1.94	PVC	28.00	47.50
LC-142	Jun-05	H S Auger	50.0	653624	1495048	287.25	287.25	**286.90**	1.94	PVC	27.00	46.50
LC-143	Jun-05	H S Auger	50.0	653700	1494654	286.26	288.66	**288.30**	3.83	PVC	40.00	49.50
LC-144A	Jun-05	H-S Auger	73.0	653031	1495393	290.06	292.43	**292.00**	4	PVC	41.0	50.5
LC-145	Jun-05	H S Auger	50.0	651831	1497307	279.92	282.27	**281.72**	1.94	PVC	29.00	48.60
LC-147	Jun-05	H S Auger	50.0	651963	1497496	277.68	280.03	**279.63**	1.94	PVC	29.00	49.00
LC-149C	Jun-05	H-S Auger	50.0	651059	1498353	306.12	308.39	**307.86**	4	PVC	38.0	47.9
LC-150	Jun-05	H S Auger	37.0	652559	1496626	279.50	281.91	**280.78**	1.94	PVC	16.00	36.00
LC-151	Jun-05	H S Auger	68.0	653206	1495111	287.49	290.09	**289.46**	1.94	PVC	43.00	63.00
LC-152	Jun-05	Air Rotary	77.0	653429	1494870	287.16	290.14	**289.39**	1.94	PVC	55.00	75.00
LC-153	Jun-05	Air Rotary	38.0	652514	1496647	278.46	281.90	**279.88**	1.94	PVC	27.50	37.50
LC-154	Jun-05	H S Auger	50.0	653154	1495062	288.79	291.32	**290.54**	1.94	PVC	30.00	49.50
LC-155	Jun-05	H S Auger	48.0	652400	1496510	277.16	279.64	**279.05**	1.94	PVC	28.00	47.50
LC-156	Jun-05	Air Rotary	40.0	652357	1496547	276.60	279.08	**278.77**	3.83	PVC	25.00	35.00
LC-157	Jun-05	H S Auger	47.5	653307	1495207	288.26	290.64	**290.10**	1.94	PVC	27.88	47.48

Table 7.3. Revised Groundwater Level Monitoring Locations Well Data.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD29	Top of Steel	Top of PVC	Diameter (inches)	Material	Screen Depth (ft bgs) Top	Bottom
LC-158	Jun-05	H S Auger	33.0	652492	1496561	276.24	278.63	**278.09**	3.83	PVC	21.00	31.00
LC-159	Apr-93	Air Rotary	87.5	652494	1496261	276.93	TBD		3.83	PVC	65.00	85.00
LC-160	Apr-93	Air Rotary	87.0	652435	1496210	276.58	TBD		3.83	PVC	65.00	85.00
LC-163				656563	1490104	272.13		**273.96**				
LC-165	Jul-95	Air rotary	45.0	659713	1491770	272.44		**273.82**	2	PVC	40.0	45.0
LC-166D*	Jul-95	Air rotary	178.0	657255	1481895	242.32		**244.57**	4	PVC	168.0	178.0
LC-167				658938	1491123	280.84	282.78	**281.83**				
LC-168				658023	1131959	269.47	268.99	**271.72**				
PA-381	Jan-86	H-S Auger	57.5	655045	1490584	268.30	269.10	**269.14**	2	PVC	47.0	57.0
PA-383	Jan-86	H-S Auger	62.5	654112	1490422	268.93	269.93	**269.93**	2	PVC	47.0	57.0
PA-384	Jan-86	H-S Auger	61.5	652865	1489631	278.50	279.50	**279.15**	2	PVC	50.5	60.5
T-04	Jul-86	Air rotary	89.0	660114	1489309	276.70		**276.13**	2	PVC	55.0	65.0
T-06	Jul-86	Air Rotary	78	660967	1489113	272.85	272.61	272.3	2	PVC	60	70
T-08	Jul-86	Air rotary	98.0	658646	1486709	260.70	**263.13**		2	PVC	66.0	76.0
T-10	Jul-86	Air Rotary	118	660316	1489689	270.65	270.24	270.1	2	PVC	104	114
T-11b	Feb-88	H-S Auger	80	661502	1489736	277.04	277.81	277.2	2	PVC	74.2	79.2
T-12B	Feb-88	H-S Auger	70.0	660206	1490605	274.40		**273.55**	2	PVC	59.1	64.1
T-13B	Mar-88	H-S Auger	80.5	659071	1488281	272.70		**272.13**	2	PVC	75.3	80.3
LR-1	1992	Air Rotary	110.5	651808	1497288	281.73	**284.28**	NA	10.38	S. Steel	78.00	108.00
LR-2	1992	Air Rotary	104.5	651988	1497528	277.96	**280.63**	NA	10.38	S. Steel	68.00	98.00
9700-MW1								**277.68**				
FL2	Mar-98	H-S Auger	48	651297.37	1495625.42	283.97	285.83	285.59	4	PVC	35	40
FL3	Mar-98	H-S Auger	48	656718	1488745	264.12	265.7	265.36	4	PVC	37.5	42.5
FL4A	Apr-98	Odex	138	651931	1493016	277.24	279.09	279.0	4	PVC	123	133
FL4B	Apr-98	Odex	38	651941	1493016	277.26	279.86	279.48	4	PVC	32.0	37.0
FL6	Apr-98	Odex	58	656543	1489780	266.3	268.26	268.0	4	PVC	47	57
NEW-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEW-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEW-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEW-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NEW-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LC-182	Sep-01	Direct Push	24	650345	1493986	269.47	n/a	272.44	0.75	PVC	19	24
MAMC 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MAMC 3*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MAMC 4*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MAMC 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MAMC 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PS-13*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LC-79d*	Apr-02	Rotosonic	278	659610	1491751	272.79	275.27	275.74	0.5	PE	4 ports/varies	
LC-80d*	Apr-02	Rotosonic	285	658062	1487184	264.06	266.67	266.68	0.5	PE	4 ports/varies	
LC-81d*	May-02	Rotosonic	283	654949	1482808	267.09	269.83	269.97	0.5	PE	4 ports/varies	
LC-82d*	May-02	Rotosonic	290	653293	1485490	274.33	276.53	276.87	0.5	PE	4 ports/varies	
LC-83d*	May-02	Rotosonic	295	655355	1486861	266.11	268.57	268.91	0.5	PE	4 ports/varies	
88-1-SS*		NA	NA	657079	1471543	NA	NA	220.07	NA	NA	NA	NA
LF4-MW2C*		NA	NA	657434	1479172	NA	NA	229.14	NA	NA	NA	NA
LF4-MW9B*		NA	NA	657399	1476838	NA	NA	232.83	NA	NA	NA	NA
LF4-MW12B*		NA	NA	658234	1477005	NA	NA	238.28	NA	NA	NA	NA
LF4-MW16B*		NA	NA	657238	1475180	NA	NA	234.54	NA	NA	NA	NA
SRC-MW1B*		NA	NA	654764	1476257	NA	NA	224.19	NA	NA	NA	NA
Extraction Wells												
LX-1	Sep-92	Air rotary	94.5	656842	1489833	268.85	**271.43**	NA	8.63	S. Steel	72.5	92.5
LX-2	Aug-92	Air rotary	95.0	656967	1489951	269.80	**272.39**	NA	8.63	S. Steel	70.0	100.0
LX-3	Aug-92	Air rotary	91.0	657095	1490070	270.89	**273.64**	NA	8.63	S. Steel	60.5	88.5

Table 7.3. Revised Groundwater Level Monitoring Locations Well Data.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD29	Top of Steel	Top of PVC	Diameter (inches)	Screen Depth (ft bgs) Material	Top	Bottom
LX-4	Aug-92	Air rotary	96.0	657228	1490193	272.81	**275.35**	NA	8.63	S. Steel	64.0	94.0
LX-5	Aug-92	Air rotary	95.0	657354	1490303	270.93	**274.10**	NA	8.63	S. Steel	54.5	72.0
LX-6	Aug-92	Air rotary	92.0	657487	1490420	271.08	**273.43**	NA	8.63	S. Steel	58.0	88.0
LX-7	Aug-92	Air rotary	105.0	657615	1490540	271.60	**273.84**	NA	8.63	S. Steel	52.0	65.0
LX-8	Aug-92	Air rotary	91.0	657731	1490671	273.56	**275.96**	NA	8.63	S. Steel	58.0	88.0
LX-9	Aug-92	Air rotary	91.0	657843	1490805	272.57	**275.74**	NA	8.63	S. Steel	58.5	88.5
LX-10	Aug-92	Air rotary	91.0	657955	1490940	272.79	**275.44**	NA	8.63	S. Steel	59.0	89.0
LX-11	Aug-92	Air rotary	112.5	658067	1491074	271.09	**274.51**	NA	8.63	S. Steel	67.0	78.0
LX-12	Aug-92	Air rotary	88.4	658179	1491208	269.98	**272.62**	NA	8.63	S. Steel	55.0	85.0
LX-13	Aug-92	Air rotary	102.0	658292	1491343	267.50	**270.35**	NA	8.63	S. Steel	68.5	99.5
LX-14	Aug-92	Air rotary	96.0	658403	1491478	273.75	**276.52**	NA	8.63	S. Steel	62.0	92.0
LX-15	Aug-92	Air rotary	98.0	658515	1491612	275.99	**278.33**	NA	8.63	S. Steel	66.0	96.0
LX-16	Oct-92	Air rotary	75.0	653197	1495105	287.33	**290.08**	NA	10.38	S. Steel	42.0	72.0
LX-17	Oct-92	Air rotary	56.6	652410	1496505	276.81	**279.34**	NA	8.63	S. Steel	34.5	54.5
LX-18	Sep-92	Air rotary	44.0	652569	1496621	279.09	**281.61**	NA	10.38	S. Steel	31.0	41.0
LX-19	Mar-93	Air rotary	87.0	652525	1496253	275.78	**278.72**	NA	10.38	S. Steel	53.0	83.0
LX-21	Jul-91	AR/CT	108.0	652710	1496411	278.94	**284.33**	NA	10.38	S. Steel	51.6	81.8
RW-1	Jan-86	Cable tool	71.3	653561	1494938	287.10	**289.55**	NA	10.38	S. Steel	41.6	66.2

Notes:

* - Sea Level Aquifer well

bold - reference elevation used to calculate groundwater elevation

bgs - below ground surface

blank cell or NA - information not available

msl - mean sea level

TBD - Elevation of steel casing to be determined in field using ground surface elevation and measurement of stickup

Drilling method abbreviations - AR/CT: Air rotary/Cable tool; H-S Auger: Hollow-stem auger; Perc. Hammer: Percussion hammer

Table 7.4. Removals from & Additions to Groundwater Level Monitoring Network.

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD 29	Top of Steel	Top of PVC	Diameter (inches)	Screen depth Top (feet bgs)	Bottom	Reason for Removal
7.4a. Monitoring Wells Removed from RAM Water Level Monitoring Program												
LC-19b	Apr-85	H-S Auger	36.0	653093	1495135	289.11	290.75	**290.42**	2	25.0	35.0	Duplicates LC-19a
LC-19c	Apr-85	H-S Auger	78.7	653099	1495138	289.18	**290.48**		2	65.0	75.0	Duplicates LC-19a
LC-30	Jan-86	H-S Auger	51.0	656692	1489872	270.90	272.34	272.21	2	15.0	51.0	Lost/To be abandoned
LC-44a	Feb-86	H-S Auger	32.0	656872	1493248	270.70	271.77	**271.51**	2	17.0	32.0	Duplicates LC-06
LC-66a	Feb-87	H-S Auger	41.0	656886	1492166	280.70		**282.20**	2	34.5	39.5	Duplicates LC-05
LC-103	Jul-91	Air Rotary	60.4	653688	1495515		291.73	**291.62**	1.91	22.3	32.3	Abandoned
LC-108	Jul-91	Air rotary	98.0	652634	1496487		281.93	**281.20**	2	60.0	65.5	Source area duplication
LC-109	Jun-05	H S Auger	50.0	656774	1489774	268.21	268.21	**267.78**	1.94	29.5	49.5	Destroyed
LC-132	Jun-05	H-S Auger	50.0	657024	1491411	279.98	282.90	**282.33**	4	40.0	49.6	Duplicates LC-05
LC-134	Jun-05	H-S Auger	28.0	652374	1496669	276.12	278.53	**277.72**	4	16.5	27.5	Abandoned
LC-137a	Jun-05	H-S Auger	45.0	652685	1496168	289.32	291.88	**291.46**	4	35.0	44.5	Duplicates LC-137b
LC-146	Jun-05	H S Auger	50.0	651898	1497408	277.59	280.02	**279.56**	1.94	29.5	49.1	Abandoned
LC-149a	Jun-05	H S Auger	40.0	651051	1498330	305.87	308.23	**307.67**	3.83	30.0	39.5	Duplicates LC-149c
LC-149d	Jun-05	Air rotary	80.0	651072	1498334	305.89	309.03	**308.19**	4	60.0	80.0	Duplicates LC-149c
LC-161	Jul-93	Rev. Rotary	34.0	652299	1497065	280.36	283.48	**282.62**	4.00	23.5	33.5	Abandoned
LC-162	Jul-93	Perc.Hammer	33.0	652338	1496882	277.32	280.40	**279.43**	4	22.4	32.4	Abandoned

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD 29	Top of Steel	Top of PVC	Diameter (inches)	Screen depth Top (feet bgs)	Bottom	Reason for Addition
7.4b. Monitoring Wells Added to RAM Water Level Monitoring Program												
LC-16	Mar-85	H-S Auger	59.1	658296	1492472	265.41	266.88		2	18.5	58.5	Newly proposed analytical well
LC-34	Jan-86	H-S Auger	35.0	653058	1493427	288.04		289.04	2	30.0	35.0	Newly proposed analytical well
LC-41b	Nov-92	AirRotary	151.0	655159	1491882	282.6	284.45	283.6	2	130.1	139.3	Newly proposed analytical well
LC-52	Jan-86	H-S Auger	32.0	650532	1496018	274.7	276.29		2	26.0	31.0	Define flow W of EDGY
LC-57	Feb-86	H-S Auger	45.0	650865	1496169	284.74	286.45	286.04	2	29.3	34.3	Define flow W of EDGY
LC-61b	Feb-87	H-S Auger	80.0	659151	1489769	277.34	277.44	277.5	2	55	60	Newly proposed analytical well
FL2	Mar-98	H-S Auger	48.0	651297	1495625	283.97	285.83	285.59	4	35	40	Newly proposed analytical well
FL3	Mar-98	H-S Auger	48.0	656718	1488745	264.12	265.7	265.36	4	37.5	42.5	Newly proposed analytical well
FL4A	Apr-98	Odex	138.0	651931	1493016	277.24	279.09	279.0	4	123	133	Newly proposed analytical well
FL4B	Apr-98	Odex	38.0	651941	1493016	277.26	279.86	279.48	4	32.0	37.0	Newly proposed analytical well
FL6	Apr-98	Odex	58.0	656543	1489780	266.3	268.26	268.0	4	47	57	Newly proposed analytical well
T-06	Jul-86	Air Rotary	78.0	660967	1489113	272.85	272.61	272.3	2	60	70	Newly proposed analytical well
T-10	Jul-86	Air Rotary	118.0	660316	1489689	270.65	270.24	270.1	2	104	114	Newly proposed analytical well
T-11b	Feb-88	H-S Auger	80.0	661502	1489736	277.04	277.81	277.2	2	74.2	79.2	Newly proposed analytical well

Well ID	Date Drilled	Drilling Method	Total Depth (feet)	Northing (NAD27)	Easting (NAD27)	Elevation (feet msl) Ground NGVD 29	Top of Steel	Top of PVC	Diameter (inches)	Screen depth Top (feet bgs)	Bottom	Reason for Addition
7.4b. Monitoring Wells Added to RAM Water Level Monitoring Program												
NEW-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Newly proposed analytical well
NEW-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Newly proposed analytical well
NEW-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Newly proposed analytical well
NEW-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Newly proposed analytical well
NEW-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Newly proposed analytical well
LC-182	Sep-01	Direct Push	24.0	650345	1493986	269.47	n/a	272.44	0.75	19	24	Newly proposed analytical well
MAMC 1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
MAMC 3*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
MAMC 4*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
MAMC 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
MAMC 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
PS-13*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Define flow near MAMC
LC-79d*	Apr-02	Rotosonic	278.0	659610	1491751	272.79	275.27	275.74	0.5	PE	4 ports	Define downgradient edge plume
LC-80d*	Apr-02	Rotosonic	285.0	658062	1487184	264.06	266.67	266.68	0.5	PE	4 ports	Define downgradient edge plume
LC-81d*	May-02	Rotosonic	283.0	654949	1482808	267.09	269.83	269.97	0.5	PE	4 ports	Define downgradient edge plume
LC-82d*	May-02	Rotosonic	290.0	653293	1485490	274.33	276.53	276.87	0.5	PE	4 ports	Define downgradient edge plume
LC-83d*	May-02	Rotosonic	295.0	655355	1486861	266.11	268.57	268.91	0.5	PE	4 ports	Define downgradient edge plume
88-1-SS*		NA	NA	657079	1471543	NA	NA	220.07	NA	NA	NA	Define downgradient flow
LF4-MW2C*		NA	NA	657434	1479172	NA	NA	229.14	NA	NA	NA	Define downgradient flow
LF4-MW9B*		NA	NA	657399	1476838	NA	NA	232.83	NA	NA	NA	Define downgradient flow
LF4-MW12B*		NA	NA	658234	1477005	NA	NA	238.28	NA	NA	NA	Define downgradient flow
LF4-MW16B*		NA	NA	657238	1475180	NA	NA	234.54	NA	NA	NA	Define downgradient flow
SRC-MW1B*		NA	NA	654764	1476257	NA	NA	224.19	NA	NA	NA	Define downgradient flow

Notes:

* - Sea Level Aquifer well

bold - reference elevation used to calculate groundwater elevation

bgs - below ground surface

NA indicates information not available

msl - mean sea level

Drilling method abbreviations - AR/CT: Air rotary/Cable tool; H-S Auger: Hollow-stem auger; Perc. Hammer: Percussion hammer

Table 7.5. Upper Vashon Aquifer Wells Historical TCE Concentration Statistics and Analytical Data Acceptance Criteria.

Well ID	Statistics (TCE ug/l) Minimum	Maximum	Average	Median	Std Dev	No. of Meas.	Acceptance Criteria (TCE ug/l) Minimum[2]	Maximum[2]	Rationale[1]
FL2	110.0	330.0	2.1E+02	1.9E+02	9.1E+01	3	8.8E+01	4.0E+02	
FL3	4.8	6.1	5.4E+00	5.4E+00	5.2E-01	4	2.0E+00	1.0E+01	Very few data points. Chosen range reasonable.
FL4B	0.3	2.5	1.0E+00	6.5E-01	9.0E-01	4	2.4E-01	3.0E+00	
FL6	2.8	23.0	8.4E+00	3.8E+00	8.5E+00	4	2.2E+00	2.8E+01	
LC-03	0.3	18.0	1.7E+00	1.0E+00	2.9E+00	37	2.2E-01	2.2E+01	
LC-05	7.0	190.0	6.2E+01	4.6E+01	4.4E+01	55	5.6E+00	1.0E+02	Maximum set at 100 to match recent trend.
LC-06	9.6	800.0	1.5E+02	1.1E+02	1.4E+02	58	7.7E+00	2.0E+02	Maximum set at 200 to match recent trend.
LC-14A	35.0	140.0	6.4E+01	5.9E+01	2.3E+01	28	2.8E+01	1.7E+02	
LC-16	6.4	24.0	1.4E+01	1.5E+01	4.6E+00	14	5.1E+00	2.9E+01	
LC-19A	100.0	400.0	1.9E+02	1.8E+02	5.7E+01	26	8.0E+01	2.5E+02	Maximum set at 250 to match recent trend.
LC-20	0.2	5.9	2.1E+00	1.7E+00	1.6E+00	10	1.6E-01	7.1E+00	
LC-24	0.6	4.0	1.7E+00	1.4E+00	9.8E-01	8	4.8E-01	4.8E+00	
LC-26	0.1	47.0	1.9E+00	5.0E-01	6.8E+00	50	8.0E-02	3.0E+00	Maximum calculated without anomalous high data points.
LC-34	1.0	1.7	1.4E+00	1.4E+00	2.2E-01	6	8.0E-01	2.0E+00	
LC-41A	130.0	230.0	1.7E+02	1.7E+02	2.3E+01	28	1.0E+02	2.8E+02	
LC-49	80.0	330.0	2.1E+02	2.3E+02	6.0E+01	33	1.5E+02	4.0E+02	Minimum changed to 150 to match recent trend.
LC-53	46.0	270.0	1.7E+02	1.7E+02	4.7E+01	30	1.5E+02	3.2E+02	Minimum changed to 150 to match recent trend.
LC-57	0.2	91.0	1.5E+01	5.8E+00	2.6E+01	10	1.6E-01	1.2E+01	Maximum mum set at 12 to match recent trend.
LC-61B	1.7	4.4	2.6E+00	2.3E+00	8.8E-01	7	1.4E+00	5.3E+00	
LC-64A	10.0	29000.0	2.7E+03	1.2E+03	5.1E+03	51	8.0E+00	3.5E+04	
LC-66B	34.0	190.0	1.2E+02	1.3E+02	2.8E+01	45	2.7E+01	2.3E+02	
LC-136A	17000.0	250000.0	1.1E+05	9.6E+04	6.4E+04	28	1.4E+04	3.0E+05	
LC-136B	68.0	760.0	1.3E+02	9.8E+01	1.3E+02	26	5.4E+01	2.0E+02	Maximum set at 200 to match recent trend.
LC-137B	46.0	690.0	2.0E+02	1.6E+02	1.3E+02	29	3.7E+01	4.0E+02	Maximum set at 400 to match recent trend.
LC-149C	0.2	1.2	5.9E-01	5.0E-01	4.3E-01	35	1.6E-01	1.4E+00	
LC-167	0.2	0.2	2.0E-01	2.0E-01	0.0E+00	2	1.6E-01	2.4E-01	
LX-1	7.6	25.0	1.2E+01	1.1E+01	3.4E+00	26	6.1E+00	3.0E+01	
LX-2	9.8	33.0	1.6E+01	1.5E+01	5.3E+00	27	7.8E+00	4.0E+01	
LX-3	20.0	83.0	3.4E+01	3.2E+01	1.6E+01	28	1.6E+01	5.0E+01	Maximum set at 50 to match recent trend.
LX-4	50.0	130.0	7.0E+01	6.6E+01	2.0E+01	25	4.0E+01	1.0E+02	Maximum set at 100 to match recent trend.
LX-5	69.0	200.0	1.1E+02	1.0E+02	2.8E+01	25	5.5E+01	1.5E+02	Maximum set at 150 to match recent trend.
LX-6	78.0	220.0	1.1E+02	1.1E+02	3.4E+01	26	6.2E+01	1.5E+02	Maximum set at 150 to match recent trend.
LX-7	45.0	130.0	8.9E+01	8.8E+01	1.7E+01	27	3.6E+01	1.2E+02	Maximum set at 120 to match recent trend.
LX-8	64.0	110.0	8.0E+01	7.6E+01	1.2E+01	25	5.1E+01	1.3E+02	
LX-9	54.0	130.0	7.6E+01	7.4E+01	1.8E+01	25	4.3E+01	1.0E+02	Maximum set at 100 to match recent trend.

Table 7.5. Upper Vashon Aquifer Wells Historical TCE Concentration Statistics and Analytical Data Acceptance Criteria.

Well ID	Statistics (TCE ug/l)						Acceptance Criteria (TCE ug/l)		
	Minimum	Maximum	Average	Median	Std Dev	No. of Meas.	Minimum[2]	Maximum[2]	Rationale[1]
LX-10	39.0	150.0	7.3E+01	6.7E+01	2.5E+01	27	3.1E+01	1.2E+02	Maximum set at 120 to match recent trend.
LX-11	20.0	75.0	4.3E+01	4.4E+01	1.3E+01	27	1.6E+01	9.0E+01	
LX-12	11.0	36.0	2.5E+01	2.4E+01	6.6E+00	27	8.8E+00	4.3E+01	
LX-13	2.0	6.8	4.6E+00	5.1E+00	1.4E+00	21	1.6E+00	8.2E+00	
LX-14	2.0	8.2	5.5E+00	5.8E+00	1.7E+00	27	1.6E+00	9.8E+00	
LX-15	0.3	4.5	2.8E+00	3.0E+00	1.0E+00	27	2.7E-01	5.4E+00	
LX-16	120.0	330.0	1.7E+02	1.6E+02	4.8E+01	16	9.6E+01	4.0E+02	
LX-17	390.0	2300.0	8.4E+02	6.5E+02	4.9E+02	26	3.1E+02	2.8E+03	
LX-18	550.0	4400.0	1.5E+03	1.1E+03	1.0E+03	28	4.4E+02	5.3E+03	
LX-19	52.0	320.0	1.4E+02	1.2E+02	5.8E+01	25	4.2E+01	3.8E+02	
LX-21	73.0	955.0	1.6E+02	1.1E+02	1.6E+02	27	5.8E+01	1.1E+03	
PA-381	15.0	110.0	4.9E+01	4.4E+01	2.1E+01	39	1.2E+01	1.3E+02	
PA-383	0.4	3.4	1.4E+00	1.4E+00	5.8E-01	30	3.2E-01	4.1E+00	
RW-1	140.0	550.0	2.1E+02	1.8E+02	1.0E+02	15	1.1E+02	6.6E+02	
T-04	0.8	79.0	2.0E+01	1.0E+01	2.0E+01	45	6.4E-01	3.0E+01	Maximum set at 30 to match recent trend.
T-06	6.0	69.0	2.4E+01	1.7E+01	2.2E+01	6	4.8E+00	8.3E+01	Maximum likely high, but well is quarterly anyway.
T-08	0.5	6.1	2.8E+00	2.5E+00	1.2E+00	36	4.0E-01	7.3E+00	
T-11B	7.1	37.0	1.4E+01	1.1E+01	7.0E+00	23	5.7E+00	4.4E+01	
T-12B	0.2	4.4	5.1E-01	2.0E-01	1.1E+00	13	1.2E-01	5.3E+00	
T-13B	0.6	6.2	4.2E+00	4.4E+00	1.0E+00	35	5.0E-01	7.4E+00	

Notes:

1. 20% below the historical minimum and 20% above the historical maximum used unless otherwise noted.
2. Analytical samples outside of this range will trigger automatic resampling. If resampling confirms TCE is outside of these limits, sampling frequency will revert to quarterly until new trend is established.

Shading indicates wells currently on quarterly sampling.

This table will be updated as new data are collected.

Table 7.6. Lower Vashon Aquifer Wells Historical TCE Concentration Statistics and Analytical Data Acceptance Criteria.

Well ID	Statistics (TCE ug/l)						Acceptance Criteria (TCE ug/l)		
	Minimum	Maximum	Average	Median	Std Dev	No. of Meas.	Minimum[2]	Maximum[2]	Rationale[1]
FL4A	1.2	5.1	2.4E+00	1.8E+00	1.4E+00	5	9.6E-01	6.1E+00	
LC-41B	110.0	160.0	1.3E+02	1.2E+02	2.0E+01	4	8.8E+01	1.9E+02	
LC-64B	12.0	210.0	5.6E+01	4.8E+01	3.9E+01	32	9.6E+00	1.0E+02	Maximum set at 100 to match recent trend.
LC-111B	0.2	2.0	6.1E-01	3.3E-01	5.1E-01	26	1.6E-01	2.4E+00	
LC-116B	0.2	86.0	5.8E+00	4.0E-01	1.6E+01	27	1.6E-01	2.0E+01	Maximum set at 20 to match recent trend.
LC-122B	0.2	2.0	6.2E-01	3.0E-01	5.2E-01	26	1.6E-01	2.4E+00	
LC-128	12.0	62.0	2.3E+01	2.1E+01	9.0E+00	27	9.6E+00	4.0E+01	Maximum set at 40 ignoring one anomalous data point.
LC-137C	0.2	110.0	1.6E+01	9.8E+00	2.2E+01	28	1.6E-01	2.0E+01	Maximum set at 20 to match recent trend.
T-10	0.1	0.2	1.6E-01	1.8E-01	4.1E-02	4	8.0E-02	2.4E-01	
MAMC -1	2.6	3.1	2.9E+00	2.9E+00	2.5E-01	2	2.1E+00	3.7E+00	
MAMC-6	2.0	2.1	2.1E+00	2.1E+00	5.0E-02	2	1.6E+00	2.5E+00	

Notes:

1. 20% below the historical minimum and 20% above the historical maximum used unless otherwise noted.
2. Analytical samples outside of this range will trigger automatic resampling. If resampling confirms TCE is outside of these limits, sampling frequency will revert to quarterly until new trend is established.

Shading indicates wells currently on quarterly sampling.

This table will be updated as new data are collected.

Table 7.7. Sea Level Aquifer Wells Historical TCE Concentration Statistics and Analytical Data Acceptance Criteria.

Well ID	Statistics (TCE ug/l) Minimum	Maximum	Average	Median	Std Dev	No. of Meas.	Acceptance Criteria (TCE ug/l) Minimum[2]	Maximum[2]	Rationale[1]
LC-21C	0.1	4.2	4.3E-01	2.0E-01	9.5E-01	17	8.0E-02	5.0E+00	
LC-26D	0.1	1.2	5.7E-01	2.0E-01	4.8E-01	27	8.0E-02	1.4E+00	
LC-35D	0.1	1.0	2.8E-01	2.0E-01	2.7E-01	17	8.0E-02	1.2E+00	
LC-40D	12.0	22.0	1.6E+01	1.6E+01	2.8E+00	18	9.6E+00	2.6E+01	
LC-47D	0.1	1.5	2.8E-01	2.0E-01	3.5E-01	13	8.0E-02	1.8E+00	
LC-50D	0.1	8.0	3.3E+00	2.6E+00	3.0E+00	16	8.0E-02	9.6E+00	
LC-66D	24.0	70.0	4.9E+01	5.1E+01	1.2E+01	20	1.9E+01	8.4E+01	
LC-67D	4.9	163.3	5.5E+01	5.3E+01	2.5E+01	27	3.9E+00	8.0E+01	Maximum set at 80 to match recent trend.
LC-69D	120.0	160.0	1.5E+02	1.5E+02	1.5E+01	4	9.6E+01	1.9E+02	
LC-70D	0.2	1.8	9.7E-01	9.0E-01	6.8E-01	6	1.6E-01	2.2E+00	
LC-71D	0.1	2.4	6.5E-01	3.0E-01	5.8E-01	26	8.0E-02	2.9E+00	
LC-72D	33.0	57.0	4.8E+01	5.0E+01	7.5E+00	18	2.6E+01	6.8E+01	
LC-73D	5.9	41.0	2.5E+01	2.8E+01	1.1E+01	26	4.7E+00	4.9E+01	
LC-74D	36.0	84.0	5.9E+01	6.2E+01	1.3E+01	25	2.9E+01	1.0E+02	
LC-75D	0.7	1.1	8.5E-01	8.0E-01	1.2E-01	10	5.6E-01	1.3E+00	
LC-76D	0.1	0.2	1.9E-01	2.0E-01	3.0E-02	10	8.0E-02	2.4E-01	
LC-77D	3.8	31.0	8.8E+00	5.7E+00	7.8E+00	10	3.0E+00	1.5E+01	Maximum set at 15 to match recent trend.
LC-126	13.0	140.0	9.6E+01	9.9E+01	2.5E+01	28	6.0E+01	1.7E+02	Minimum set at 60 ignoring anomalous data point.
MAMC-3	2.6	2.7	2.7E+00	2.7E+00	5.0E-02	2	2.1E+00	3.2E+00	
MAMC-4	0.2	0.2	2.0E-01	2.0E-01	0.0E+00	2	1.6E-01	2.4E-01	
PS-13	0.4	0.5	4.5E-01	4.5E-01	5.0E-02	2	3.2E-01	6.0E-01	

Notes:

1. 20% below the historical minimum and 20% above the historical maximum used unless otherwise noted.
2. Analytical samples outside of this range will trigger automatic resampling. If resampling confirms TCE is outside of these limits, sampling frequency will revert to quarterly until new trend is established.

Shading indicates wells currently on quarterly sampling.

This table will be updated as new data are collected.

Table 7.8. Murray Creek Sampling Locations Historical TCE Concentration Statistics and Analytical Data Acceptance Criteria.

Well ID	Statistics (TCE ug/l)						Acceptance Criteria (TCE ug/l)		
	Minimum	Maximum	Average	Median	Std Dev	No. of Meas.	Minimum[2]	Maximum[2]	Rationale[1]
SW-MC-1	0.1	2.9	3.8E-01	3.0E-01	4.3E-01	43	8.0E-02	3.5E+00	
SW-MC-4	0.2	1.2	7.3E-01	8.0E-01	3.1E-01	7	1.6E-01	1.4E+00	
SW-MC-6	1.0	1.8	1.4E+00	1.4E+00	4.0E-01	2	8.0E-01	2.2E+00	

Notes:

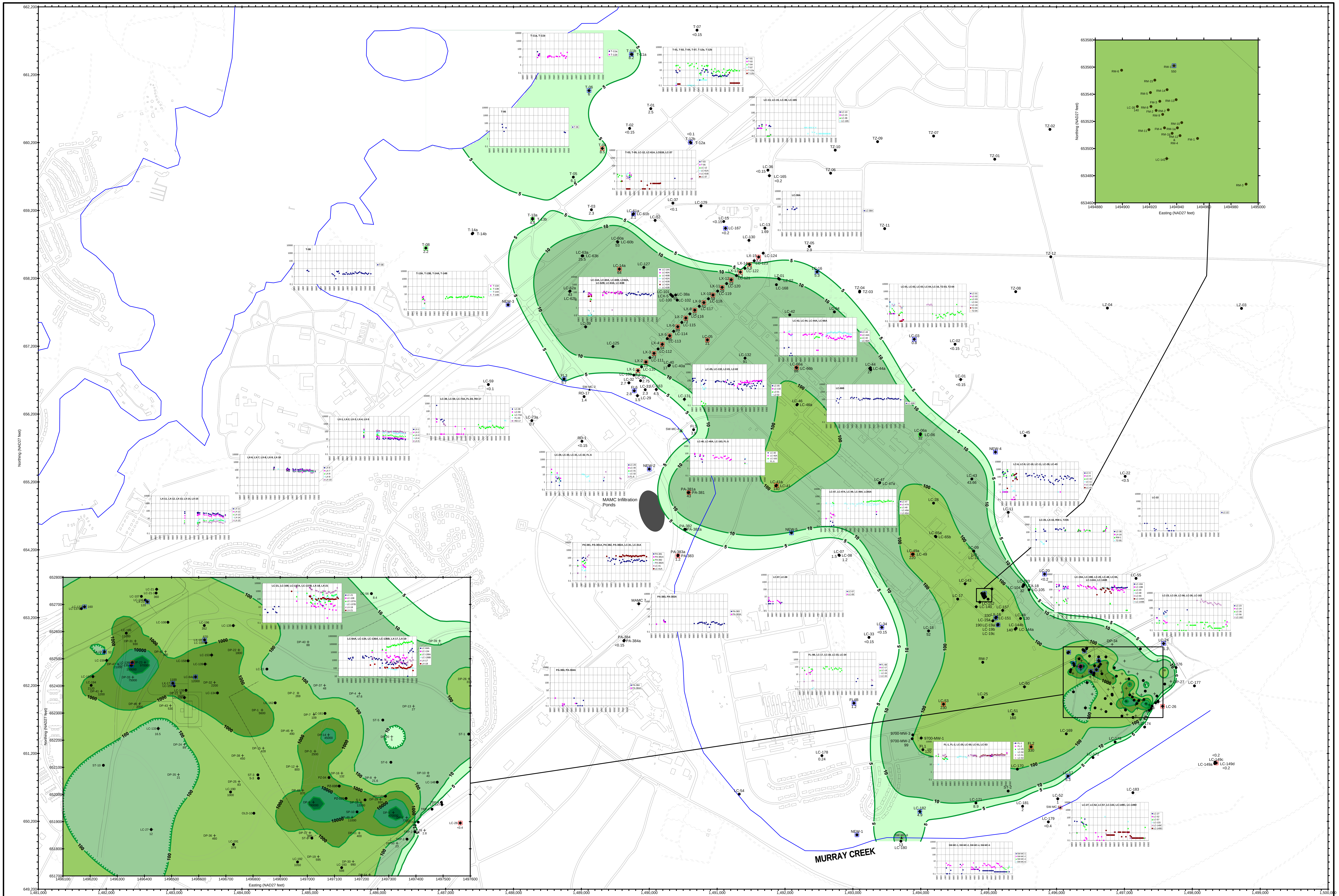
1. 20% below the historical minimum and 20% above the historical maximum used unless otherwise noted.
2. Analytical samples outside of this range will trigger automatic resampling. If resampling confirms TCE is outside of these limits, sampling frequency will revert to quarterly until new trend is established.

Shading indicates wells currently on quarterly sampling.

This table will be updated as new data are collected.

PLATES

Plate 1. Upper Vashon Aquifer – Historical TCE Concentrations & Proposed Monitoring.



- ● Upper Vashon Aquifer well
- Well proposed for LOGRAM groundwater elevation monitoring
- ☐ (red) Well proposed for annual LOGRAM groundwater TCE monitoring
- ☐ (green) Well proposed for semiannual LOGRAM groundwater TCE monitoring
- ☐ (blue) Well proposed for quarterly LOGRAM groundwater TCE monitoring
- \+ EGDY ESI Phase I drive point GW sample location
- ▲ Surface water (Murray Creek) sample location

Notes:
1. Graph y-axis is TCE concentration in ug/l; x-axis is the date.
2. TCE plume was contoured using Kriging interpolation of measured TCE concentrations from Mar 2002 and older data from wells where Mar 2002 data were not available.

[12/13/02]

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PLATE 1
UPPER VASHON AQUIFER HISTORICAL TCE CONCENTRATIONS AND PROPOSED MONITORING

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Plate 2. Lower Vashon Aquifer – Historical TCE Concentrations & Proposed Monitoring.

● Lower Vashon Aquifer well

Well proposed for LOGRAM groundwater elevation monitoring

Well proposed for annual LOGRAM groundwater TCE monitoring

Well proposed for quarterly LOGRAM groundwater TCE monitoring

Notes:
1. Graph y-axis is TCE concentration in ug/l; x-axis is the date.
2. TCE plume was contoured using Kriging interpolation of measured TCE concentrations from Mar 2002 and older data from wells where Mar 2002 data were not available.
3. TCE values for wells LC-184, LC-185, and LC-187 through LC-196 were from lowest-elevation port (Lower Vashon) in multi-port wells sampled between 11/01 and 5/02. No time series graphs for these multi-port wells shown since only one data point exists for each well.

[12/13/02]

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PLATE 2
LOWER VASHON AQUIFER
HISTORICAL TCE CONCENTRATIONS
AND PROPOSED MONITORING

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Plate 3. Sea Level Aquifer – Historical TCE Concentrations & Proposed Monitoring.

- Lower Aquifer well
- Well proposed for LOGRAM groundwater elevation monitoring
- Well proposed for annual LOGRAM groundwater TCE monitoring
- Well proposed for quarterly LOGRAM groundwater TCE monitoring

Notes:
1. Graph y-axis is TCE concentration in ug/l; x-axis is the date.
2. TCE plume was contoured using Kriging interpolation of measured TCE concentrations from Mar 2002 and older data from wells where Mar 2002 data were not available.

[12/13/02]

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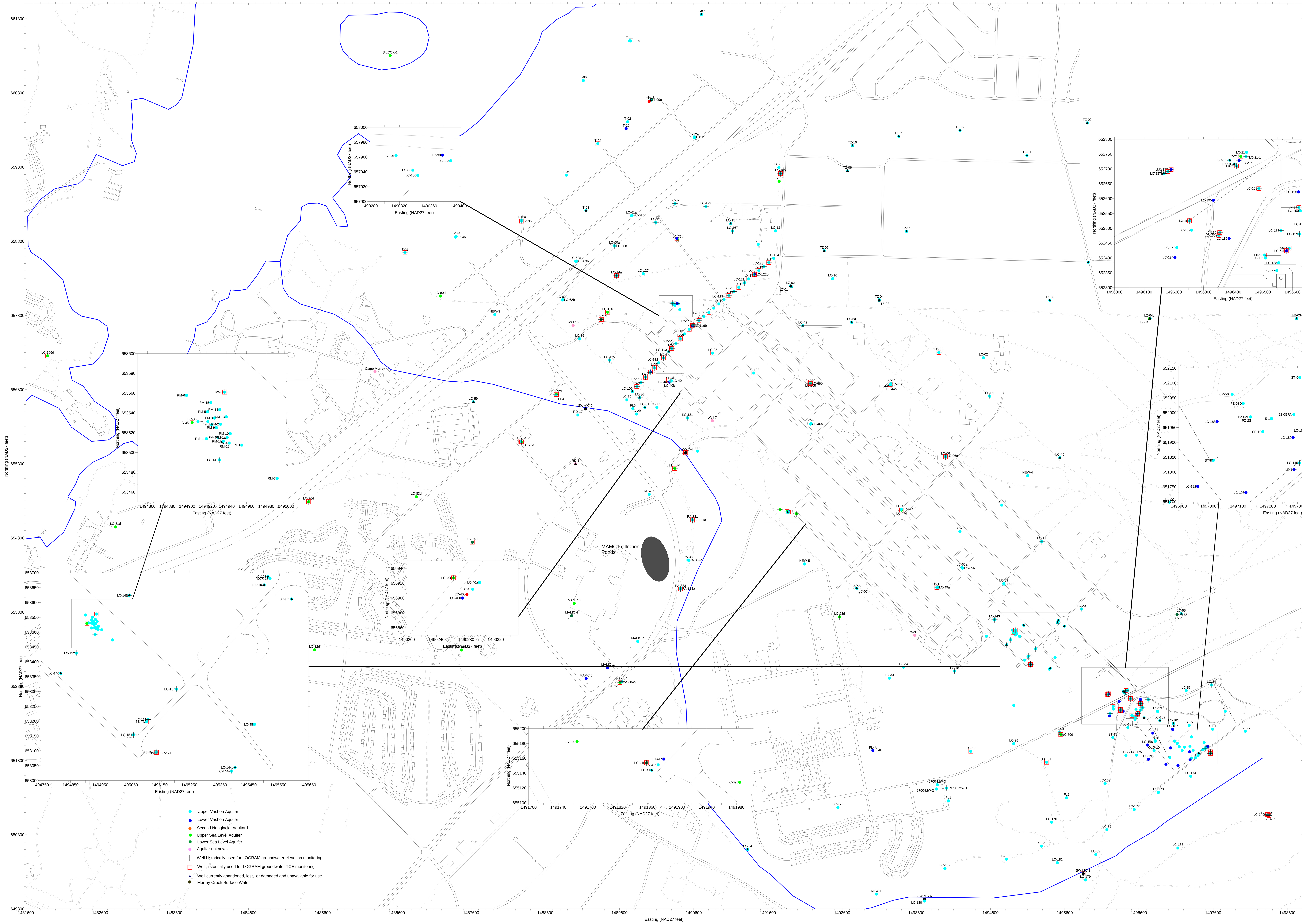
FORT LEWIS LOGISTICS CENTER
LOG RAM NETWORK OPTIMIZATION REPORT

PLATE 3
SEA LEVEL AQUIFER
HISTORICAL
TCE CONCENTRATIONS
AND PROPOSED MONITORING

FORT LEWIS WASHINGTON

Plate 4. Historical RAM Network.



[12/13/02]

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FORT LEWIS LOGISTICS CENTER
LOG RAM NETWORK OPTIMIZATION REPORT

PLATE 4
HISTORICAL RAM NETWORK

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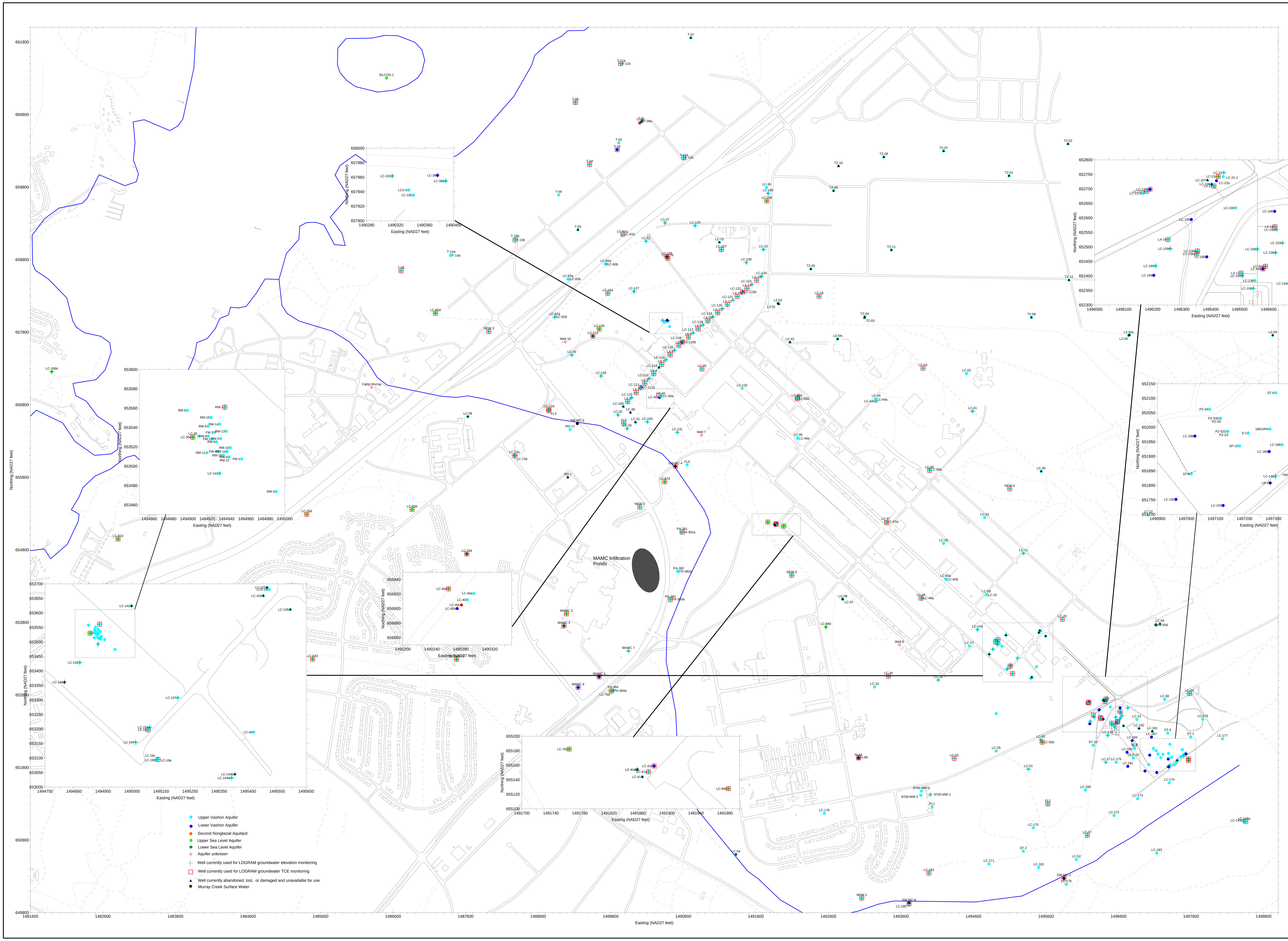
Plate 5. Revised RAM Network.



[12/13/02]

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FORT LEWIS LOGISTICS CENTER
LOG RAM NETWORK OPTIMIZATION REPORT

PLATE 5
REVISED RAM NETWORK

FORT LEWIS WASHINGTON

APPENDICES

Appendix A – Statistical Analysis Calculation Sheets and Plots (MAROS Output).

A.1. Quarterly RAM Data (2/95-9/00).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-137c	S	9.5E-01	-121	100.0%	D
LC-21c	S	0.0E+00	0	0.0%	N/A
LC-19c	S	3.8E-01	-1	50.0%	S
LC-19a	S	1.8E-01	-2	54.0%	S
LC-162	S	5.5E-01	-144	100.0%	D
LC-149d	S	6.3E-01	-117	100.0%	D
LC-149c	S	7.1E-01	-108	100.0%	D
LC-26	S	8.4E-01	-138	100.0%	D
LC-144a	S	5.1E-01	-7	65.6%	S
LC-19b	S	6.5E-01	-13	89.0%	S
LC-137b	S	5.5E-01	-18	69.4%	S
LC-137a	S	1.2E+00	7	57.1%	NT
LC-136b	S	3.7E-01	-25	77.9%	S
LC-136a	S	5.5E-01	181	100.0%	I
LC-134	S	1.2E+00	-58	95.7%	D
LC-108	S	1.6E+00	-29	79.8%	NT
LC-06	S	7.3E-01	58	95.7%	I
LC-144b	S	5.9E-01	-11	74.8%	S
LC-51	S	1.8E-01	119	100.0%	I
LC-53	S	1.9E-01	94	99.8%	I
LC-64a	S	8.3E-01	15	66.2%	NT
LC-64b	S	4.1E-01	-91	99.8%	D
LC-66b	T	5.7E-01	7	57.1%	NT
LC-05	T	6.1E-01	10	60.6%	NT
T-12B	T	1.8E+00	-3	72.9%	NT
T-08	T	2.2E-01	56	95.1%	I
LC-111b	T	7.9E-01	-101	99.9%	D
LC-116b	T	1.7E+00	-36	85.3%	NT
LC-122b	T	7.9E-01	-120	100.0%	D
LC-128	T	4.3E-01	65	97.4%	I
LC-132	T	3.6E-01	131	100.0%	I
T-04	T	8.7E-01	1	50.0%	NT
T-01	T	4.8E-01	-35	91.8%	PD
PA-383	T	3.4E-01	3	52.4%	NT
LC-165	T	7.1E-01	-114	100.0%	D
LC-73a	T	4.1E-01	4	53.8%	NT
LC-41a	T	1.4E-01	-10	60.6%	S
LC-66a	T	2.4E-01	51	93.4%	PI
LC-14a	T	2.6E-01	-39	87.3%	S
LC-03	T	2.4E+00	76	98.9%	I
LC-49a	T	2.7E-01	3	55.3%	NT
T-13b	T	1.4E-01	74	98.7%	I
LC-49	T	1.4E-01	38	86.6%	NT
LC-44a	T	4.9E-01	-38	86.6%	S
PA-381	T	3.1E-01	43	89.6%	NT

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-50D	S	1.0E+00	7	80.9%	NT
LC-26D	S	7.3E-01	-110	100.0%	D
LC-35D	S	5.9E-01	-6	76.4%	S
LC-41D	S	1.4E-01	2	51.3%	NT
LC-47D	S	0.0E+00	0	42.3%	S
LC-166D	T	3.0E-01	19	71.8%	NT
LC-40D	T	4.8E-01	-47	91.6%	PD
LC-126	T	1.8E-01	-60	96.3%	D
LC-67D	T	1.5E-01	8	58.3%	NT
LC-77D	T	0.0E+00	0	0.0%	N/A
LC-71D	T	7.8E-01	-71	98.3%	D
LC-72D	T	3.6E-01	-3	52.5%	S
LC-73D	T	4.1E-01	-55	94.8%	PD
LC-74D	T	2.5E-01	90	99.9%	I
LC-75D	T	0.0E+00	0	0.0%	N/A
LC-76D	T	0.0E+00	0	0.0%	N/A
LC-66D	T	5.5E-01	-49	92.5%	PD

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LX-19	S	2.0E-01	-79	98.1%	D
LX-16	S	1.9E-01	14	71.8%	NT
LX-17	S	3.6E-01	-176	100.0%	D
LX-18	S	5.5E-01	-237	100.0%	D
RW-1	S	1.9E-01	-5	58.5%	S
LX-21	S	4.3E-01	-117	99.5%	D
LX-4	T	2.1E-01	-136	99.9%	D
LX-3	T	2.2E-01	-141	100.0%	D
LX-5	T	1.8E-01	-131	100.0%	D
LX-6	T	1.8E-01	-121	99.4%	D
LX-7	T	1.9E-01	-99	97.4%	D
LX-1	T	1.6E-01	-33	77.0%	S
LX-8	T	1.3E-01	6	54.3%	NT
LX-9	T	1.4E-01	-87	98.4%	D
LX-15	T	3.7E-01	185	100.0%	I
LX-14	T	2.6E-01	73	92.2%	PI
LX-13	T	3.2E-01	168	100.0%	I
LX-12	T	2.4E-01	-86	96.2%	D
LX-11	T	2.3E-01	-162	99.9%	D
LX-10	T	2.0E-01	-74	93.6%	PD
LX-2	T	2.7E-01	-231	100.0%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-149c	S	3.5E-04	2.5E-04	-1.1E-03	7.1E-01	100.0%	D
	LC-64a	S	5.6E-01	4.7E-01	1.5E-04	8.3E-01	77.0%	NT
	LC-53	S	1.7E-01	3.1E-02	2.1E-04	1.9E-01	99.9%	I
	LC-51	S	1.5E-01	2.6E-02	2.4E-04	1.8E-01	100.0%	I
	LC-26	S	3.5E-04	2.9E-04	-1.3E-03	8.4E-01	100.0%	D
	LC-21c	S	1.6E-03	2.3E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-19c	S	4.3E-02	1.6E-02	2.0E-03	3.8E-01	91.5%	PI
	LC-19b	S	1.3E-01	8.3E-02	-8.8E-04	6.5E-01	100.0%	D
	LC-19a	S	1.7E-01	3.2E-02	2.8E-04	1.8E-01	80.7%	NT
	LC-06	S	6.4E-02	4.6E-02	5.0E-04	7.3E-01	93.0%	PI
	LC-149d	S	3.7E-04	2.3E-04	-1.0E-03	6.3E-01	100.0%	D
	LC-64b	S	4.8E-02	2.0E-02	-5.7E-04	4.1E-01	100.0%	D
	LC-144b	S	1.9E-01	1.1E-01	-5.5E-04	5.9E-01	100.0%	D
	LC-144a	S	9.3E-02	4.8E-02	2.0E-04	5.1E-01	63.1%	NT
	LC-137c	S	1.4E-02	1.4E-02	-2.4E-03	9.5E-01	100.0%	D
	LC-137b	S	1.5E-01	8.3E-02	-1.3E-04	5.5E-01	100.0%	D
	LC-137a	S	1.6E-01	1.8E-01	2.1E-05	1.2E+00	52.3%	NT
	LC-136b	S	1.0E-01	3.8E-02	-2.1E-04	3.7E-01	100.0%	D
	LC-136a	S	9.4E+01	5.2E+01	1.0E-03	5.5E-01	100.0%	I
	LC-134	S	3.2E+00	3.8E+00	-6.2E-04	1.2E+00	100.0%	D
	LC-108	S	3.8E-02	6.2E-02	-5.5E-04	1.6E+00	100.0%	D
	LC-162	S	5.2E-01	2.8E-01	-6.8E-04	5.5E-01	100.0%	D
	LC-44a	T	2.5E-02	1.2E-02	-2.1E-04	4.9E-01	100.0%	D
	T-12B	T	1.2E-03	2.2E-03	-1.2E-02	1.8E+00	100.0%	D
	T-08	T	2.5E-03	5.5E-04	1.4E-04	2.2E-01	96.4%	I
	T-04	T	9.5E-03	8.3E-03	-1.5E-04	8.7E-01	100.0%	D
	T-01	T	2.1E-03	1.0E-03	-4.0E-04	4.8E-01	100.0%	D
	PA-383	T	1.4E-03	4.6E-04	-5.3E-05	3.4E-01	100.0%	D
	PA-381	T	4.3E-02	1.3E-02	1.1E-04	3.1E-01	81.4%	NT
	LC-73a	T	8.8E-04	3.6E-04	-8.9E-05	4.1E-01	100.0%	D
	LC-66b	T	1.4E-01	8.0E-02	6.1E-05	5.7E-01	68.0%	NT
	LC-66a	T	9.8E-02	2.4E-02	2.6E-04	2.4E-01	98.7%	I
	LC-03	T	1.6E-03	3.8E-03	7.4E-04	2.4E+00	99.1%	I
	LC-49	T	2.3E-01	3.2E-02	4.2E-05	1.4E-01	77.7%	NT
	LC-05	T	2.8E-02	1.7E-02	4.6E-05	6.1E-01	57.3%	NT
	LC-41a	T	1.7E-01	2.4E-02	-1.5E-05	1.4E-01	100.0%	D
	LC-165	T	3.3E-04	2.3E-04	-1.2E-03	7.1E-01	100.0%	D
	LC-14a	T	6.1E-02	1.6E-02	-7.9E-05	2.6E-01	100.0%	D
	LC-132	T	6.3E-02	2.3E-02	5.9E-04	3.6E-01	100.0%	I
	LC-128	T	2.3E-02	9.9E-03	2.3E-04	4.3E-01	97.0%	I
	LC-122b	T	3.8E-04	3.0E-04	-1.1E-03	7.9E-01	100.0%	D
	LC-116b	T	7.0E-04	1.2E-03	-4.3E-04	1.7E+00	100.0%	D
	LC-111b	T	4.0E-04	3.2E-04	-1.2E-03	7.9E-01	100.0%	D
	T-13b	T	4.7E-03	6.7E-04	1.0E-04	1.4E-01	96.9%	I
	LC-49a	T	8.6E-02	2.3E-02	2.6E-05	2.7E-01	54.5%	NT

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-35D	S	1.3E-04	7.6E-05	-1.1E-03	5.9E-01	100.0%	D
	LC-41D	S	1.2E-01	1.6E-02	4.1E-05	1.4E-01	76.6%	NT
	LC-47D	S	1.0E-04	0.0E+00	0.0E+00	0.0E+00	100.0%	S
	LC-50D	S	2.8E-03	2.8E-03	2.2E-03	1.0E+00	83.6%	NT
	LC-26D	S	3.4E-04	2.5E-04	-1.2E-03	7.3E-01	100.0%	D
	LC-67D	T	5.5E-02	8.4E-03	2.8E-05	1.5E-01	68.5%	NT
	LC-126	T	1.0E-01	1.9E-02	-1.2E-04	1.8E-01	100.0%	D
	LC-166D	T	5.4E-04	1.6E-04	2.1E-04	3.0E-01	83.7%	NT
	LC-66D	T	4.1E-02	2.2E-02	-1.4E-03	5.5E-01	100.0%	D
	LC-77D	T	1.7E-02	1.2E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-71D	T	3.9E-04	3.0E-04	-9.0E-04	7.8E-01	100.0%	D
	LC-72D	T	4.5E-02	1.6E-02	-5.4E-04	3.6E-01	100.0%	D
	LC-73D	T	2.7E-02	1.1E-02	-5.8E-04	4.1E-01	100.0%	D
	LC-74D	T	5.7E-02	1.4E-02	3.1E-04	2.5E-01	99.9%	I
	LC-75D	T	8.3E-04	1.5E-04	0.0E+00	0.0E+00	0.0%	N/A
	LC-76D	T	1.0E-04	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-40D	T	1.4E-02	6.7E-03	-7.2E-04	4.8E-01	100.0%	D

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LX-17	S	6.6E-01	2.4E-01	-3.8E-04	3.6E-01	100.0%	D
	LX-18	S	1.3E+00	7.1E-01	-7.5E-04	5.5E-01	100.0%	D
	LX-19	S	1.2E-01	2.4E-02	-9.9E-05	2.0E-01	100.0%	D
	LX-21	S	1.2E-01	5.0E-02	-9.5E-05	4.3E-01	100.0%	D
	RW-1	S	1.7E-01	3.2E-02	-1.7E-05	1.9E-01	100.0%	D
	LX-16	S	1.6E-01	3.0E-02	7.9E-05	1.9E-01	69.0%	NT
	LX-14	T	6.2E-03	1.6E-03	1.4E-04	2.6E-01	92.9%	PI
	LX-1	T	1.1E-02	1.8E-03	-7.0E-05	1.6E-01	100.0%	D
	LX-10	T	7.1E-02	1.4E-02	-6.2E-05	2.0E-01	100.0%	D
	LX-11	T	4.8E-02	1.1E-02	-2.3E-04	2.3E-01	100.0%	D
	LX-13	T	4.2E-03	1.3E-03	5.0E-04	3.2E-01	100.0%	I
	LX-9	T	7.6E-02	1.1E-02	-9.4E-05	1.4E-01	100.0%	D
	LX-15	T	2.9E-03	1.1E-03	5.8E-04	3.7E-01	99.9%	I
	LX-2	T	1.7E-02	4.7E-03	-3.3E-04	2.7E-01	100.0%	D
	LX-3	T	3.1E-02	6.9E-03	-2.7E-04	2.2E-01	100.0%	D
	LX-4	T	7.2E-02	1.5E-02	-2.0E-04	2.1E-01	100.0%	D
	LX-5	T	1.1E-01	2.0E-02	-1.9E-04	1.8E-01	100.0%	D
	LX-6	T	1.1E-01	2.0E-02	-1.5E-04	1.8E-01	100.0%	D
	LX-7	T	9.3E-02	1.8E-02	-1.3E-04	1.9E-01	100.0%	D
	LX-8	T	7.7E-02	1.0E-02	-7.6E-06	1.3E-01	100.0%	D
	LX-12	T	2.8E-02	6.8E-03	-1.4E-04	2.4E-01	100.0%	D

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-137c	S	D	D	N/A	N/A
	LC-21c	S	N/A	N/A	N/A	N/A
	LC-19c	S	S	PI	N/A	N/A
	LC-19a	S	S	NT	N/A	N/A
	LC-162	S	D	D	N/A	N/A
	LC-149d	S	D	D	N/A	N/A
	LC-149c	S	D	D	N/A	N/A
	LC-26	S	D	D	N/A	N/A
	LC-144a	S	S	NT	N/A	N/A
	LC-19b	S	S	D	N/A	N/A
	LC-137b	S	S	D	N/A	N/A
	LC-137a	S	NT	NT	N/A	N/A
	LC-136b	S	S	D	N/A	N/A
	LC-136a	S	I	I	N/A	N/A
	LC-134	S	D	D	N/A	N/A
	LC-108	S	NT	D	N/A	N/A
	LC-06	S	I	PI	N/A	N/A
	LC-144b	S	S	D	N/A	N/A
	LC-51	S	I	I	N/A	N/A
	LC-53	S	I	I	N/A	N/A
	LC-64a	S	NT	NT	N/A	N/A
	LC-64b	S	D	D	N/A	N/A
	LC-66b	T	NT	NT	N/A	N/A
	LC-05	T	NT	NT	N/A	N/A
	T-12B	T	NT	D	N/A	N/A
	T-08	T	I	I	N/A	N/A
	LC-111b	T	D	D	N/A	N/A
	LC-116b	T	NT	D	N/A	N/A
	LC-122b	T	D	D	N/A	N/A
	LC-128	T	I	I	N/A	N/A
	LC-132	T	I	I	N/A	N/A
	T-04	T	NT	D	N/A	N/A
	T-01	T	PD	D	N/A	N/A
	PA-383	T	NT	D	N/A	N/A
	LC-165	T	D	D	N/A	N/A
	LC-73a	T	NT	D	N/A	N/A
	LC-41a	T	S	D	N/A	N/A
	LC-66a	T	PI	I	N/A	N/A
	LC-14a	T	S	D	N/A	N/A
	LC-03	T	I	I	N/A	N/A
	LC-49a	T	NT	NT	N/A	N/A
	T-13b	T	I	I	N/A	N/A
	LC-49	T	NT	NT	N/A	N/A

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-44a	T	S	D	N/A	N/A
	PA-381	T	NT	NT	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-50D	S	NT	NT	N/A	N/A
	LC-26D	S	D	D	N/A	N/A
	LC-35D	S	S	D	N/A	N/A
	LC-41D	S	NT	NT	N/A	N/A
	LC-47D	S	S	S	N/A	N/A
	LC-166D	T	NT	NT	N/A	N/A
	LC-40D	T	PD	D	N/A	N/A
	LC-126	T	D	D	N/A	N/A
	LC-67D	T	NT	NT	N/A	N/A
	LC-77D	T	N/A	N/A	N/A	N/A
	LC-71D	T	D	D	N/A	N/A
	LC-72D	T	S	D	N/A	N/A
	LC-73D	T	PD	D	N/A	N/A
	LC-74D	T	I	I	N/A	N/A
	LC-75D	T	N/A	N/A	N/A	N/A
	LC-76D	T	N/A	N/A	N/A	N/A
	LC-66D	T	PD	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LX-19	S	D	D	N/A	N/A
	LX-16	S	NT	NT	N/A	N/A
	LX-17	S	D	D	N/A	N/A
	LX-18	S	D	D	N/A	N/A
	RW-1	S	S	D	N/A	N/A
	LX-21	S	D	D	N/A	N/A
	LX-4	T	D	D	N/A	N/A
	LX-3	T	D	D	N/A	N/A
	LX-5	T	D	D	N/A	N/A
	LX-6	T	D	D	N/A	N/A
	LX-7	T	D	D	N/A	N/A
	LX-1	T	S	D	N/A	N/A
	LX-8	T	NT	D	N/A	N/A
	LX-9	T	D	D	N/A	N/A
	LX-15	T	I	I	N/A	N/A
	LX-14	T	PI	PI	N/A	N/A
	LX-13	T	I	I	N/A	N/A
	LX-12	T	D	D	N/A	N/A
	LX-11	T	D	D	N/A	N/A
	LX-10	T	PD	D	N/A	N/A
	LX-2	T	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft. Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 22 **Number of Tail Wells:** 23

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Limited

Number of Source Wells: 5 **Number of Tail Wells:** 12

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: No Current Site Treatment

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	PD	S	L	Sample 4 more years	Annually	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Limited

Number of Source Wells: 6 **Number of Tail Wells:** 15

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

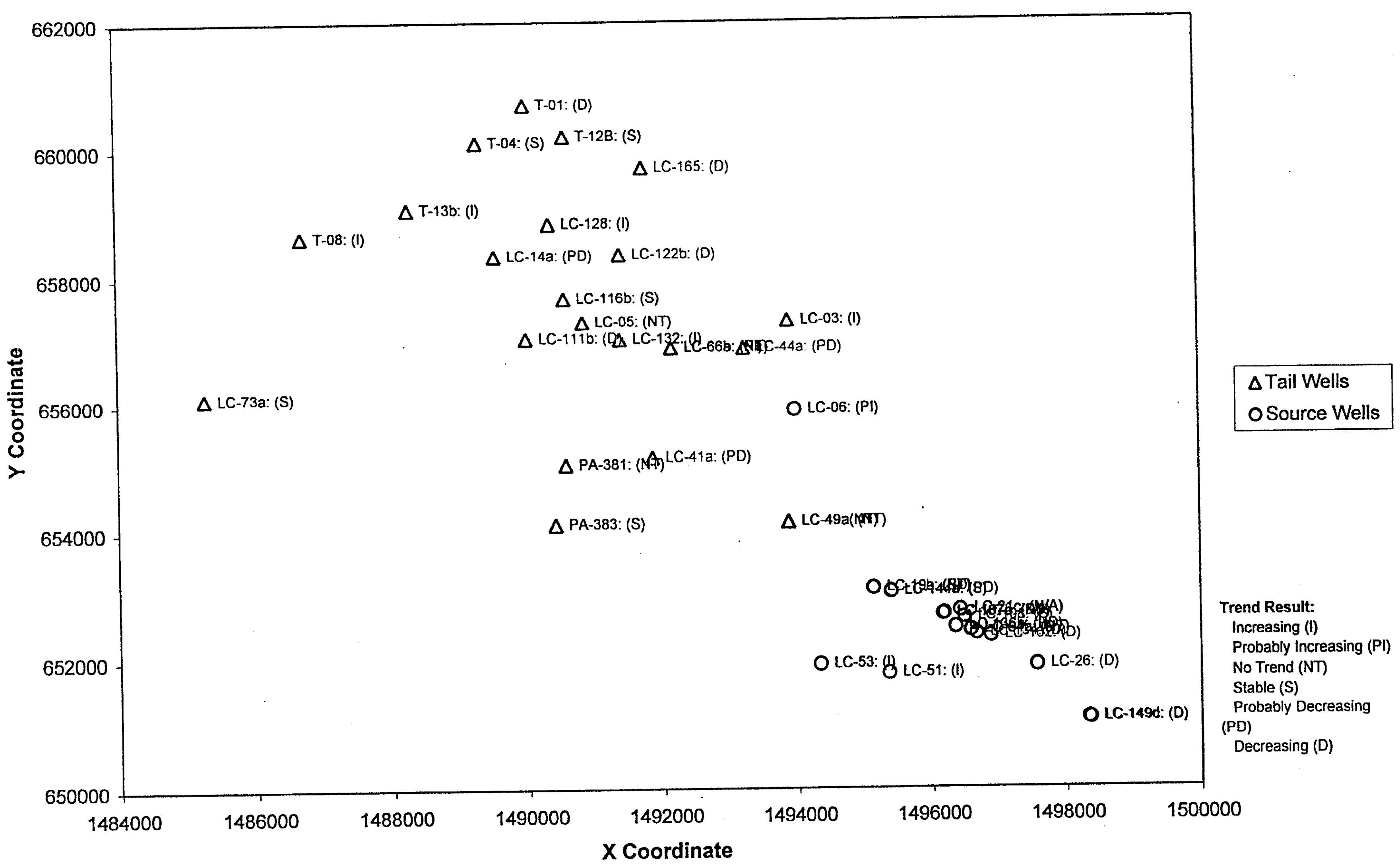
COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	PD	PD	L	Continue remediation mechanism unitl reach stable trend or	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

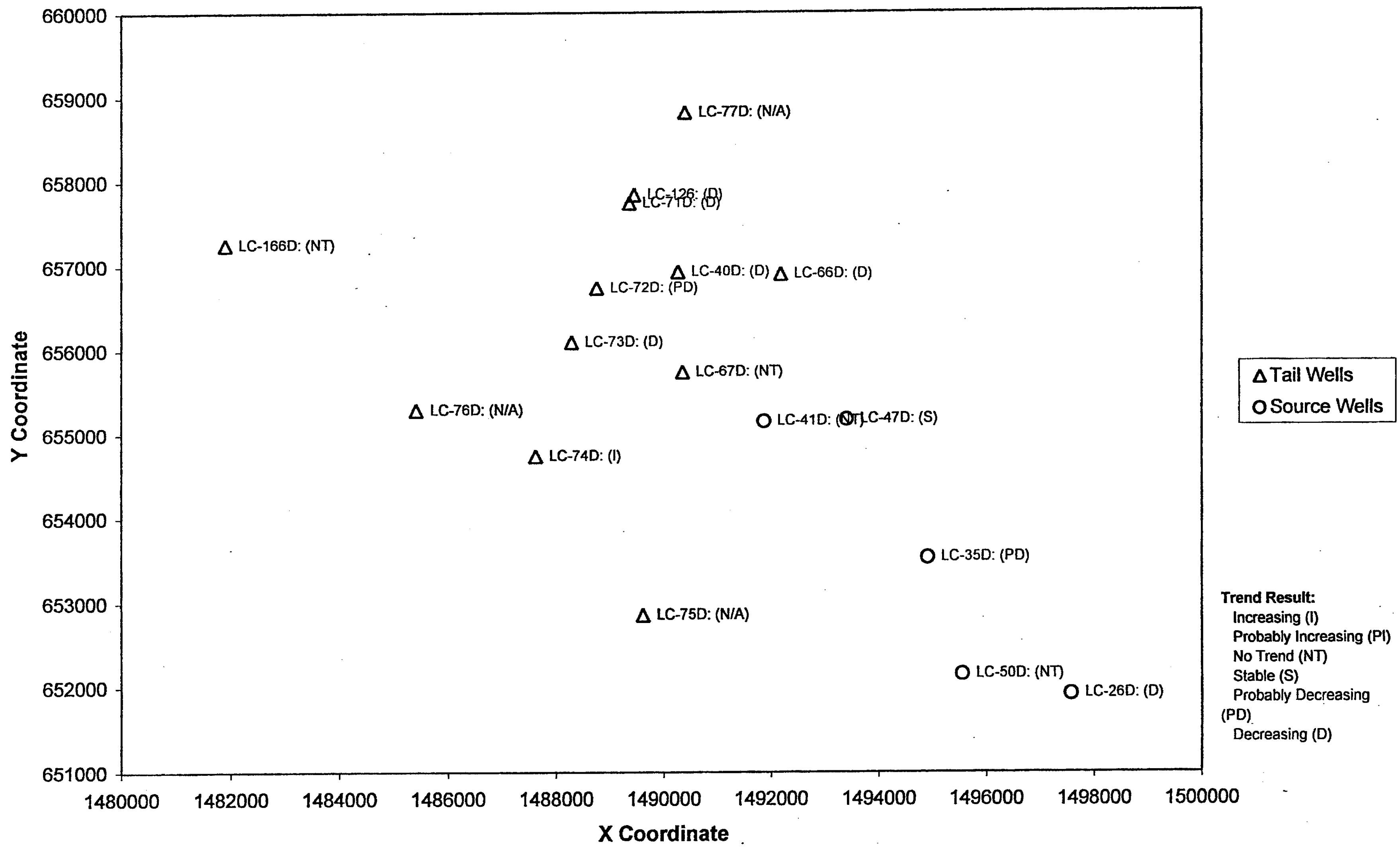
Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Trend Results for TRICHLOROETHYLENE (TCE)

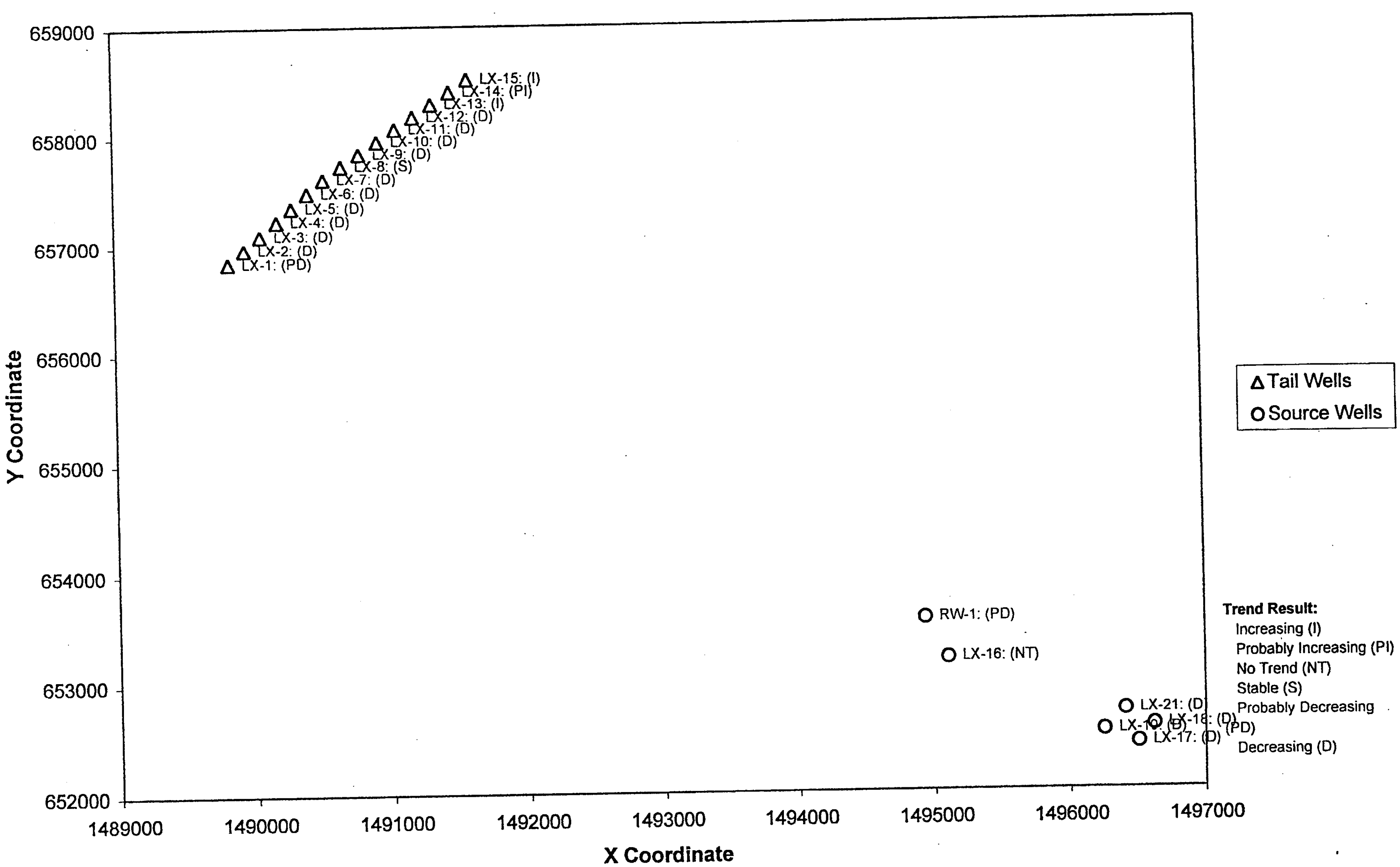


Trend Result:
Increasing (I)
Probably Increasing (PI)
No Trend (NT)
Stable (S)
Probably Decreasing (PD)
Decreasing (D)

Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



MAROS Sampling Frequency Optimization Results

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft. Lewis **State** Washington

Analysis by Modified CES Method

Number of Sampling Events Anal 21

Recent Sampling Even **Fro** Q15 6/1/99

To Q20 9/1/00

Constituent	Well Name	ampling Frequenc	Frequency based on	Frequency based on
TRICHLOROETHYLENE (TCE)	LC-03	SemiAnnual	SemiAnnual	Annual
	LC-05	Annual	Annual	Annual
	LC-06	Quarterly	Quarterly	SemiAnnual
	LC-108	Annual	Annual	Annual
	LC-111b	Biennial	Annual	Annual
	LC-116b	Annual	Annual	Annual
	LC-122b	Biennial	Annual	Annual
	LC-128	Quarterly	Quarterly	Annual
	LC-132	Quarterly	Annual	Quarterly
	LC-134	Quarterly	Quarterly	Annual
	LC-136a	Quarterly	Quarterly	Quarterly
	LC-136b	Annual	Annual	Annual
	LC-137a	Quarterly	Quarterly	Annual
	LC-137b	Annual	Annual	Annual
	LC-137c	Annual	Annual	Annual
	LC-149c	Biennial	Annual	Annual
	LC-149d	Biennial	Annual	Annual
	LC-14a	Annual	Annual	Annual
	LC-162	Annual	Annual	Annual
	LC-165	Biennial	Annual	Annual
	LC-19a	Annual	Annual	SemiAnnual
	LC-19b	Annual	Annual	Annual
	LC-19c	Annual	Annual	Annual
	LC-21c	SemiAnnual	SemiAnnual	SemiAnnual

Projec Ft Lewis Log Center **User Nam** Seattle District

Location: Ft. Lewis **State** Washington

LC-26	Biennial	Annual	Annual
LC-41a	Annual	Annual	Annual
LC-44a	SemiAnnual	SemiAnnual	Annual
LC-49	Quarterly	Quarterly	Annual
LC-51	Quarterly	Annual	Quarterly
LC-53	Quarterly	Annual	Quarterly
LC-64a	Quarterly	Annual	Quarterly
LC-64b	Annual	Annual	Annual
LC-66a	Annual	Annual	Annual
LC-66b	Annual	Annual	Annual
LC-73a	Biennial	Annual	Annual
PA-381	Annual	Annual	Annual
PA-383	Annual	Annual	Annual
T-01	SemiAnnual	SemiAnnual	SemiAnnual
T-04	Annual	Annual	Annual
T-08	Annual	Annual	Annual
T-12B	Annual	Annual	Annual
T-13b	Annual	Annual	Annual

Note:Modified CES (LLNL) method results in a recommended sampling interval for each well. This is based on analysis of concentration trend, so looks at specified sampling interval.

Summary - Final Recommendation for Sampling Fre

Well Name	Sampling Frequency
LC-03	SemiAnnual
LC-05	Annual
LC-06	Quarterly
LC-108	Annual
LC-111b	Biennial
LC-116b	Annual
LC-122b	Biennial
LC-128	Quarterly
LC-132	Quarterly
LC-134	Quarterly
LC-136a	Quarterly
LC-136b	Annual

LC-137a	Quarterly
LC-137b	Annual
LC-137c	Annual
LC-149c	Biennial
LC-149d	Biennial
LC-14a	Annual
LC-162	Annual
LC-165	Biennial
LC-19a	Annual
LC-19b	Annual
LC-19c	Annual
LC-21c	SemiAnnual
LC-26	Biennial
LC-41a	Annual
LC-44a	SemiAnnual
LC-49	Quarterly
LC-51	Quarterly
LC-53	Quarterly
LC-64a	Quarterly
LC-64b	Annual
LC-66a	Annual
LC-66b	Annual
LC-73a	Biennial
PA-381	Annual
PA-383	Annual
T-01	SemiAnnual
T-04	Annual
T-08	Annual
T-12B	Annual
T-13b	Annual

Note: the most stringent sampling frequency was chosen among all COCs.

MAROS Sampling Frequency Optimization Results

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft Lewis **State** Washington

Analysis by Modified CES Method

Number of Sampling Events Anal 21

Recent Sampling Even **Fro** Q15 6/1/99

To Q20 9/1/00

Constituent	Well Name	ampling Frequenc	Frequency based on	Frequency based on
TRICHLOROETHYLENE (TCE)	LC-126	Annual	Annual	Annual
	LC-166D	Biennial	Annual	Annual
	LC-26D	Biennial	Annual	Annual
	LC-35D	Biennial	Annual	Annual
	LC-40D	Annual	Annual	Annual
	LC-41D	Annual	Annual	Annual
	LC-47D	Biennial	Annual	Annual
	LC-50D	Annual	Annual	Annual
	LC-66D	Annual	Annual	Annual
	LC-67D	Annual	Annual	Annual
	LC-71D	Biennial	Annual	Annual
	LC-72D	Annual	Annual	Annual
	LC-73D	Annual	Annual	Annual
	LC-74D	SemiAnnual	Annual	SemiAnnual
	LC-75D	Annual	Annual	Annual
	LC-76D	Annual	Annual	Annual
	LC-77D	Quarterly	Quarterly	Quarterly

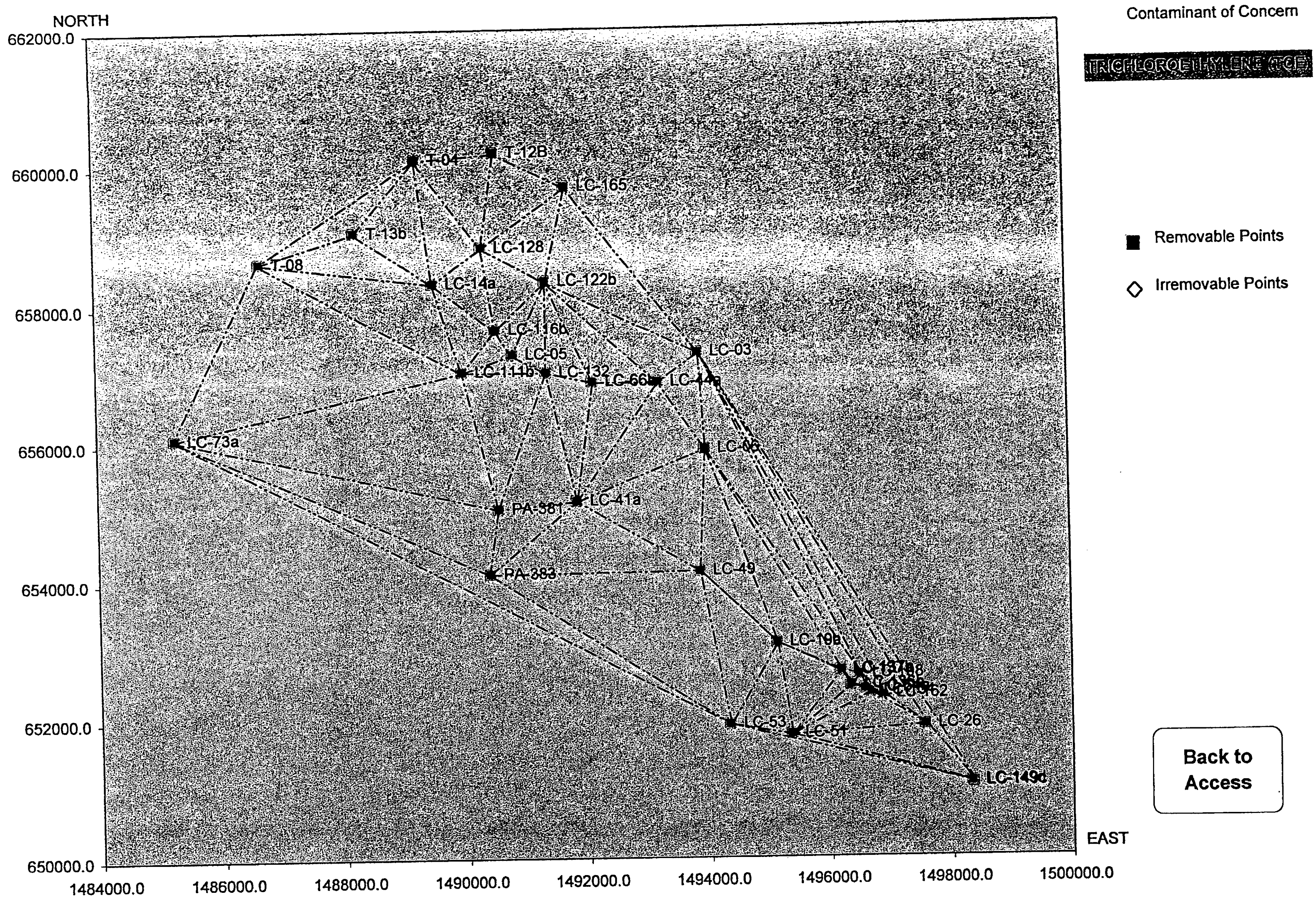
Note:Modified CES (LLNL) method results in a recommended sampling interval for each well. This is based on analysis of concentration trend, so looks at specified sampling interval.

Summary - Final Recommendation for Sampling Fre

Well Name	Sampling Frequency
LC-126	Annual
LC-166D	Biennial

LC-26D	Biennial
LC-35D	Biennial
LC-40D	Annual
LC-41D	Annual
LC-47D	Biennial
LC-50D	Annual
LC-66D	Annual
LC-67D	Annual
LC-71D	Biennial
LC-72D	Annual
LC-73D	Annual
LC-74D	SemiAnnual
LC-75D	Annual
LC-76D	Annual
LC-77D	Quarterly

Note: the most stringent sampling frequency was chosen among all COCs.



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1484000.0
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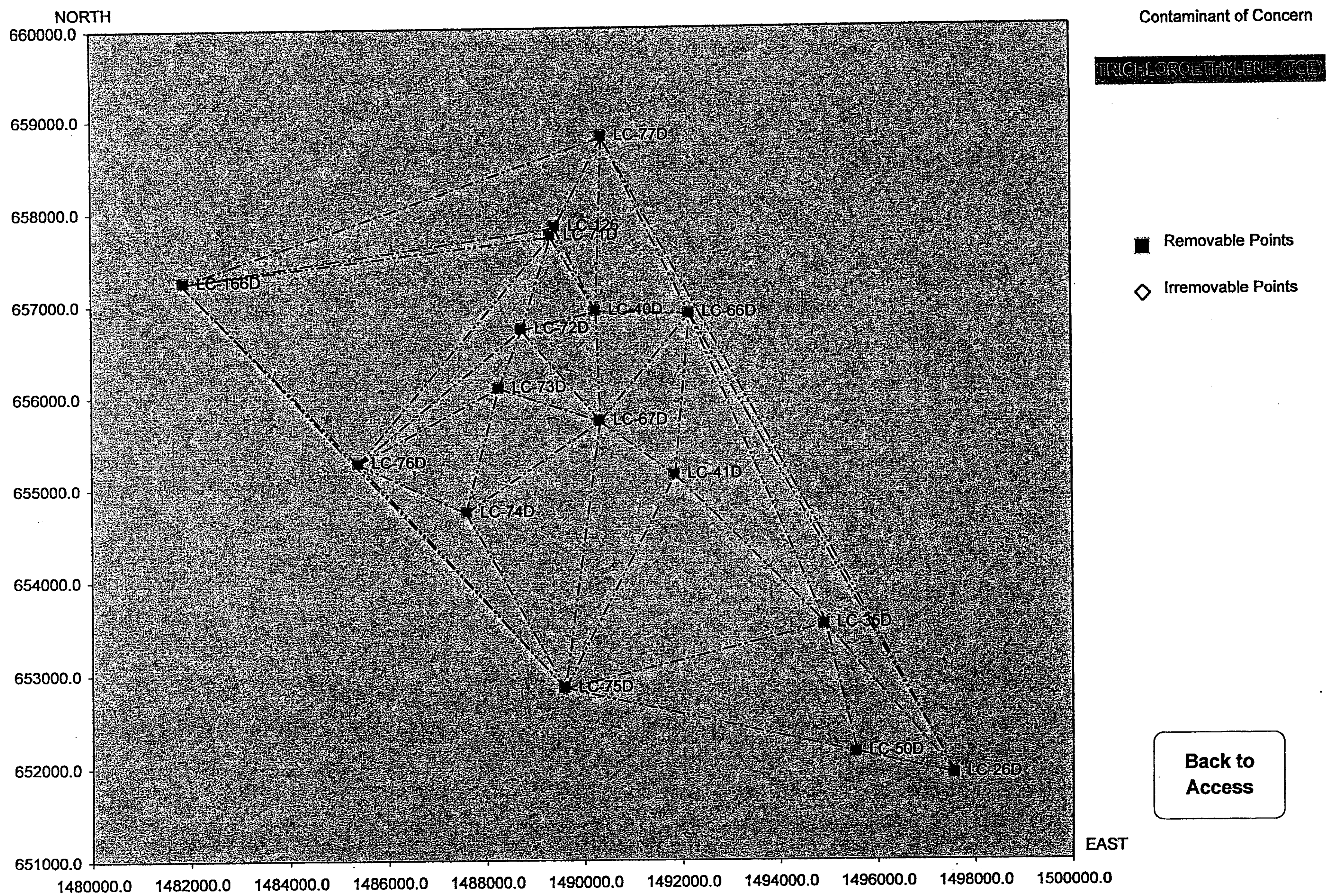
1492000.0
1494000.0
1496000.0
1498000.0
1500000.0
EAST
T-04
T-12B
LC-165
T-13b
LC-128
T-08
LC-14a
LC-122b
LC-116b
LC-05
LC-03
LC-111b
LC-132
LC-66b
LC-44a
LC-73a
LC-06
LC-41a
PA-381
PA-383
LC-49
LC-19b
LC-62
LC-53
LC-51
LC-26
LC-149d
Contaminant of Concern
TRICHLOROETHYLENE (TCE)
Removable Points
Irremovable Points
Back to Access



NORTH
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LC-77D
LC-126
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LC-166D
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Contaminant of Concern
TRICHLOROETHYLENE (TCE)
Removable Points
Irremovable Points
Back to Access

Summary – Final Recommendation for Sampling Locations
MAROS Output for Quarterly Sample Frequency Data Set

Shallow Wells Recommended for Elimination from TCE Sampling:

LC-137a
LC-162
LC-19a
LC-19b
LC-19c
LC-41a
LC-44a
LC-49
LC-51
LC-66a
LC-66b
T-01
T-04
T-08

MAROS Sampling Location Optimization Results

Projec Ft Lewis Log Center | **User Nam** Seattle District

Locatio Ft Lewis | **State** Washington

Analysis by DeLauney Method

Sampling Events Analyz **Fro** Q20 9/1/00
To Q20 9/1/00

Constituen	Well Name	Average Slope Fact	Eliminated?
TRICHLOROETHYLENE (TCE)	LC-67D	0.000	☑
	LC-166D	0.000	☐
	LC-26D	0.000	☐
	LC-35D	0.000	☐
	LC-40D	0.000	☑
	LC-41D	0.000	☐
	LC-126	0.000	☐
	LC-66D	0.000	☑
	LC-77D	0.000	☐
	LC-71D	0.000	☐
	LC-72D	0.000	☑
	LC-73D	0.000	☑
	LC-74D	0.000	☐
	LC-75D	0.000	☐
	LC-76D	0.000	☐
	LC-50D	0.000	☐

Note: The Delauney method results tell how important a well is in a given sampling event. The larger the SF value of a well, the more important it is.

Abandoned Sampling Locations by considering al

Well Name	East Coord.	North Coord	Abandoned?
LC-126	1489440.750	657844.250	☐
LC-166D	1481894.875	657255.313	☐
LC-26D	1497564.000	651917.000	☐
LC-35D	1494905.000	653530.000	☐

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft Lewis **State** Washington

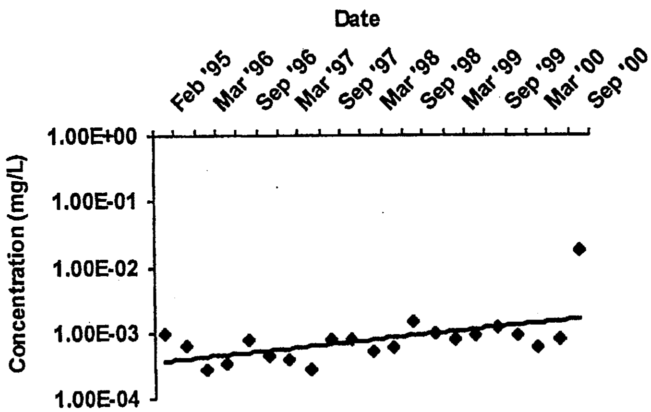
LC-40D	1490263.000	656927.250	☑
LC-41D	1491859.000	655154.000	☐
LC-50D	1495547.000	652150.000	☐
LC-66D	1492176.000	656900.188	☑
LC-67D	1490344.000	655739.000	☑
LC-71D	1489354.875	657746.188	☐
LC-72D	1488748.500	656735.750	☑
LC-73D	1488279.875	656095.375	☑
LC-74D	1487615.375	654744.000	☐
LC-75D	1489606.750	652853.438	☐
LC-76D	1485410.125	655289.375	☐
LC-77D	1490387.750	658817.813	☐

To be conservative, a location is abandoned only when it is eliminated from all COCs.

Linear Regression Plot

Well: LC-03

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (●) Log
- ( ) Linear

COV: 2.428

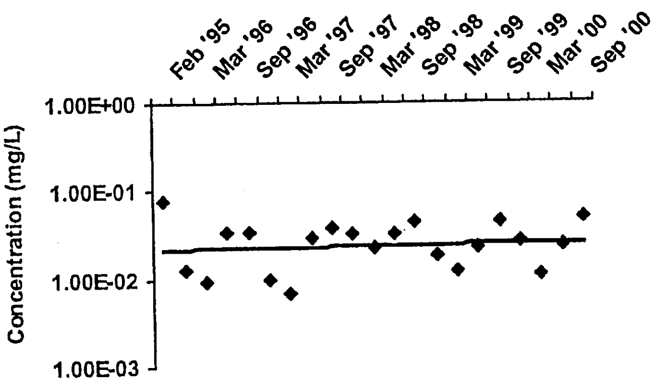
Confidence in Trend: 99.1%

Ln Slope: 7.4E-04

Concentration Trend: I

Linear Regression Plot

Well LC-05 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.610

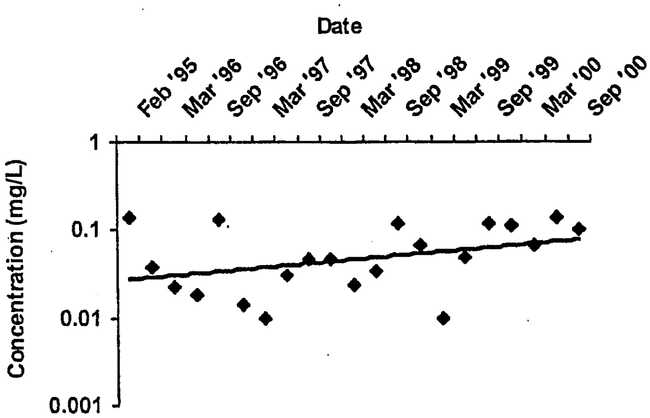
Confidence in Trend: 57.3%

Ln Slope: 4.6E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-06 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.728

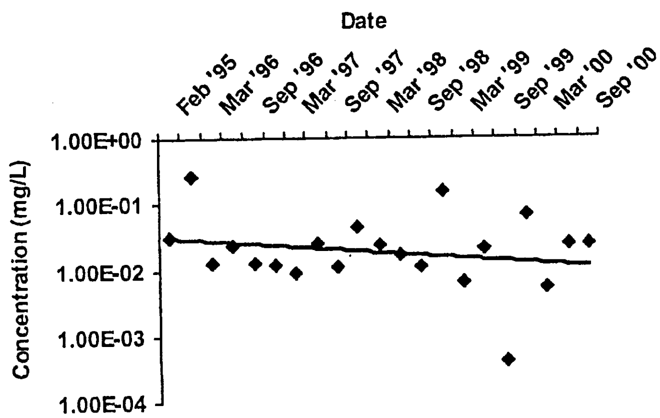
Confidence in Trend: 93.0%

Ln Slope: 5.0E-04

Concentration Trend: PI

Linear Regression Plot

Well LC-108 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 1.618

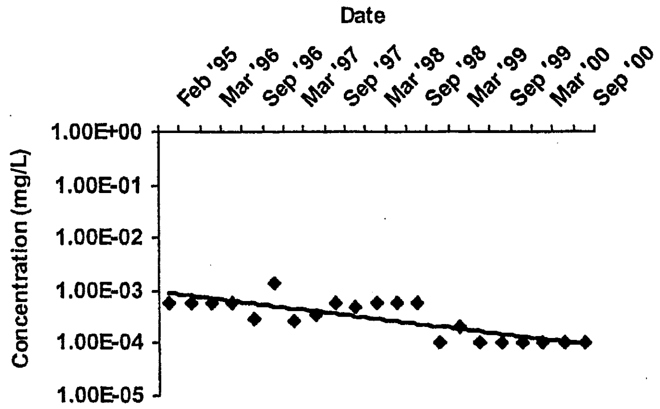
Confidence in Trend: 100.0%

Ln Slope: -5.5E-04

Concentration Trend: D

Linear Regression Plot

Well LC-111b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.786

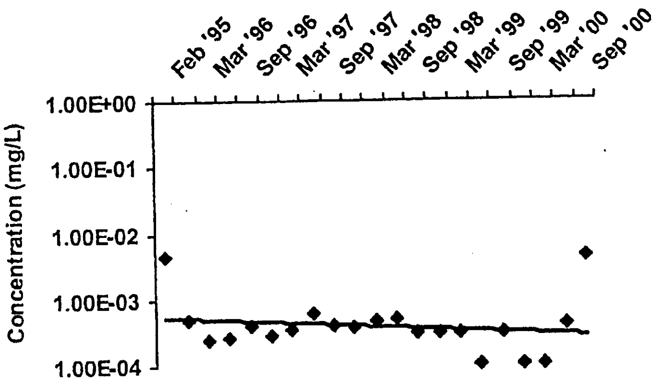
Confidence in Trend: 100.0%

Ln Slope: -1.2E-03

Concentration Trend: D

Linear Regression Plot

Well LC-116b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 1.687

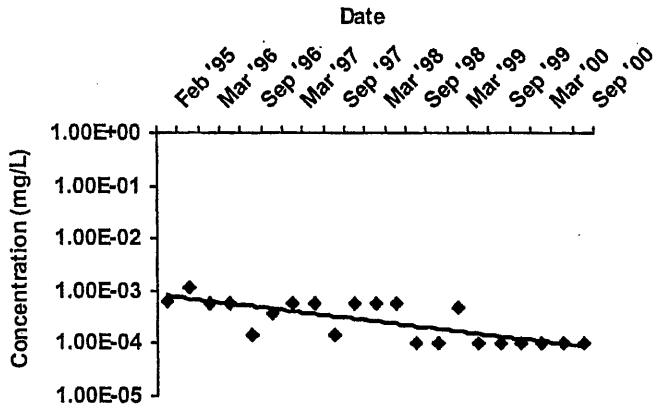
Confidence in Trend: 100.0%

Ln Slope: -4.3E-04

Concentration Trend: D

Linear Regression Plot

Well LC-122b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- ◉ **Log**
- ○ **Linear**

COV: 0.790

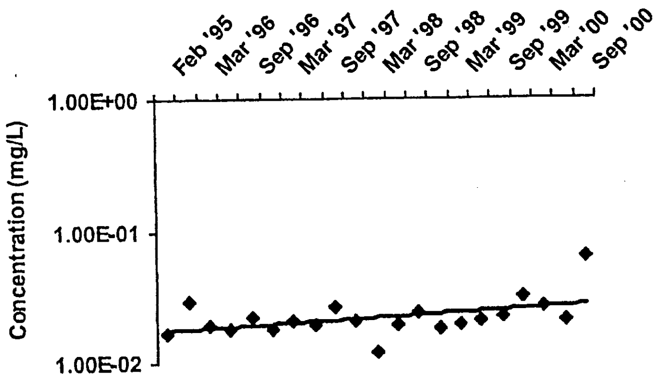
Confidence in Trend: 100.0%

Ln Slope: -1.1E-03

Concentration Trend: D

Linear Regression Plot

Well LC-128 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.428

Confidence in Trend: 97.0%

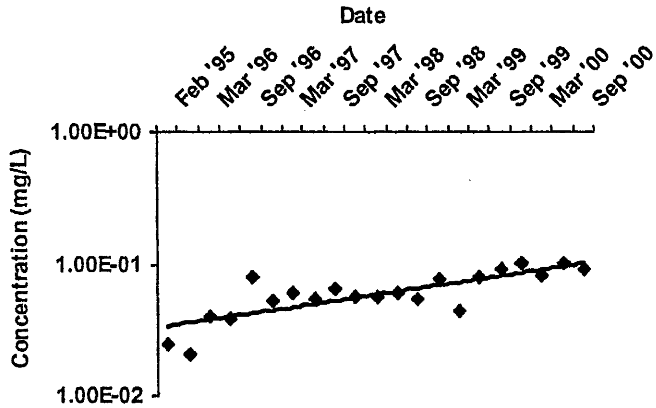
Ln Slope: 2.3E-04

Concentration Trend: I

Linear Regression Plot

Well: LC-132

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (•) Log
- ( ) Linear

COV: 0.361

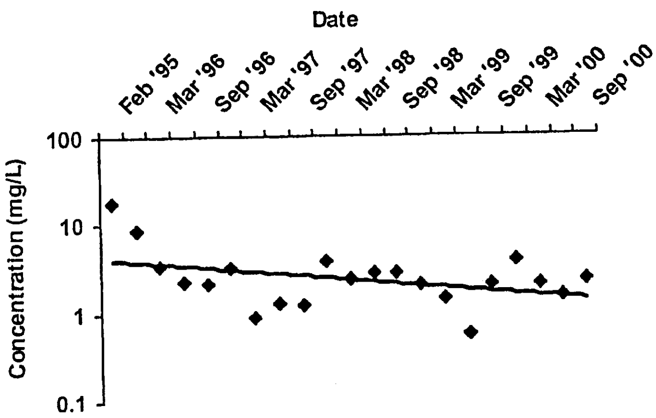
Confidence in Trend: 100.0%

Ln Slope: 5.9E-04

Concentration Trend: I

Linear Regression Plot

Well LC-134 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 1.163

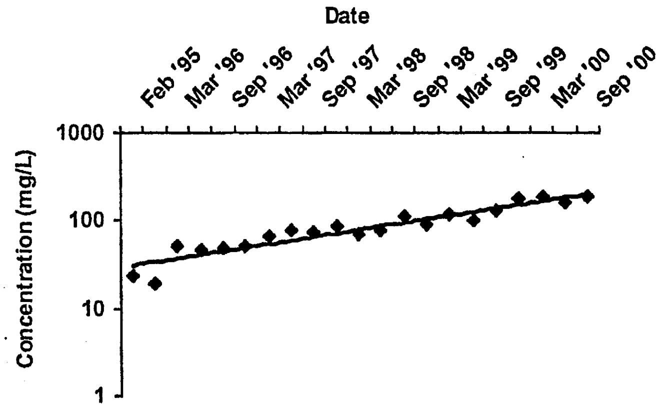
Confidence in Trend: 100.0%

Ln Slope: -6.2E-04

Concentration Trend: D

Linear Regression Plot

Well LC-136a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.550

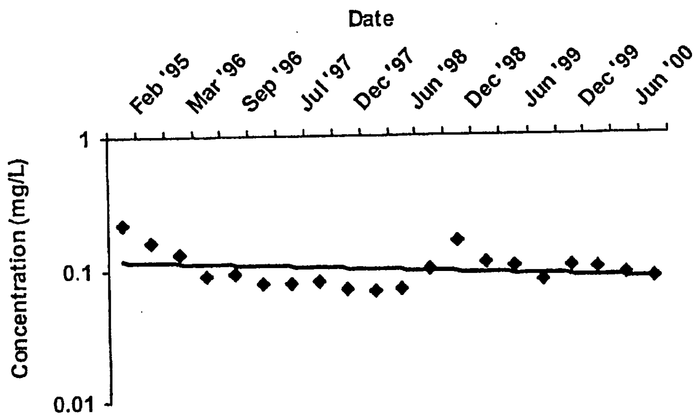
Confidence in Trend: 100.0%

Ln Slope: 1.0E-03

Concentration Trend: I

Linear Regression Plot

Well LC-136b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.373

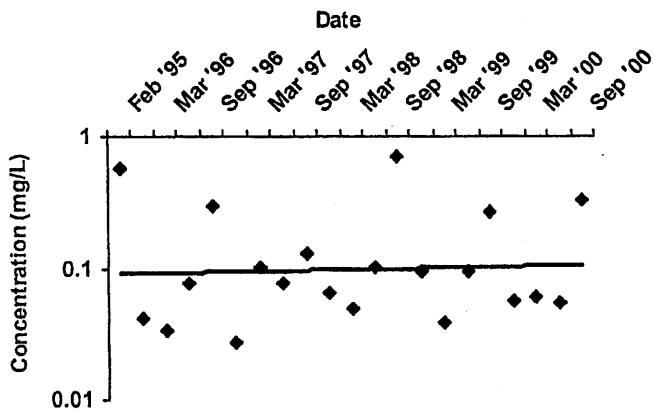
Confidence in Trend: 100.0%

Ln Slope: -2.1E-04

Concentration Trend: D

Linear Regression Plot

Well LC-137a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 1.176

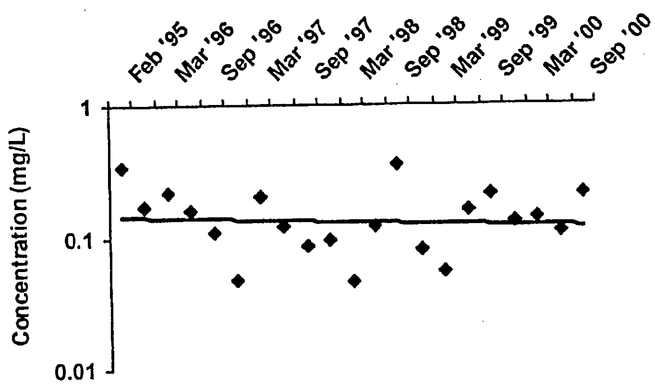
Confidence in Trend: 52.3%

Ln Slope: 2.1E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-137b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.554

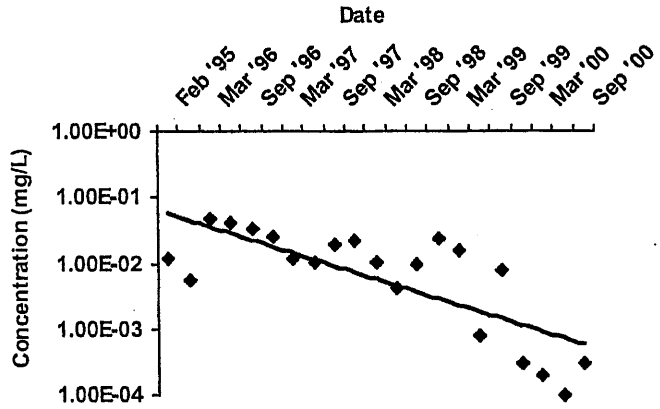
Confidence in Trend: 100.0%

Ln Slope: -1.3E-04

Concentration Trend: D

Linear Regression Plot

Well LC-137c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

◉ **Log**

○ **Linear**

COV: 0.947

Confidence in Trend: 100.0%

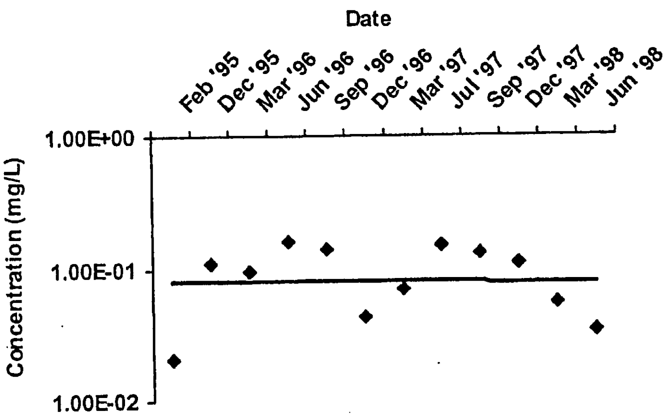
Ln Slope: -2.4E-03

Concentration Trend: D

Linear Regression Plot

Well: LC-144a

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.515

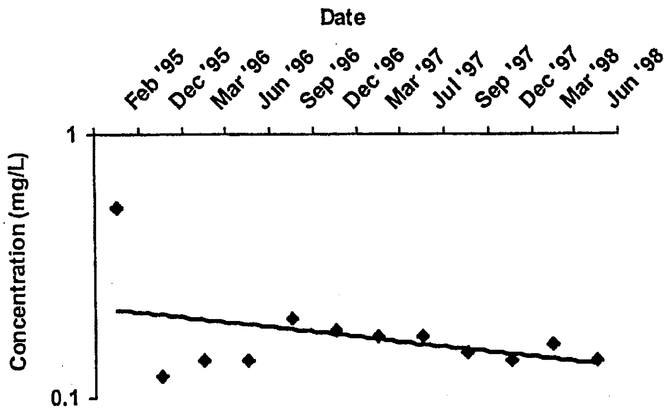
Confidence in Trend: 63.1%

Ln Slope: 2.0E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-144b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.591

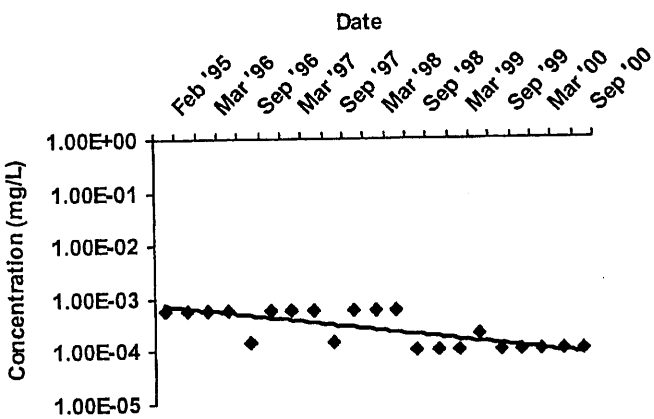
Confidence in Trend: 100.0%

Ln Slope: -5.5E-04

Concentration Trend: D

Linear Regression Plot

Well LC-149c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.713

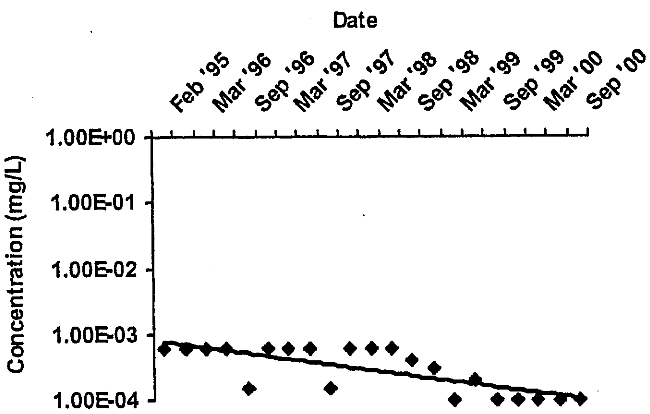
Confidence in Trend: 100.0%

Ln Slope: -1.1E-03

Concentration Trend: D

Linear Regression Plot

Well LC-149d **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.631

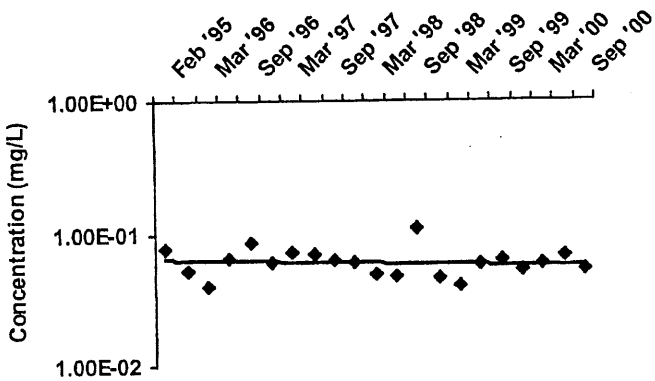
Confidence in Trend: 100.0%

Ln Slope: -1.0E-03

Concentration Trend: D

Linear Regression Plot

Well LC-14a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.265

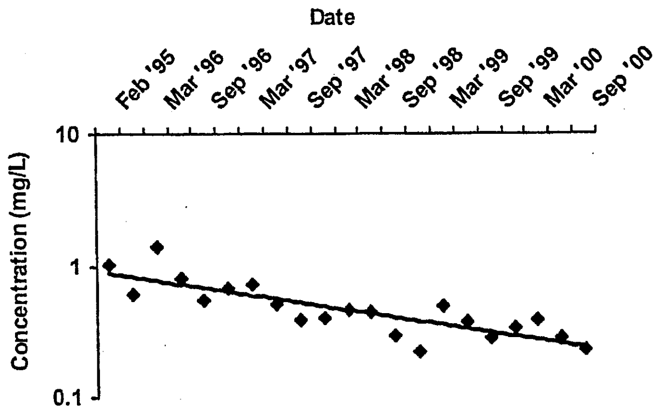
Confidence in Trend: 100.0%

Ln Slope: -7.9E-05

Concentration Trend: D

Linear Regression Plot

Well LC-162 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.551

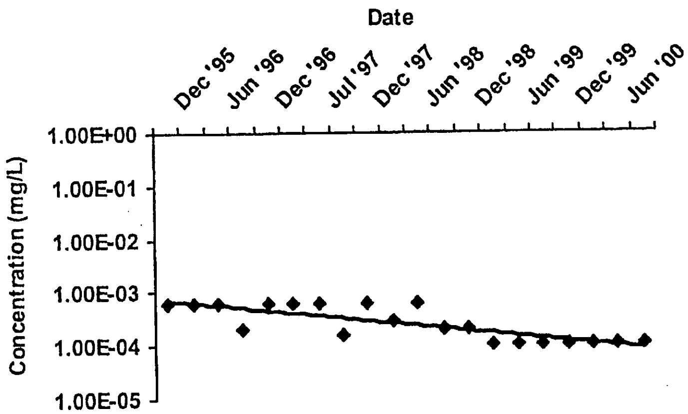
Confidence in Trend: 100.0%

Ln Slope: -6.8E-04

Concentration Trend: D

Linear Regression Plot

Well LC-165 Chemical TRICHLOROETHYLENE (TCE)



Graph Type

- (●) **Log**
- ( ) **Linear**

COV: 0.715

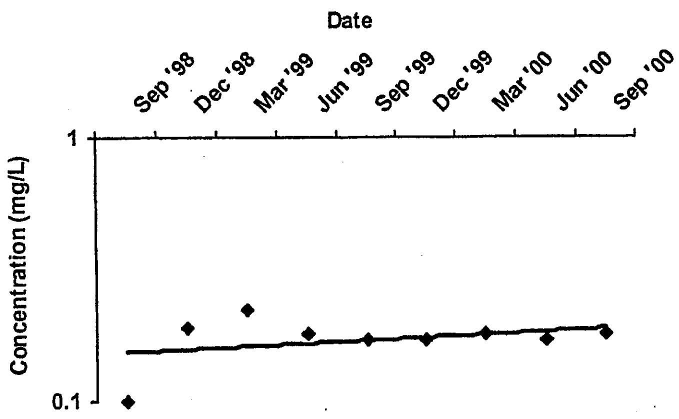
Confidence in Trend: 100.0%

Ln Slope: -1.2E-03

Concentration Trend: D

Linear Regression Plot

Well LC-19a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (●) **Log**
- ( ) **Linear**

COV: 0.182

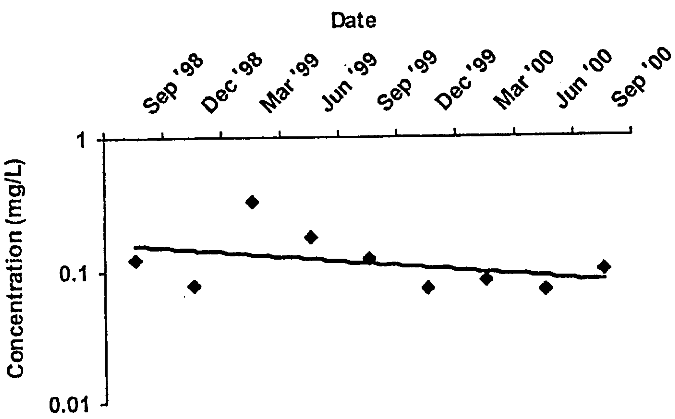
Confidence in Trend: 80.7%

Ln Slope: 2.8E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-19b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.650

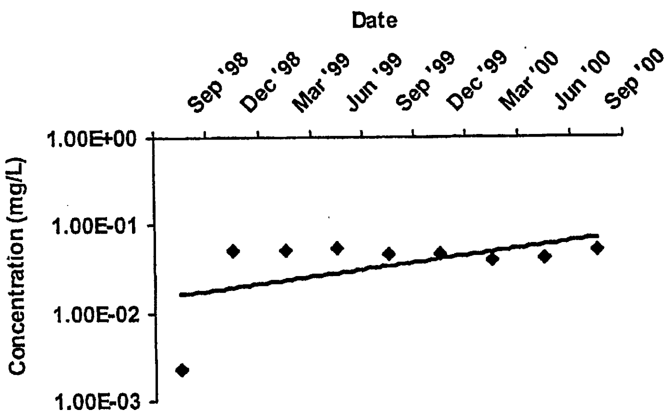
Confidence in Trend: 100.0%

Ln Slope: -8.8E-04

Concentration Trend: D

Linear Regression Plot

Well LC-19c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (●) **Log**
- ( ) **Linear**

COV: 0.375

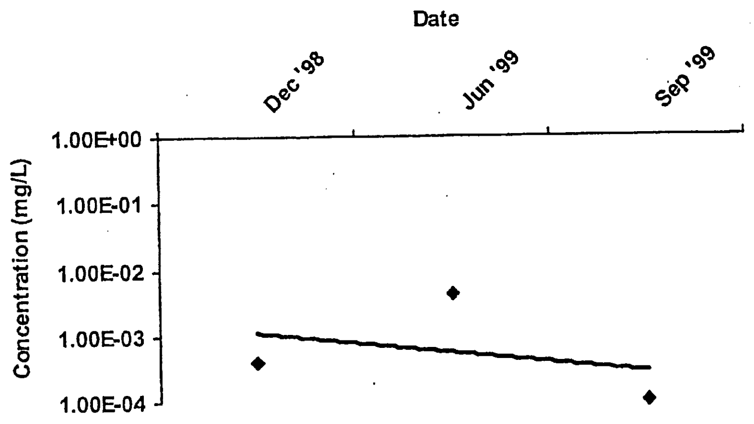
Confidence in Trend: 91.5%

Ln Slope: 2.0E-03

Concentration Trend: PI

Linear Regression Plot

Well LC-21c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.000

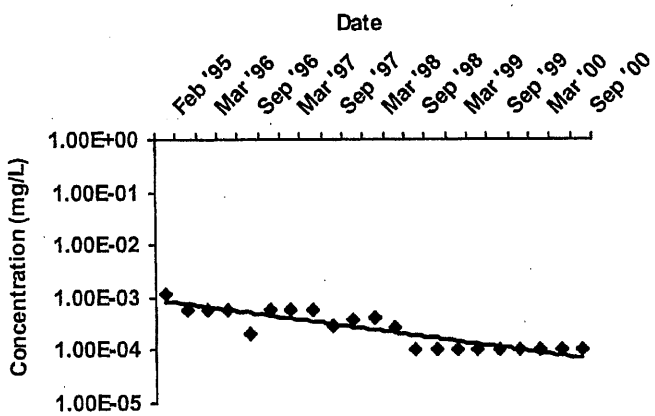
Confidence in Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well LC-26 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.840

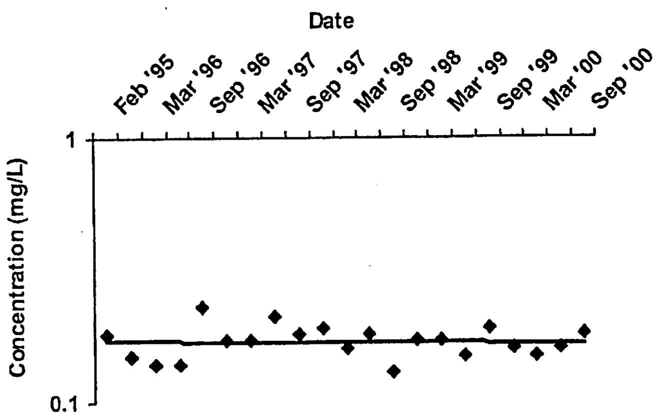
Confidence In Trend: 100.0%

Ln Slope: -1.3E-03

Concentration Trend: D

Linear Regression Plot

Well LC-41a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.140

Confidence in Trend: 100.0%

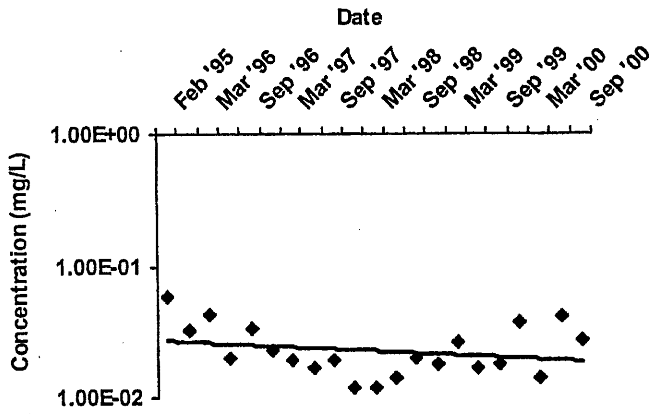
Ln Slope: -1.5E-05

Concentration Trend: D

Linear Regression Plot

Well: LC-44a

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.490

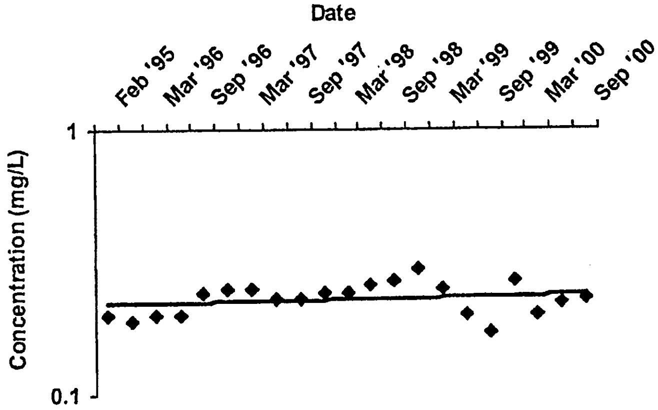
Confidence in Trend: 100.0%

Ln Slope: -2.1E-04

Concentration Trend: D

Linear Regression Plot

Well LC-49 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.138

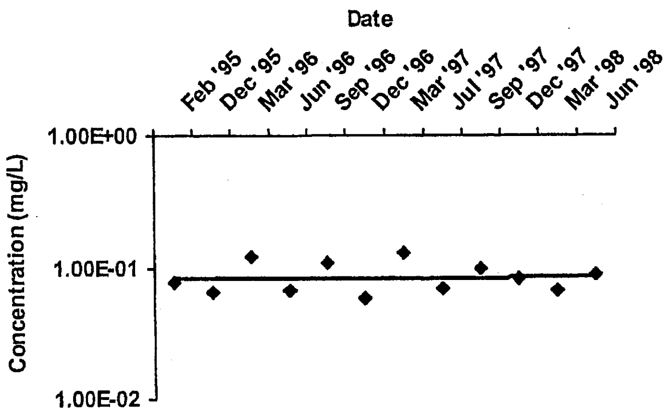
Confidence in Trend: 77.7%

Ln Slope: 4.2E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-49a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.271

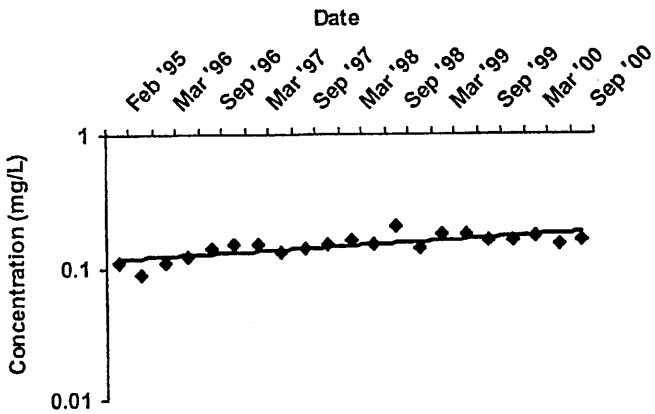
Confidence in Trend: 54.5%

Ln Slope: 2.6E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-51 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.177

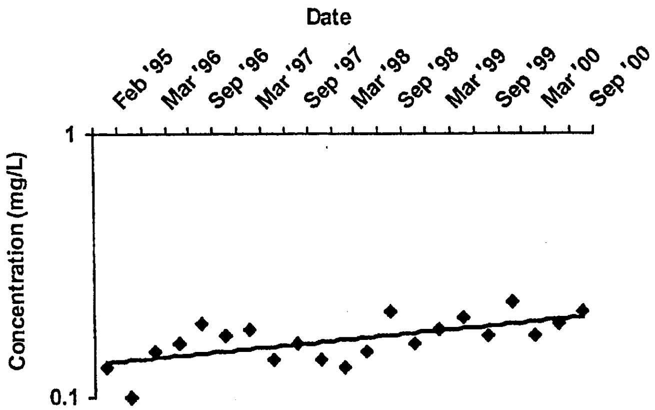
Confidence in Trend: 100.0%

Ln Slope: 2.4E-04

Concentration Trend: I

Linear Regression Plot

Well LC-53 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.187

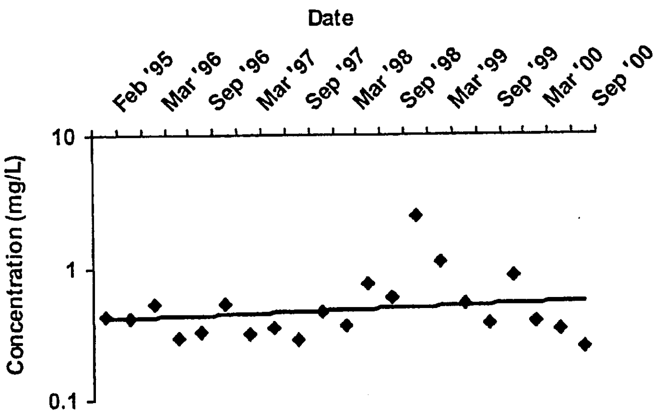
Confidence in Trend: 99.9%

Ln Slope: 2.1E-04

Concentration Trend: I

Linear Regression Plot

Well LC-64a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.834

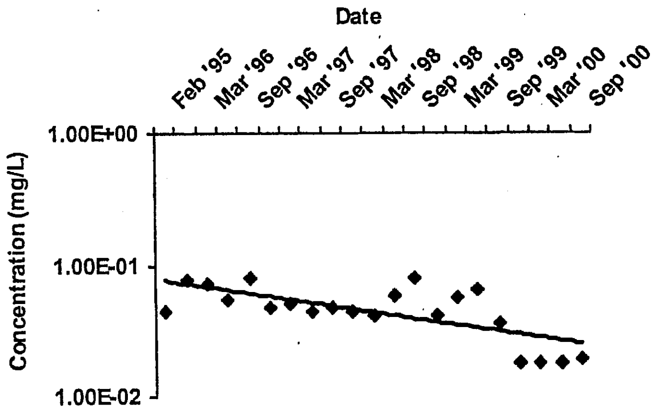
Confidence in Trend: 77.0%

Ln Slope: 1.5E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-64b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.409

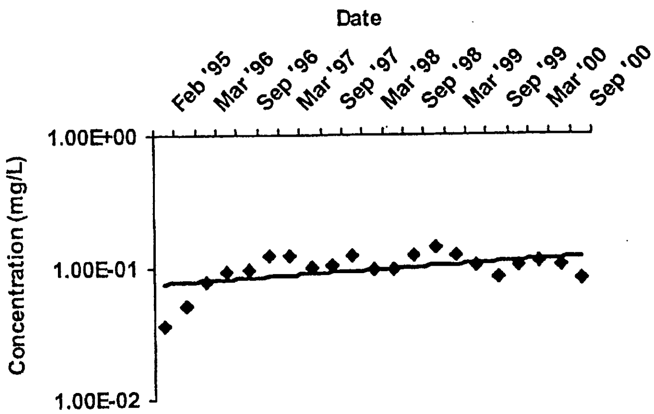
Confidence in Trend: 100.0%

Ln Slope: -5.7E-04

Concentration Trend: D

Linear Regression Plot

Well LC-66a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.244

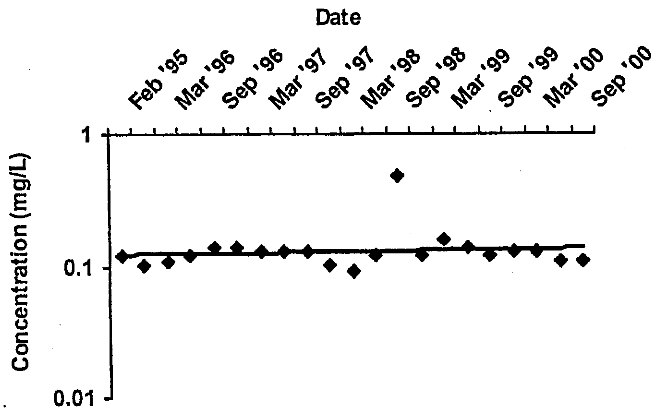
Confidence in Trend: 98.7%

Ln Slope: 2.6E-04

Concentration Trend: I

Linear Regression Plot

Well LC-66b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.570

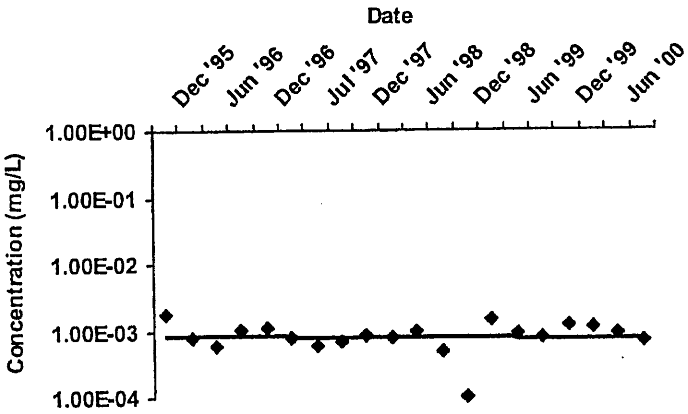
Confidence in Trend: 68.0%

Ln Slope: 6.1E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-73a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- ◉ **Log**
- ○ **Linear**

COV: 0.410

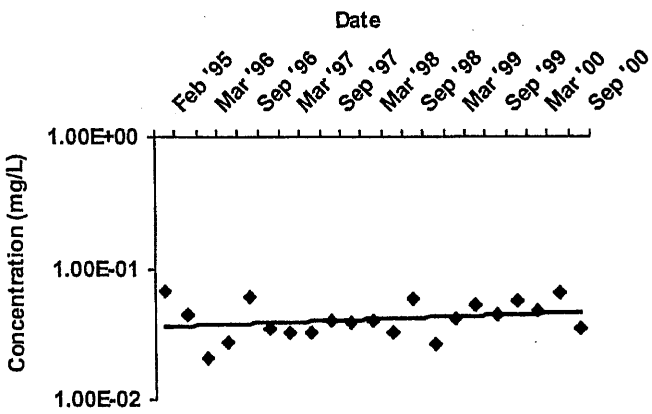
Confidence in Trend: 100.0%

Ln Slope: -8.9E-05

Concentration Trend: D

Linear Regression Plot

Well PA-381 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.309

Confidence in Trend: 81.4%

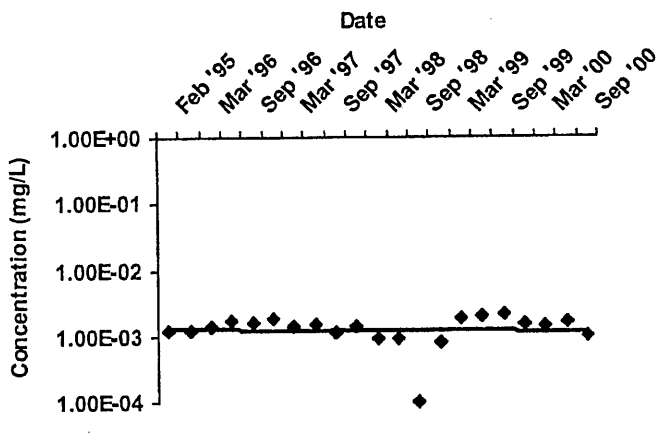
Ln Slope: 1.1E-04

Concentration Trend: NT

Linear Regression Plot

Well: PA-383

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (●) **Log**
- ( ) **Linear**

COV: 0.337

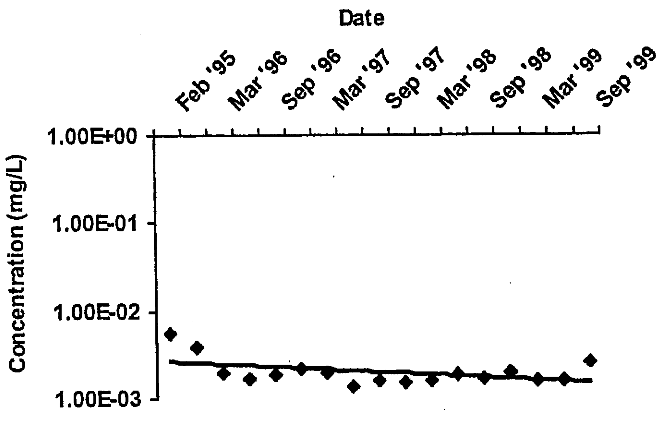
Confidence in Trend: 100.0%

Ln Slope: -5.3E-05

Concentration Trend: D

Linear Regression Plot

Well T-01 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.478

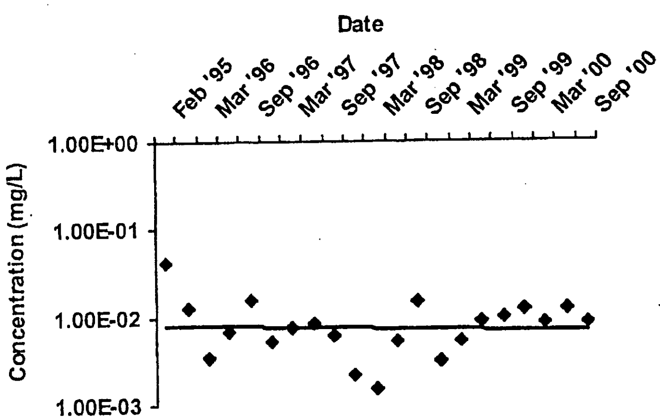
Confidence in Trend: 100.0%

Ln Slope: -4.0E-04

Concentration Trend: D

Linear Regression Plot

Well T-04 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.867

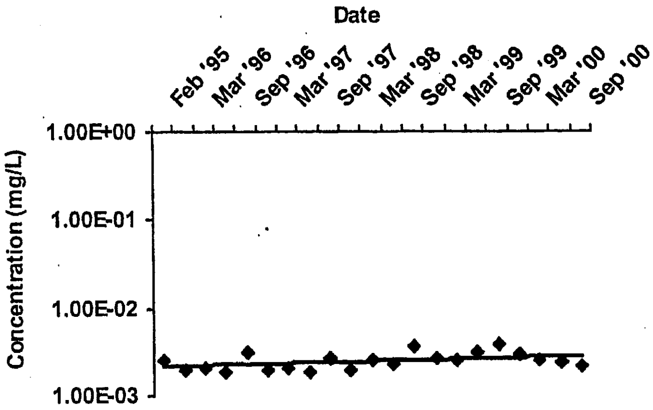
Confidence in Trend: 100.0%

Ln Slope: -1.5E-04

Concentration Trend: D

Linear Regression Plot

Well T-08 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.218

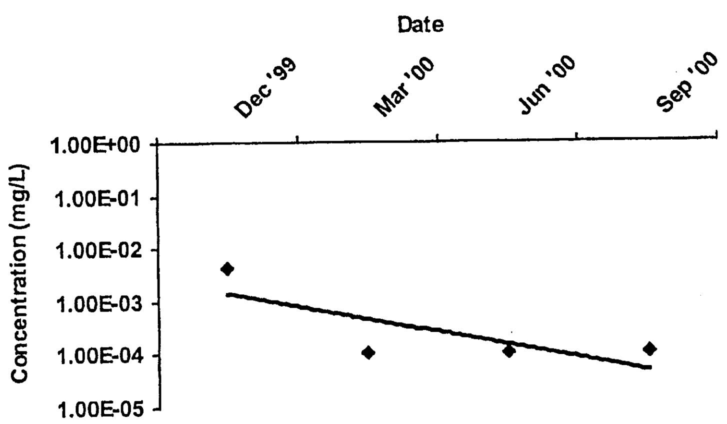
Confidence In Trend: 96.4%

Ln Slope: 1.4E-04

Concentration Trend: I

Linear Regression Plot

Well T-12B **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 1.830

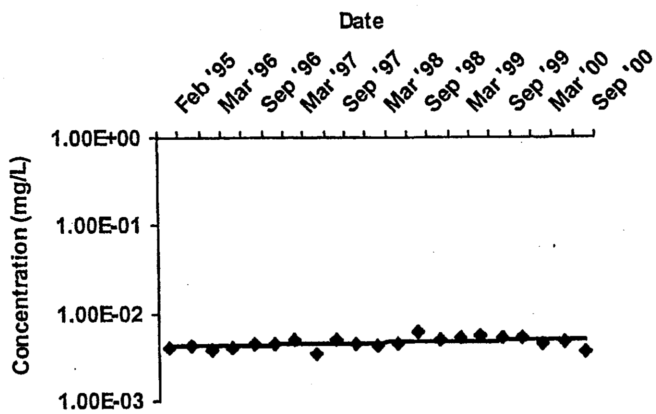
Confidence in Trend: 100.0%

Ln Slope: -1.2E-02

Concentration Trend: D

Linear Regression Plot

Well T-13b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ⦿ **Log**
- ○ **Linear**

COV: 0.144

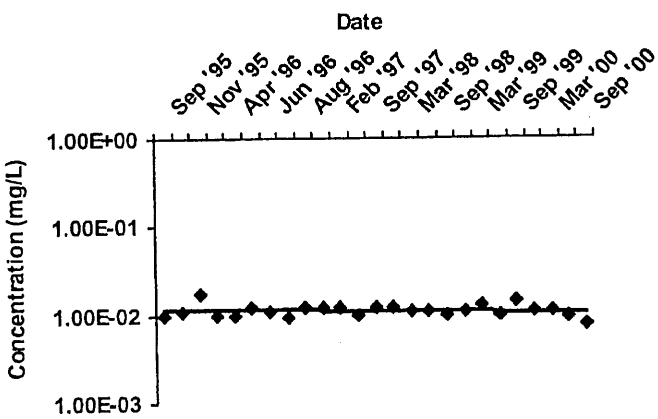
Confidence in Trend: 96.9%

Ln Slope: 1.0E-04

Concentration Trend: I

Linear Regression Plot

Well LX-1 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.164

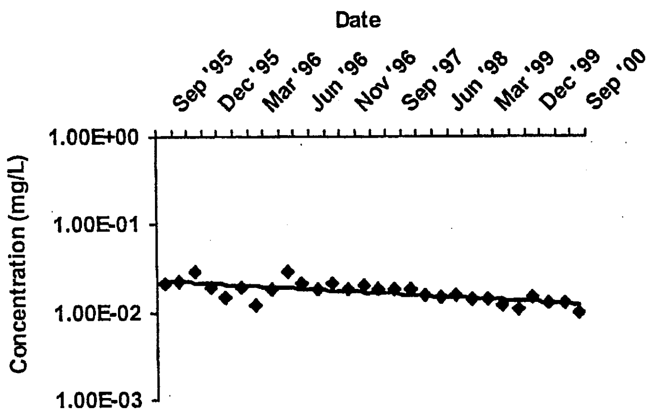
Confidence in Trend: 100.0%

Ln Slope: -7.0E-05

Concentration Trend: D

Linear Regression Plot

Well LX-2 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.270

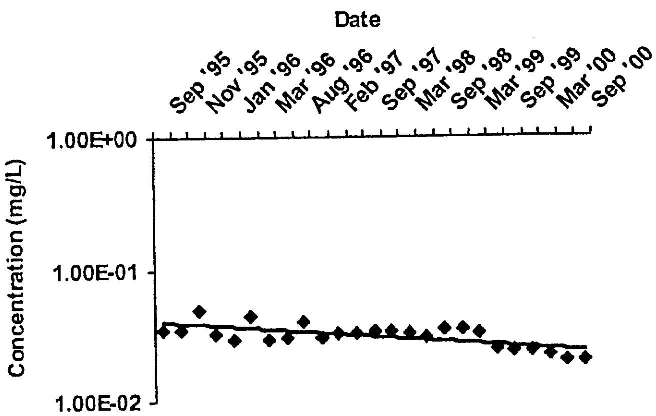
Confidence in Trend: 100.0%

Ln Slope: -3.3E-04

Concentration Trend: D

Linear Regression Plot

Well LX-3 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.220

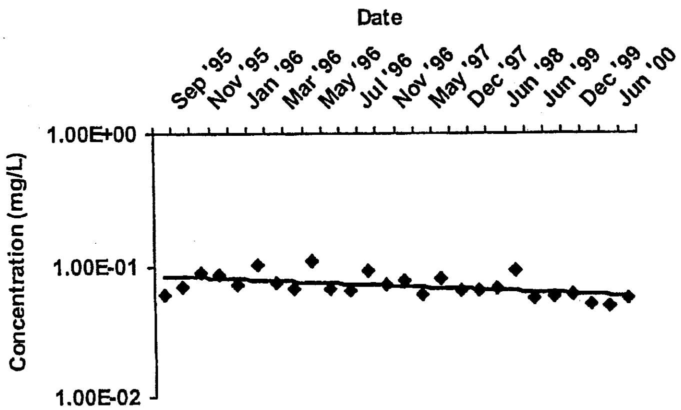
Confidence in Trend: 100.0%

Ln Slope: -2.7E-04

Concentration Trend: D

Linear Regression Plot

Well LX-4 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.209

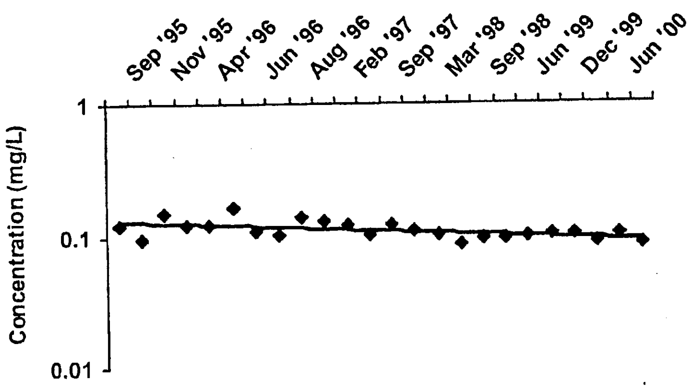
Confidence in Trend: 100.0%

Ln Slope: -2.0E-04

Concentration Trend: D

Linear Regression Plot

Well LX-5 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

◉ **Log**

○ **Linear**

COV: 0.180

Confidence in Trend: 100.0%

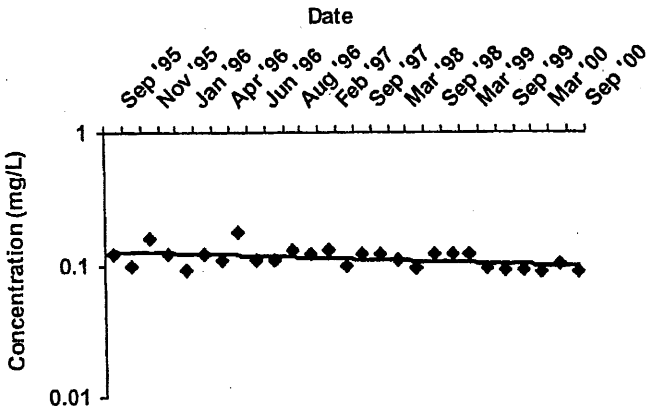
Ln Slope: -1.9E-04

Concentration Trend: D

Linear Regression Plot

Well: LX-6

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.181

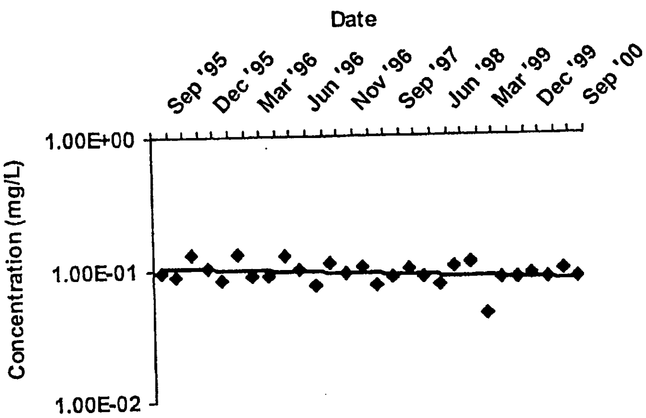
Confidence in Trend: 100.0%

Ln Slope: -1.5E-04

Concentration Trend: D

Linear Regression Plot

Well LX-7 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.192

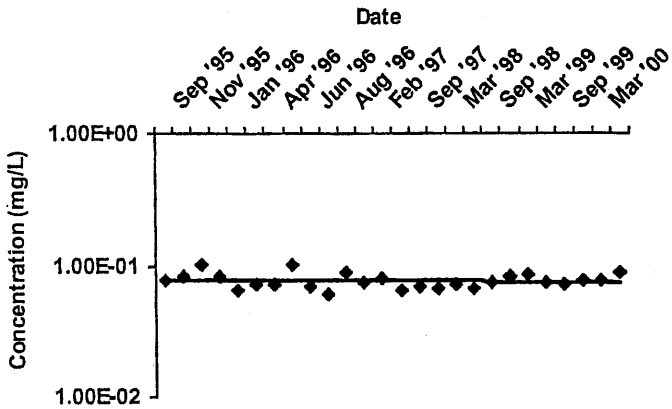
Confidence in Trend: 100.0%

Ln Slope: -1.3E-04

Concentration Trend: D

Linear Regression Plot

Well LX-8 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.133

Confidence in Trend: 100.0%

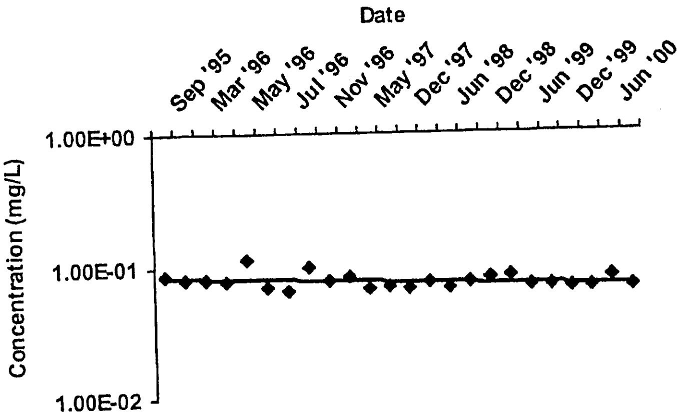
Ln Slope: -7.6E-06

Concentration Trend: D

Linear Regression Plot

Well: LX-9

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.141

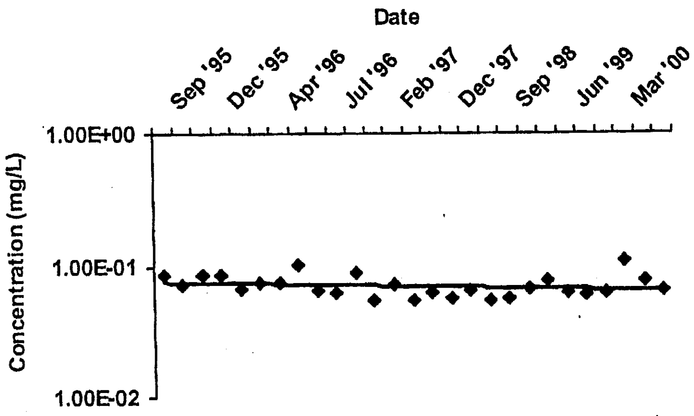
Confidence in Trend: 100.0%

Ln Slope: -9.4E-05

Concentration Trend: D

Linear Regression Plot

Well LX-10 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.201

Confidence in Trend: 100.0%

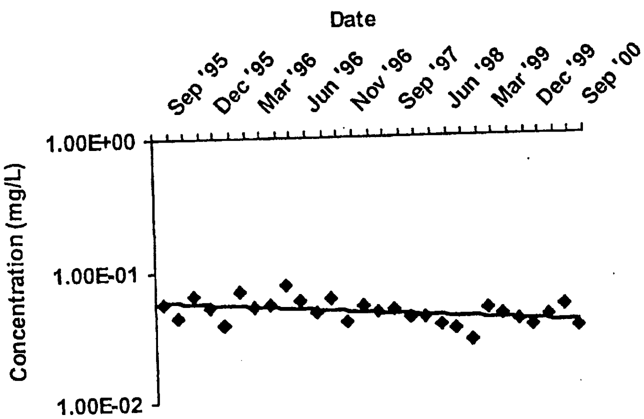
Ln Slope: -6.2E-05

Concentration Trend: D

Linear Regression Plot

Well: LX-11

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (●) Log
- ( ) Linear

COV: 0.234

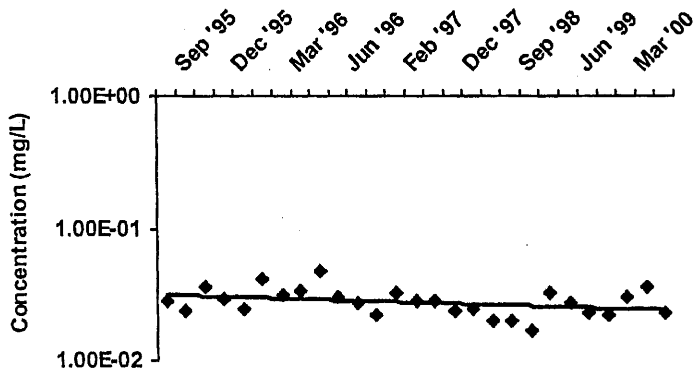
Confidence in Trend: 100.0%

Ln Slope: -2.3E-04

Concentration Trend: D

Linear Regression Plot

Well LX-12 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.241

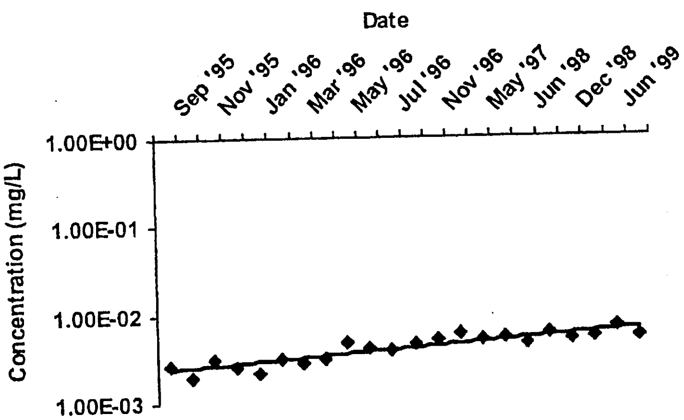
Confidence in Trend: 100.0%

Ln Slope: -1.4E-04

Concentration Trend: D

Linear Regression Plot

Well LX-13 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.318

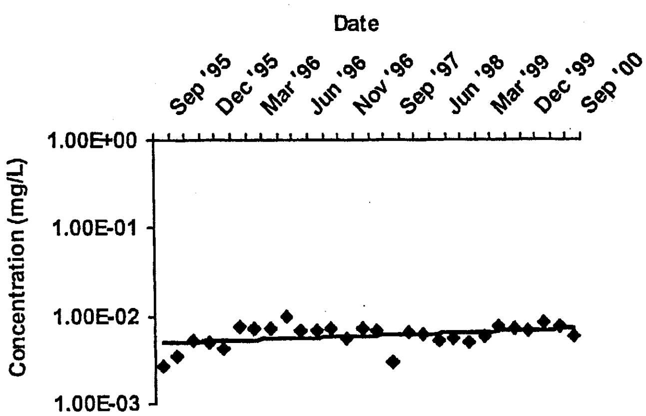
Confidence in Trend: 100.0%

Ln Slope: 5.0E-04

Concentration Trend: I

Linear Regression Plot

Well LX-14 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.261

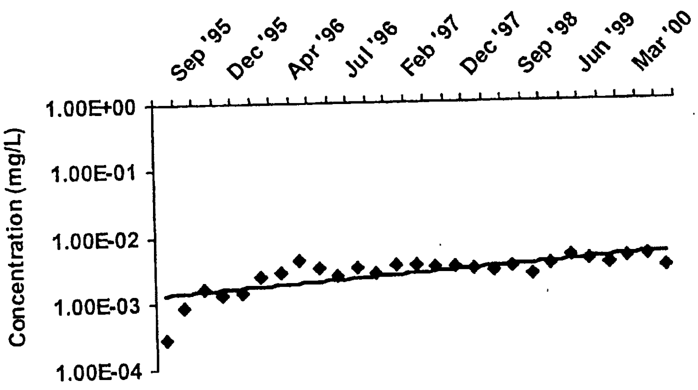
Confidence in Trend: 92.9%

Ln Slope: 1.4E-04

Concentration Trend: PI

Linear Regression Plot

Well LX-15 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.369

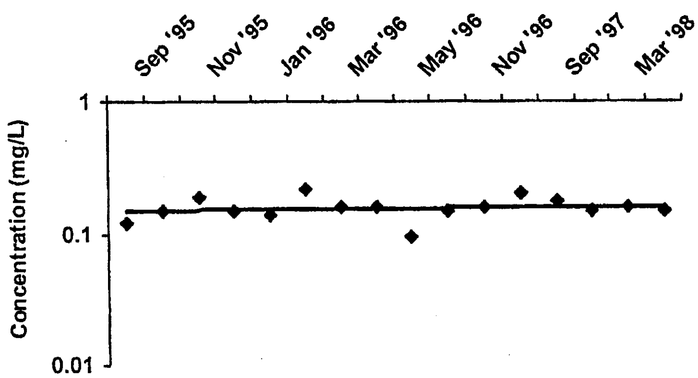
Confidence in Trend: 99.9%

Ln Slope: 5.8E-04

Concentration Trend: I

Linear Regression Plot

Well LX-16 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.187

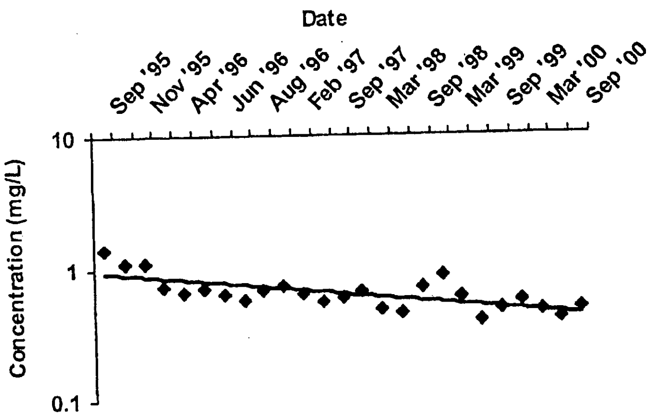
Confidence in Trend: 69.0%

Ln Slope: 7.9E-05

Concentration Trend: NT

Linear Regression Plot

Well LX-17 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.361

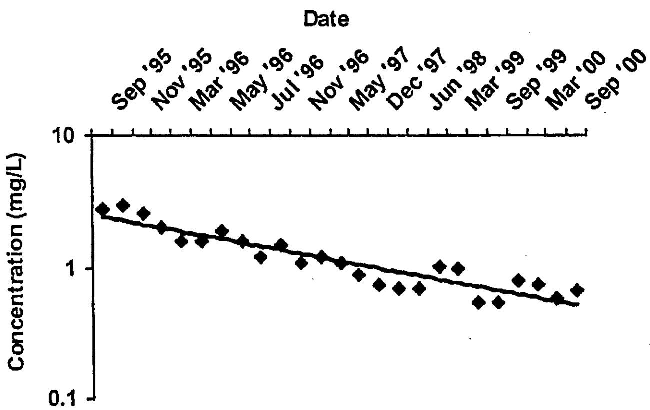
Confidence in Trend: 100.0%

Ln Slope: -3.8E-04

Concentration Trend: D

Linear Regression Plot

Well LX-18 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.553

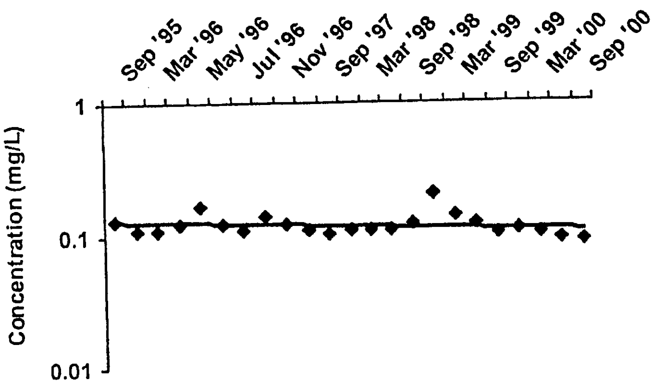
Confidence in Trend: 100.0%

Ln Slope: -7.5E-04

Concentration Trend: D

Linear Regression Plot

Well LX-19 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.204

Confidence in Trend: 100.0%

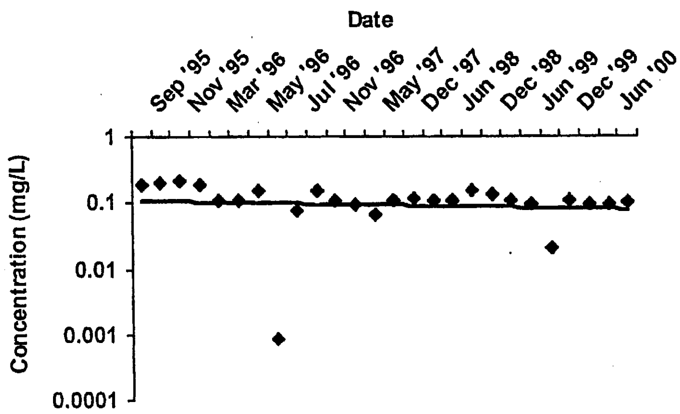
Ln Slope: -9.9E-05

Concentration Trend: D

Linear Regression Plot

Well: LX-21

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.430

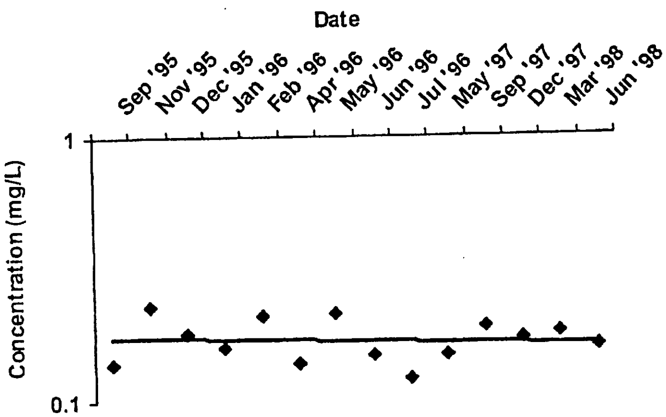
Confidence in Trend: 100.0%

Ln Slope: -9.5E-05

Concentration Trend: D

Linear Regression Plot

Well RW-1 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.186

Confidence in Trend: 100.0%

Ln Slope: -1.7E-05

Concentration Trend: D

A.2. Annual RAM Data (March).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-137b	S	6.7E-01	-9	93.2%	PD
LC-19c	S	0.0E+00	0	0.0%	N/A
LC-19b	S	0.0E+00	0	0.0%	N/A
LC-162	S	5.3E-01	-11	97.2%	D
LC-149d	S	6.0E-01	-8	89.8%	S
LC-149c	S	6.0E-01	-8	89.8%	S
LC-144b	S	0.0E+00	0	0.0%	N/A
LC-26	S	8.2E-01	-13	99.2%	D
LC-137c	S	9.7E-01	-6	81.5%	S
LC-19a	S	0.0E+00	0	0.0%	N/A
LC-137a	S	1.5E+00	-3	64.0%	NT
LC-136b	S	4.7E-01	-7	86.4%	S
LC-136a	S	6.8E-01	15	99.9%	I
LC-134	S	1.4E+00	-7	86.4%	NT
LC-108	S	7.2E-01	-11	97.2%	D
LC-06	S	1.1E+00	-1	50.0%	NT
LC-144a	S	5.1E-01	0	37.5%	S
LC-51	S	1.8E-01	8	95.8%	I
LC-53	S	1.5E-01	5	76.5%	NT
LC-64a	S	5.6E-01	1	50.0%	NT
LC-64b	S	3.8E-01	-5	76.5%	S
LC-66b	T	1.8E-01	4	70.3%	NT
LC-05	T	1.2E+00	-3	64.0%	NT
T-12B	T	0.0E+00	0	0.0%	N/A
T-08	T	1.0E-01	3	64.0%	NT
LC-111b	T	5.8E-01	-10	95.2%	D
LC-116b	T	1.7E+00	-7	86.4%	NT
LC-122b	T	4.0E-01	-12	98.2%	D
LC-128	T	2.4E-01	6	81.5%	NT
LC-132	T	3.9E-01	9	93.2%	PI
T-04	T	1.3E+00	-1	50.0%	NT
T-01	T	6.6E-01	-8	95.8%	D
PA-383	T	2.1E-01	4	70.3%	NT
LC-165	T	7.4E-01	-8	95.8%	D
LC-73a	T	3.2E-01	7	92.0%	PI
LC-41a	T	9.1E-02	-4	70.3%	S
LC-66a	T	3.5E-01	8	89.8%	NT
LC-14a	T	2.9E-01	-4	70.3%	S
LC-03	T	4.3E-01	3	64.0%	NT
T-13b	T	1.3E-01	7	86.4%	NT
LC-49a	T	3.1E-01	0	37.5%	S
LC-49	T	1.2E-01	3	64.0%	NT
LC-44a	T	6.4E-01	-9	93.2%	PD
PA-381	T	3.8E-01	5	76.5%	NT

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft Lewis **State** Washington

Well	Source/Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-50D	S	0.0E+00	0	0.0%	N/A
LC-26D	S	6.0E-01	-8	89.8%	S
LC-35D	S	0.0E+00	0	0.0%	N/A
LC-41D	S	1.2E-01	-1	50.0%	S
LC-47D	S	0.0E+00	0	0.0%	N/A
LC-166D	T	1.4E-01	2	59.2%	NT
LC-40D	T	4.2E-01	-4	70.3%	S
LC-126	T	2.1E-01	-2	57.0%	S
LC-67D	T	1.6E-01	1	50.0%	NT
LC-77D	T	0.0E+00	0	0.0%	N/A
LC-71D	T	7.7E-01	-7	86.4%	S
LC-72D	T	3.1E-01	2	57.0%	NT
LC-73D	T	2.3E-01	-4	70.3%	S
LC-74D	T	2.4E-01	6	95.8%	I
LC-75D	T	0.0E+00	0	0.0%	N/A
LC-76D	T	0.0E+00	0	0.0%	N/A
LC-66D	T	4.6E-01	-5	76.5%	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LX-19	S	1.4E-01	-3	67.5%	S
LX-16	S	2.0E-01	3	72.9%	NT
LX-17	S	5.0E-01	-13	99.2%	D
LX-18	S	5.9E-01	-11	97.2%	D
RW-1	S	0.0E+00	0	0.0%	N/A
LX-21	S	3.0E-01	-8	89.8%	S
LX-4	T	2.0E-01	1	50.0%	NT
LX-3	T	1.5E-01	-8	89.8%	S
LX-5	T	1.3E-01	-7	92.0%	PD
LX-6	T	1.3E-01	-6	81.5%	S
LX-7	T	2.4E-01	-9	93.2%	PD
LX-1	T	1.0E-01	7	86.4%	NT
LX-8	T	6.6E-02	3	64.0%	NT
LX-9	T	8.4E-02	-7	86.4%	S
LX-15	T	4.9E-01	12	98.2%	I
LX-14	T	3.1E-01	5	76.5%	NT
LX-13	T	4.0E-01	4	83.3%	NT
LX-12	T	9.8E-02	3	64.0%	NT
LX-11	T	1.1E-01	-12	98.2%	D
LX-10	T	2.0E-01	1	50.0%	NT
LX-2	T	2.3E-01	-7	86.4%	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-149c	S	4.3E-04	2.6E-04	-1.1E-03	6.0E-01	100.0%	D
	LC-06	S	4.6E-02	5.1E-02	-4.1E-04	1.1E+00	100.0%	D
	LC-64a	S	5.2E-01	2.9E-01	1.4E-04	5.6E-01	66.1%	NT
	LC-53	S	1.6E-01	2.3E-02	1.2E-04	1.5E-01	87.2%	NT
	LC-51	S	1.5E-01	2.7E-02	2.9E-04	1.8E-01	97.0%	I
	LC-26	S	5.0E-04	4.1E-04	-1.4E-03	8.2E-01	100.0%	D
	LC-19c	S	4.5E-02	8.5E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-19b	S	2.1E-01	1.7E-01	0.0E+00	0.0E+00	0.0%	N/A
	LC-19a	S	2.0E-01	2.8E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-149d	S	4.3E-04	2.6E-04	-1.1E-03	6.0E-01	100.0%	D
	LC-64b	S	4.7E-02	1.8E-02	-4.1E-04	3.8E-01	100.0%	D
	LC-144b	S	1.6E-01	1.5E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-144a	S	6.0E-02	3.1E-02	7.0E-04	5.1E-01	76.0%	NT
	LC-137c	S	1.6E-02	1.6E-02	-1.8E-03	9.7E-01	100.0%	D
	LC-137b	S	1.7E-01	1.1E-01	-7.8E-04	6.7E-01	100.0%	D
	LC-137a	S	1.4E-01	2.2E-01	-9.1E-04	1.5E+00	100.0%	D
	LC-136b	S	1.2E-01	5.5E-02	-3.7E-04	4.7E-01	100.0%	D
	LC-136a	S	8.7E+01	5.9E+01	1.0E-03	6.8E-01	100.0%	I
	LC-134	S	4.7E+00	6.6E+00	-9.9E-04	1.4E+00	100.0%	D
	LC-108	S	1.5E-02	1.1E-02	-8.0E-04	7.2E-01	100.0%	D
	LC-162	S	7.4E-01	3.9E-01	-6.5E-04	5.3E-01	100.0%	D
	LC-05	T	2.4E-02	2.8E-02	-6.3E-04	1.2E+00	100.0%	D
	LC-49	T	2.2E-01	2.6E-02	4.9E-05	1.2E-01	71.4%	NT
	T-12B	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	T-08	T	2.4E-03	2.5E-04	5.5E-05	1.0E-01	75.8%	NT
	T-04	T	1.1E-02	1.5E-02	-6.5E-04	1.3E+00	100.0%	D
	T-01	T	2.5E-03	1.7E-03	-7.3E-04	6.6E-01	100.0%	D
	PA-383	T	1.4E-03	2.9E-04	8.6E-05	2.1E-01	69.6%	NT
	PA-381	T	4.2E-02	1.6E-02	2.8E-05	3.8E-01	53.7%	NT
	LC-73a	T	9.9E-04	3.2E-04	3.7E-04	3.2E-01	91.9%	PI
	LC-66b	T	1.2E-01	2.3E-02	9.0E-05	1.8E-01	74.3%	NT
	LC-03	T	6.0E-04	2.6E-04	5.5E-05	4.3E-01	56.3%	NT
	LC-49a	T	9.9E-02	3.1E-02	-6.8E-05	3.1E-01	100.0%	D
	T-13b	T	4.5E-03	6.0E-04	1.2E-04	1.3E-01	90.4%	PI
	LC-44a	T	2.9E-02	1.9E-02	-7.1E-04	6.4E-01	100.0%	D
	LC-41a	T	1.6E-01	1.5E-02	-3.1E-05	9.1E-02	100.0%	D
	LC-165	T	3.4E-04	2.5E-04	-1.5E-03	7.4E-01	100.0%	D
	LC-14a	T	5.6E-02	1.6E-02	-1.5E-04	2.9E-01	100.0%	D
	LC-132	T	5.2E-02	2.0E-02	4.9E-04	3.9E-01	97.7%	I
	LC-128	T	1.9E-02	4.6E-03	1.2E-04	2.4E-01	73.6%	NT
	LC-122b	T	5.1E-04	2.0E-04	-7.6E-04	4.0E-01	100.0%	D
	LC-116b	T	9.8E-04	1.7E-03	-1.4E-03	1.7E+00	100.0%	D
	LC-111b	T	4.0E-04	2.3E-04	-8.8E-04	5.8E-01	100.0%	D
	LC-66a	T	9.3E-02	3.2E-02	5.2E-04	3.5E-01	96.7%	I

MAROS Linear Regression Statistics

Projec Ft Lewis Log Center   **User Nam** Seattle District

Locatio Ft Lewis   **State** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-35D	S	1.0E-04	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-41D	S	1.1E-01	1.3E-02	-2.1E-05	1.2E-01	100.0%	D
	LC-47D	S	1.0E-04	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-50D	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-26D	S	4.3E-04	2.6E-04	-1.1E-03	6.0E-01	100.0%	D
	LC-67D	T	5.2E-02	8.5E-03	2.3E-06	1.6E-01	100.0%	I
	LC-126	T	1.1E-01	2.3E-02	-1.3E-04	2.1E-01	100.0%	D
	LC-166D	T	6.4E-04	8.9E-05	7.9E-05	1.4E-01	72.0%	NT
	LC-66D	T	4.2E-02	1.9E-02	-1.1E-03	4.6E-01	100.0%	D
	LC-77D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-71D	T	5.3E-04	4.1E-04	-1.2E-03	7.7E-01	100.0%	D
	LC-72D	T	4.7E-02	1.5E-02	-3.6E-04	3.1E-01	100.0%	D
	LC-73D	T	3.1E-02	7.3E-03	-1.8E-04	2.3E-01	100.0%	D
	LC-74D	T	4.9E-02	1.2E-02	3.7E-04	2.4E-01	98.6%	I
	LC-75D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-76D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-40D	T	1.5E-02	6.4E-03	-6.6E-04	4.2E-01	100.0%	D

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LX-17	S	7.1E-01	3.5E-01	-5.2E-04	5.0E-01	100.0%	D
	LX-18	S	1.3E+00	7.9E-01	-7.0E-04	5.9E-01	100.0%	D
	LX-19	S	1.2E-01	1.6E-02	-5.1E-05	1.4E-01	100.0%	D
	LX-21	S	1.2E-01	3.5E-02	-2.5E-04	3.0E-01	100.0%	D
	RW-1	S	1.8E-01	3.5E-02	0.0E+00	0.0E+00	0.0%	N/A
	LX-16	S	1.6E-01	3.3E-02	3.0E-04	2.0E-01	79.2%	NT
	LX-14	T	6.3E-03	1.9E-03	3.6E-04	3.1E-01	88.5%	NT
	LX-1	T	1.1E-02	1.2E-03	9.6E-05	1.0E-01	89.4%	NT
	LX-10	T	8.1E-02	1.6E-02	1.2E-04	2.0E-01	77.7%	NT
	LX-11	T	5.0E-02	5.6E-03	-1.5E-04	1.1E-01	100.0%	D
	LX-13	T	4.2E-03	1.7E-03	5.9E-04	4.0E-01	89.7%	NT
	LX-9	T	7.9E-02	6.6E-03	-9.3E-05	8.4E-02	100.0%	D
	LX-15	T	2.8E-03	1.4E-03	1.1E-03	4.9E-01	93.9%	PI
	LX-2	T	1.6E-02	3.7E-03	-1.7E-04	2.3E-01	100.0%	D
	LX-3	T	3.1E-02	4.6E-03	-1.7E-04	1.5E-01	100.0%	D
	LX-4	T	7.0E-02	1.4E-02	-3.9E-05	2.0E-01	100.0%	D
	LX-5	T	1.1E-01	1.4E-02	-1.9E-04	1.3E-01	100.0%	D
	LX-6	T	1.1E-01	1.5E-02	-1.5E-04	1.3E-01	100.0%	D
	LX-7	T	8.3E-02	2.0E-02	-2.4E-04	2.4E-01	100.0%	D
	LX-8	T	7.8E-02	5.1E-03	2.9E-05	6.6E-02	70.5%	NT
	LX-12	T	3.0E-02	2.9E-03	2.0E-05	9.8E-02	59.5%	NT

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-137b	S	PD	D	N/A	N/A
	LC-19c	S	N/A	N/A	N/A	N/A
	LC-19b	S	N/A	N/A	N/A	N/A
	LC-162	S	D	D	N/A	N/A
	LC-149d	S	S	D	N/A	N/A
	LC-149c	S	S	D	N/A	N/A
	LC-144b	S	N/A	N/A	N/A	N/A
	LC-26	S	D	D	N/A	N/A
	LC-137c	S	S	D	N/A	N/A
	LC-19a	S	N/A	N/A	N/A	N/A
	LC-137a	S	NT	D	N/A	N/A
	LC-136b	S	S	D	N/A	N/A
	LC-136a	S	I	I	N/A	N/A
	LC-134	S	NT	D	N/A	N/A
	LC-108	S	D	D	N/A	N/A
	LC-06	S	NT	D	N/A	N/A
	LC-144a	S	S	NT	N/A	N/A
	LC-51	S	I	I	N/A	N/A
	LC-53	S	NT	NT	N/A	N/A
	LC-64a	S	NT	NT	N/A	N/A
	LC-64b	S	S	D	N/A	N/A
	LC-66b	T	NT	NT	N/A	N/A
	LC-05	T	NT	D	N/A	N/A
	T-12B	T	N/A	N/A	N/A	N/A
	T-08	T	NT	NT	N/A	N/A
	LC-111b	T	D	D	N/A	N/A
	LC-116b	T	NT	D	N/A	N/A
	LC-122b	T	D	D	N/A	N/A
	LC-128	T	NT	NT	N/A	N/A
	LC-132	T	PI	I	N/A	N/A
	T-04	T	NT	D	N/A	N/A
	T-01	T	D	D	N/A	N/A
	PA-383	T	NT	NT	N/A	N/A
	LC-165	T	D	D	N/A	N/A
	LC-73a	T	PI	PI	N/A	N/A
	LC-41a	T	S	D	N/A	N/A
	LC-66a	T	NT	I	N/A	N/A
	LC-14a	T	S	D	N/A	N/A
	LC-03	T	NT	NT	N/A	N/A
	T-13b	T	NT	PI	N/A	N/A
	LC-49a	T	S	D	N/A	N/A
	LC-49	T	NT	NT	N/A	N/A
	LC-44a	T	PD	D	N/A	N/A

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	PA-381	T	NT	NT	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft Lewis **State** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-50D	S	N/A	N/A	N/A	N/A
	LC-26D	S	S	D	N/A	N/A
	LC-35D	S	N/A	N/A	N/A	N/A
	LC-41D	S	S	D	N/A	N/A
	LC-47D	S	N/A	N/A	N/A	N/A
	LC-166D	T	NT	NT	N/A	N/A
	LC-40D	T	S	D	N/A	N/A
	LC-126	T	S	D	N/A	N/A
	LC-67D	T	NT	I	N/A	N/A
	LC-77D	T	N/A	N/A	N/A	N/A
	LC-71D	T	S	D	N/A	N/A
	LC-72D	T	NT	D	N/A	N/A
	LC-73D	T	S	D	N/A	N/A
	LC-74D	T	I	I	N/A	N/A
	LC-75D	T	N/A	N/A	N/A	N/A
	LC-76D	T	N/A	N/A	N/A	N/A
	LC-66D	T	S	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center | **User Name:** Seattle District

Location: Ft Lewis | **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LX-19	S	S	D	N/A	N/A
	LX-16	S	NT	NT	N/A	N/A
	LX-17	S	D	D	N/A	N/A
	LX-18	S	D	D	N/A	N/A
	RW-1	S	N/A	N/A	N/A	N/A
	LX-21	S	S	D	N/A	N/A
	LX-4	T	NT	D	N/A	N/A
	LX-3	T	S	D	N/A	N/A
	LX-5	T	PD	D	N/A	N/A
	LX-6	T	S	D	N/A	N/A
	LX-7	T	PD	D	N/A	N/A
	LX-1	T	NT	NT	N/A	N/A
	LX-8	T	NT	NT	N/A	N/A
	LX-9	T	S	D	N/A	N/A
	LX-15	T	I	PI	N/A	N/A
	LX-14	T	NT	NT	N/A	N/A
	LX-13	T	NT	NT	N/A	N/A
	LX-12	T	NT	NT	N/A	N/A
	LX-11	T	D	D	N/A	N/A
	LX-10	T	NT	NT	N/A	N/A
	LX-2	T	S	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 21 **Number of Tail Wells:** 23

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Projec Ft Lewis Log Center
User Nam Seattle District
Locatio Ft Lewis
State Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitorin Moderate

Number of Source We 5 **Number of Tail We** 12

Hydrogeology and Plume Inform

Main Constituents: Chlorinated Solvent
Groundwater Seepage Velocity: 132 ft/yr
Current Plume Length: 10800 ft
Current Plume Width: 3000 ft

Source Informati

Source Treatment: No Current Site Treatment
NAPL is not present at this

Down-gradient Inform

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft
Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft
Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Re

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	PD	M	Sample 4 more years	Biannually (6 months)	> 50

Note:
Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing
Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 6 **Number of Tail Wells:** 15

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

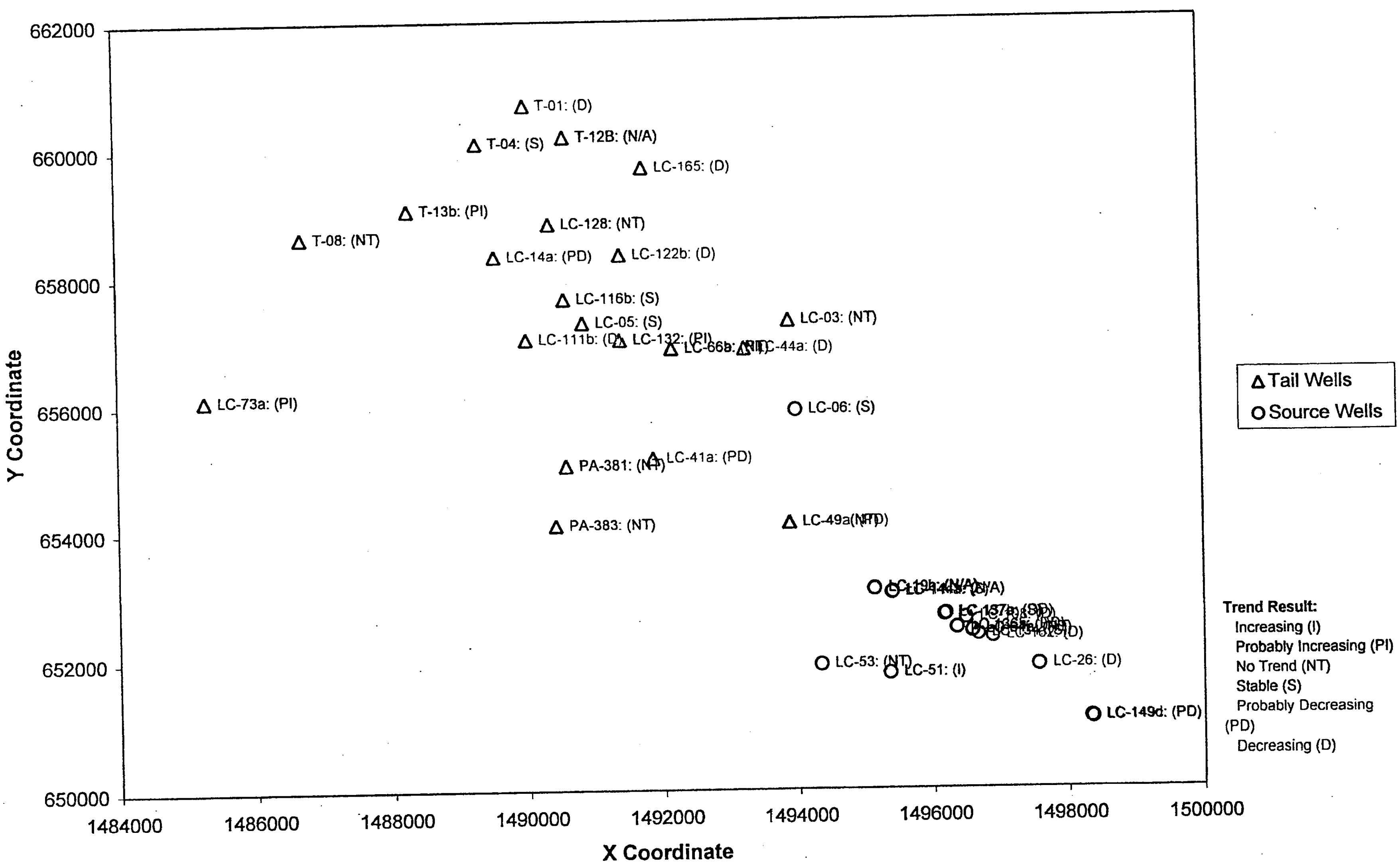
COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	PD	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

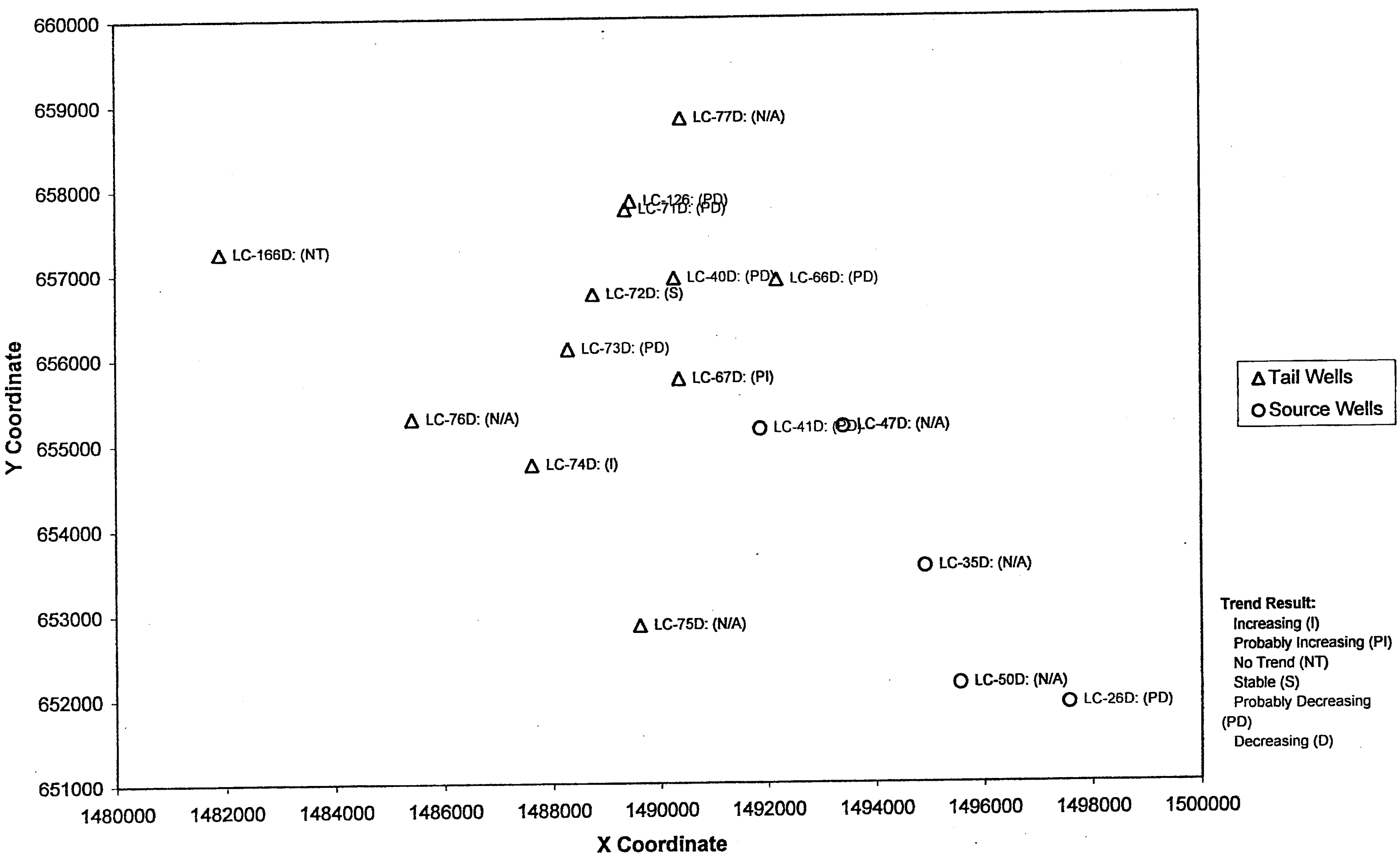
Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

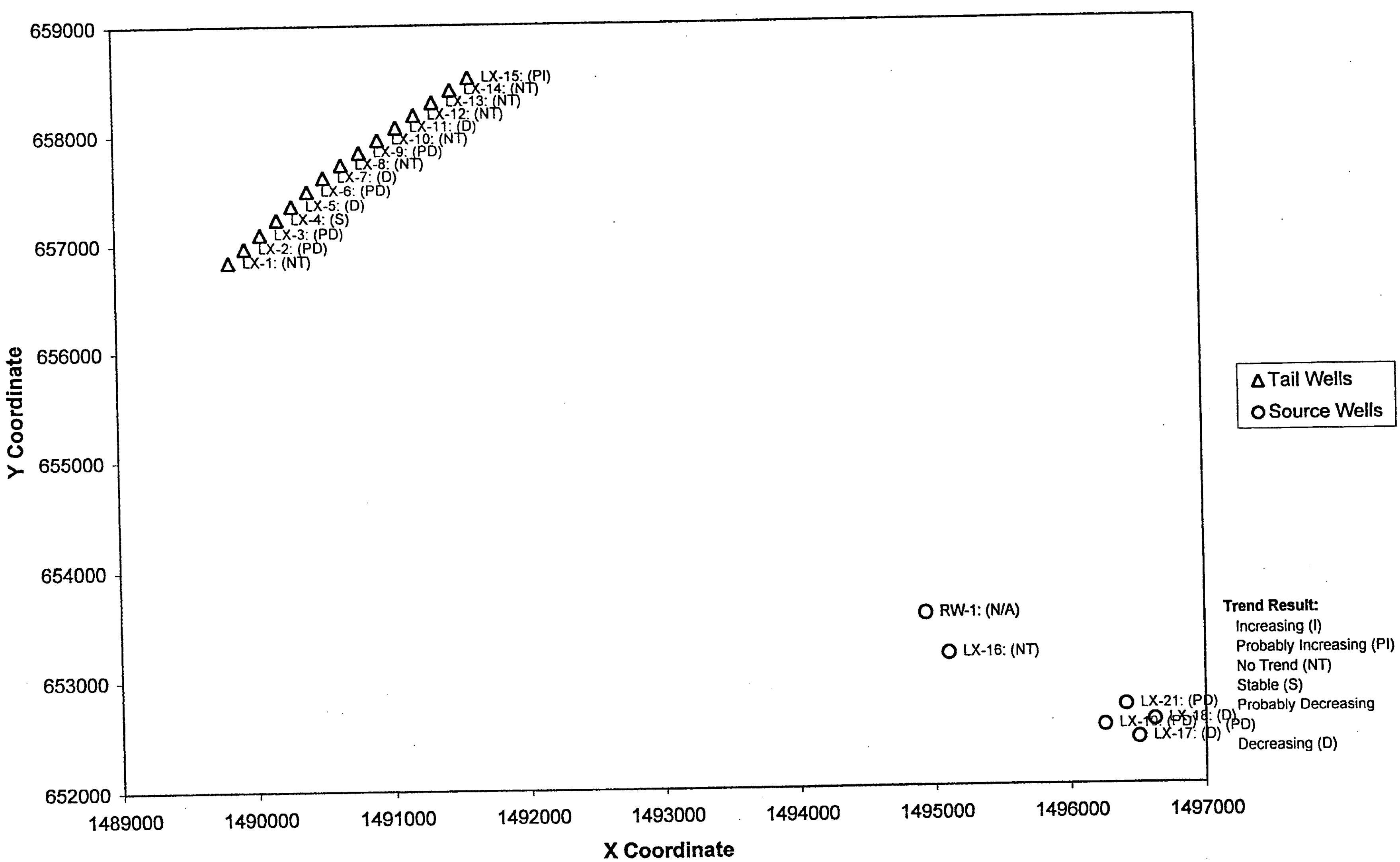
Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



MAROS Sampling Frequency Optimization Results

Projec Ft Lewis Log Center **User Nam** Seattle District

Locatio Ft Lewis **State** Washington

Analysis by Modified CES Method

Number of Sampling Events Anal 6

Recent Sampling Even **Fro** baseline 2/1/95
To Q18 3/1/00

Constituent	Well Name	Sampling Frequency	Frequency based on	Frequency based on
TRICHLOROETHYLENE (TCE)	LC-03	Annual	Annual	Annual
	LC-05	Annual	Annual	Annual
	LC-06	Annual	Annual	Annual
	LC-108	Annual	Annual	Annual
	LC-111b	Biennial	Annual	Annual
	LC-116b	Annual	Annual	Annual
	LC-122b	Biennial	Annual	Annual
	LC-128	Annual	Annual	Annual
	LC-132	Annual	Annual	Annual
	LC-134	Annual	Annual	Annual
	LC-136a	Quarterly	Quarterly	Quarterly
	LC-136b	Annual	Annual	Annual
	LC-137a	Annual	Annual	Annual
	LC-137b	Annual	Annual	Annual
	LC-137c	Annual	Annual	Annual
	LC-144a	Annual	Annual	Annual
	LC-144b	Quarterly	Quarterly	Quarterly
	LC-149c	Biennial	Annual	Annual
	LC-149d	Biennial	Annual	Annual
	LC-14a	Annual	Annual	Annual
	LC-162	Annual	Annual	Annual
	LC-165	Biennial	Annual	Annual
	LC-19a	Quarterly	Quarterly	Quarterly
	LC-19b	Quarterly	Quarterly	Quarterly

Projec Ft Lewis Log Center **User Nam** Seattle District

Location: Ft Lewis **State** Washington

LC-19c	Quarterly	Quarterly	Quarterly
LC-26	Biennial	Annual	Annual
LC-41a	Annual	Annual	Annual
LC-44a	Annual	Annual	Annual
LC-49	Annual	Annual	Annual
LC-49a	Annual	Annual	Annual
LC-51	Quarterly	Quarterly	Quarterly
LC-53	Annual	Annual	Annual
LC-64a	Quarterly	Quarterly	Quarterly
LC-64b	Annual	Annual	Annual
LC-66a	SemiAnnual	SemiAnnual	SemiAnnual
LC-66b	Annual	Annual	Annual
LC-73a	Biennial	Annual	Annual
PA-381	Annual	Annual	Annual
PA-383	Annual	Annual	Annual
T-01	Annual	Annual	Annual
T-04	Annual	Annual	Annual
T-08	Annual	Annual	Annual
T-12B	Annual	Annual	Annual
T-13b	Annual	Annual	Annual

Note:Modified CES (LLNL) method results in a recommended sampling interval for each well. This is based on analysis of concentration trend, so looks at specified sampling interval.

Summary - Final Recommendation for Sampling Fre

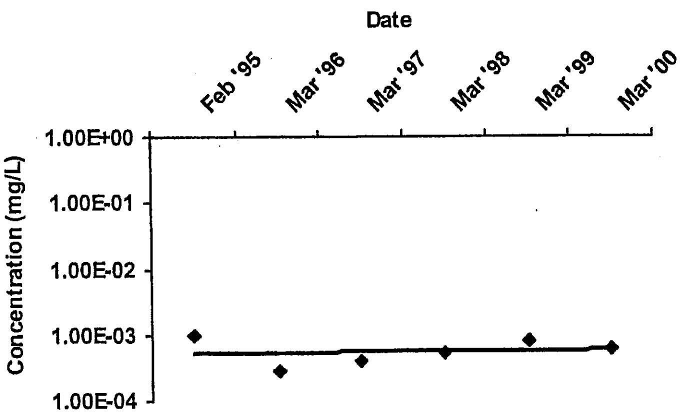
Well Name	Sampling Frequency
LC-03	Annual
LC-05	Annual
LC-06	Annual
LC-108	Annual
LC-111b	Biennial
LC-116b	Annual
LC-122b	Biennial
LC-128	Annual
LC-132	Annual

LC-134	Annual
LC-136a	Quarterly
LC-136b	Annual
LC-137a	Annual
LC-137b	Annual
LC-137c	Annual
LC-144a	Annual
LC-144b	Quarterly
LC-149c	Biennial
LC-149d	Biennial
LC-14a	Annual
LC-162	Annual
LC-165	Biennial
LC-19a	Quarterly
LC-19b	Quarterly
LC-19c	Quarterly
LC-26	Biennial
LC-41a	Annual
LC-44a	Annual
LC-49	Annual
LC-49a	Annual
LC-51	Quarterly
LC-53	Annual
LC-64a	Quarterly
LC-64b	Annual
LC-66a	SemiAnnual
LC-66b	Annual
LC-73a	Biennial
PA-381	Annual
PA-383	Annual
T-01	Annual
T-04	Annual
T-08	Annual
T-12B	Annual
T-13b	Annual

Note: the most stringent sampling frequency was chosen among all COCs.

Linear Regression Plot

Well LC-03 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.435

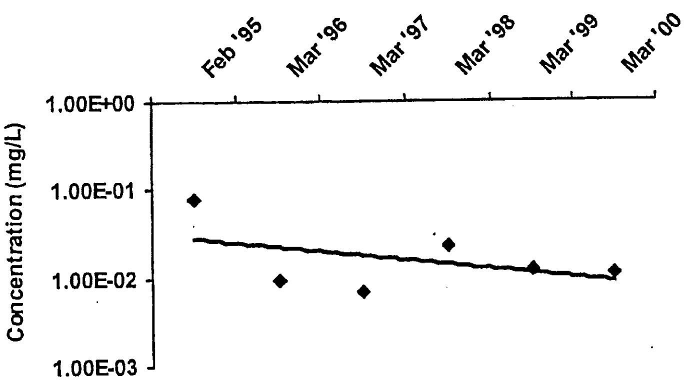
Confidence in Trend: 56.3%

Ln Slope: 5.5E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-05 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 1.193

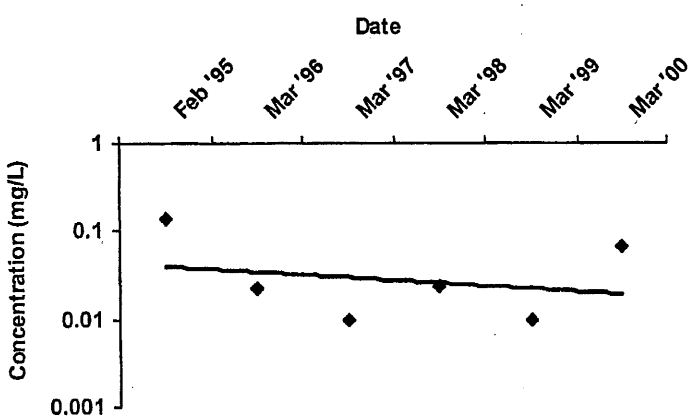
Confidence in Trend: 100.0%

Ln Slope: -6.3E-04

Concentration Trend: D

Linear Regression Plot

Well LC-06 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 1.120

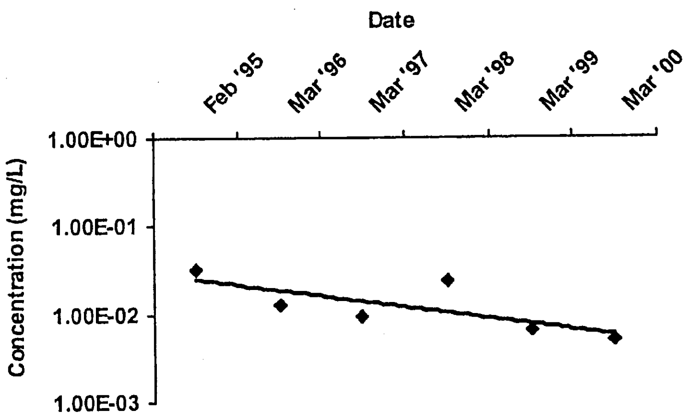
Confidence in Trend: 100.0%

Ln Slope: -4.1E-04

Concentration Trend: D

Linear Regression Plot

Well LC-108 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.722

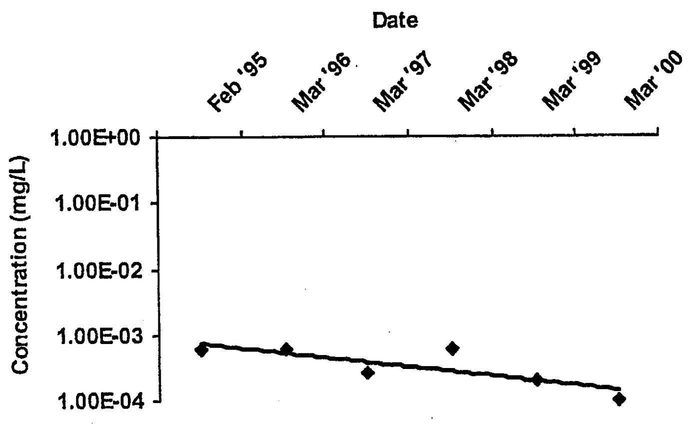
Confidence in Trend: 100.0%

Ln Slope: -8.0E-04

Concentration Trend: D

Linear Regression Plot

Well LC-111b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.585

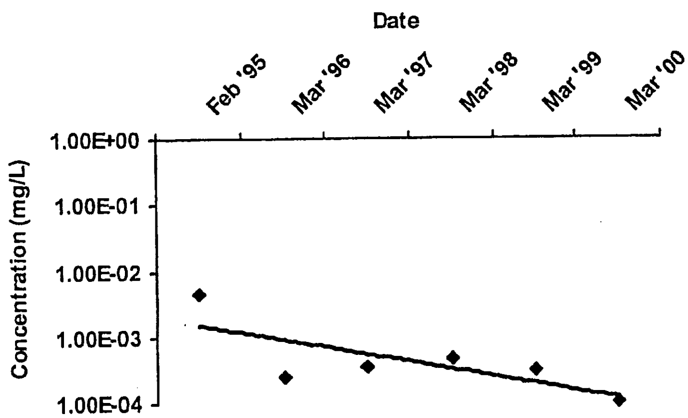
Confidence in Trend: 100.0%

Ln Slope: -8.8E-04

Concentration Trend: D

Linear Regression Plot

Well LC-116b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 1.718

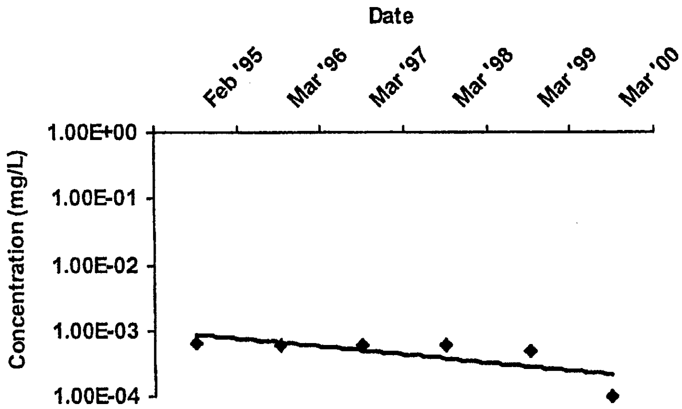
Confidence in Trend: 100.0%

Ln Slope: -1.4E-03

Concentration Trend: D

Linear Regression Plot

Well LC-122b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.404

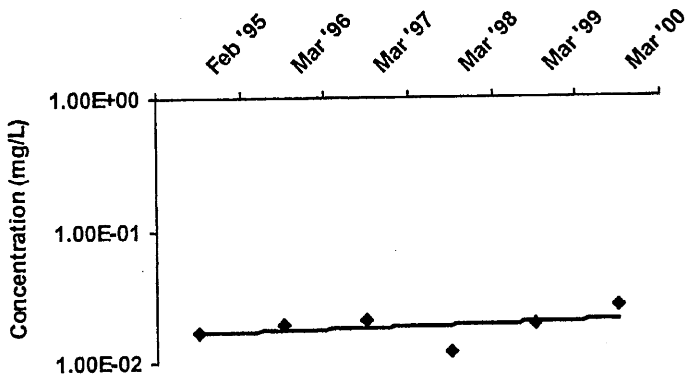
Confidence in Trend: 100.0%

Ln Slope: -7.6E-04

Concentration Trend: D

Linear Regression Plot

Well LC-128 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.242

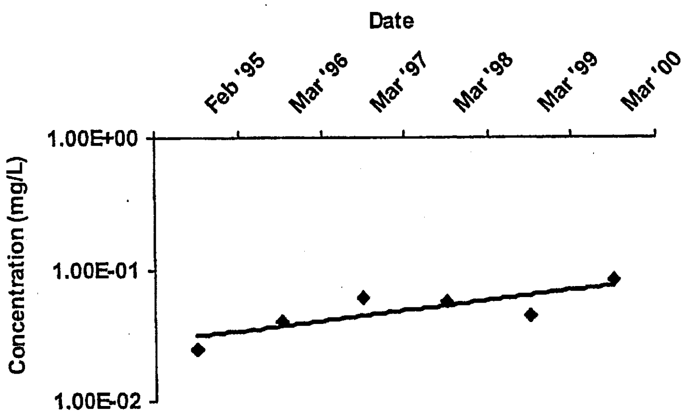
Confidence in Trend: 73.6%

Ln Slope: 1.2E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-132 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.385

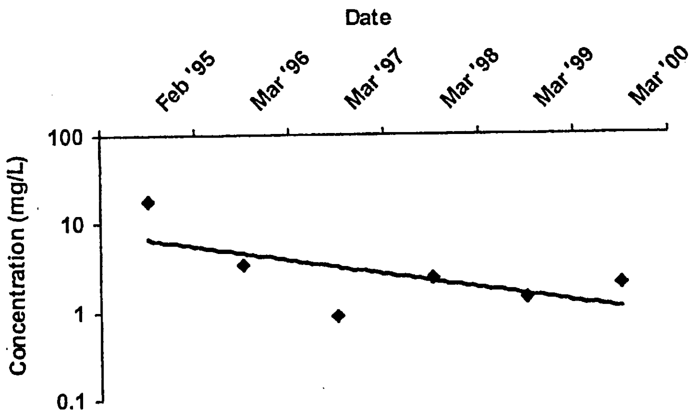
Confidence in Trend: 97.7%

Ln Slope: 4.9E-04

Concentration Trend: I

Linear Regression Plot

Well LC-134 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- ◉ **Log**
- ○ **Linear**

COV:

1.406

Confidence in Trend:

100.0%

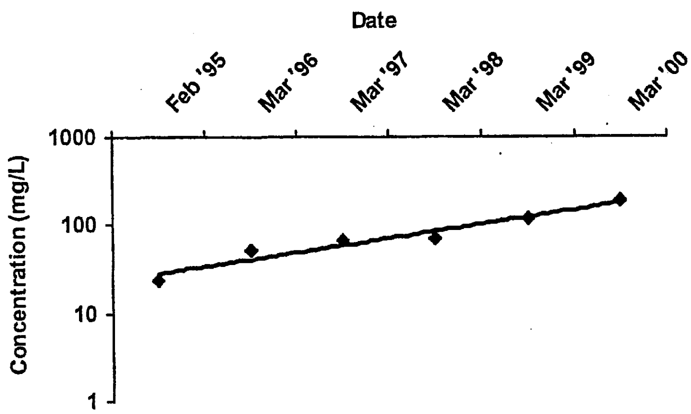
Ln Slope:

-9.9E-04

Concentration Trend: D

Linear Regression Plot

Well LC-136a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.683

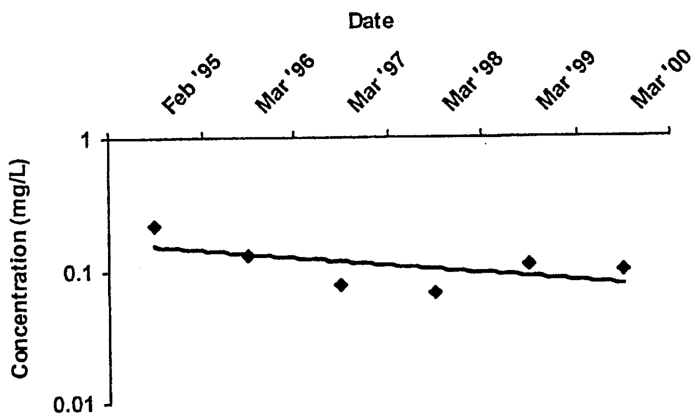
Confidence in Trend: 100.0%

Ln Slope: 1.0E-03

Concentration Trend: I

Linear Regression Plot

Well LC-136b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (●) **Log**
- ( ) **Linear**

COV: 0.469

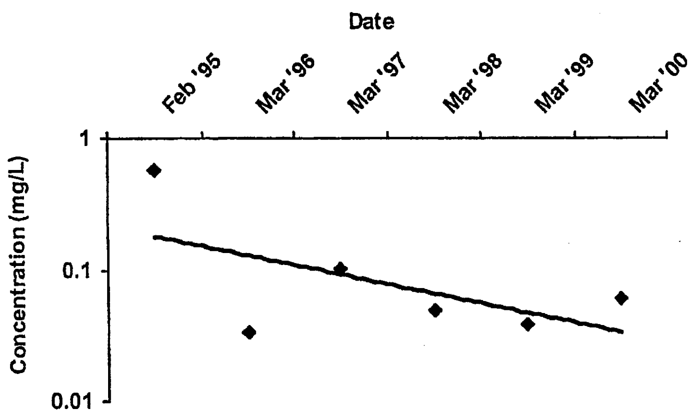
Confidence in Trend: 100.0%

Ln Slope: -3.7E-04

Concentration Trend: D

Linear Regression Plot

Well LC-137a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 1.497

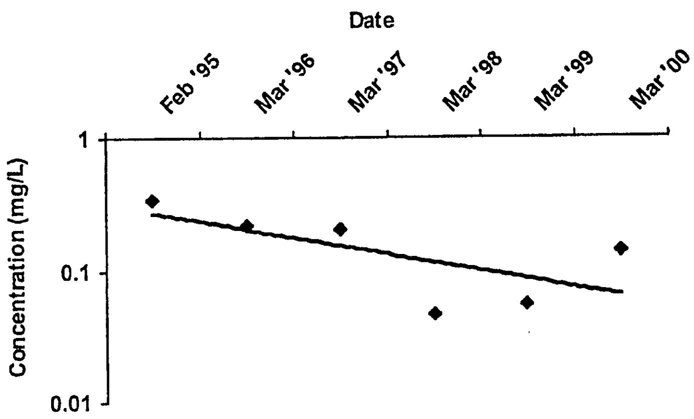
Confidence in Trend: 100.0%

Ln Slope: -9.1E-04

Concentration Trend: D

Linear Regression Plot

Well LC-137b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.666

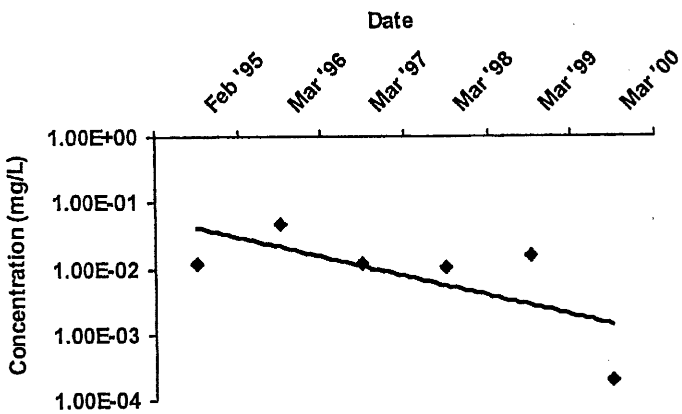
Confidence in Trend: 100.0%

Ln Slope: -7.8E-04

Concentration Trend: D

Linear Regression Plot

Well LC-137c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.973

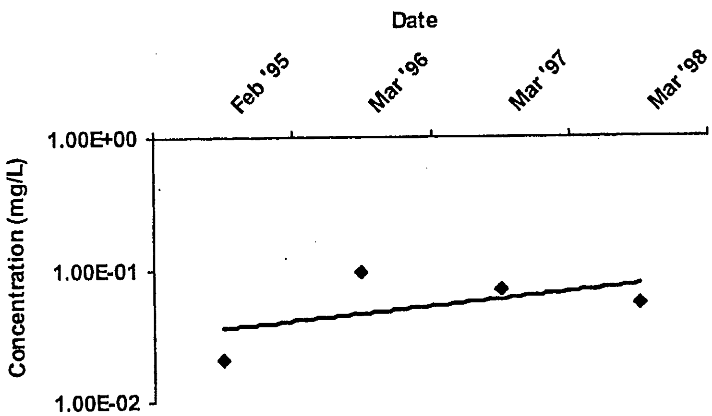
Confidence in Trend: 100.0%

Ln Slope: -1.8E-03

Concentration Trend: D

Linear Regression Plot

Well LC-144a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.513

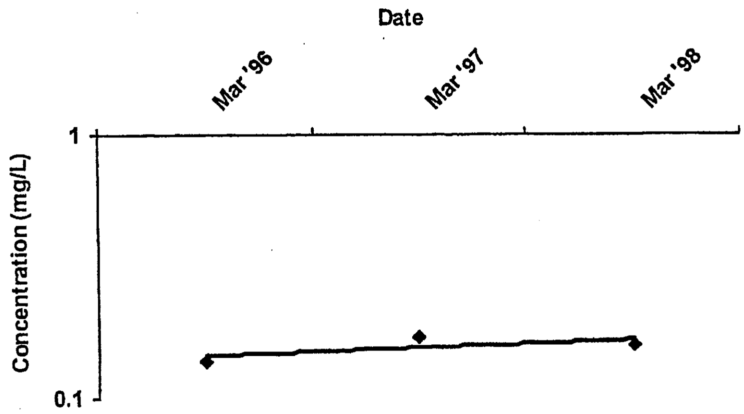
Confidence In Trend: 76.0%

Ln Slope: 7.0E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-144b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.000

Confidence in Trend: 0.0%

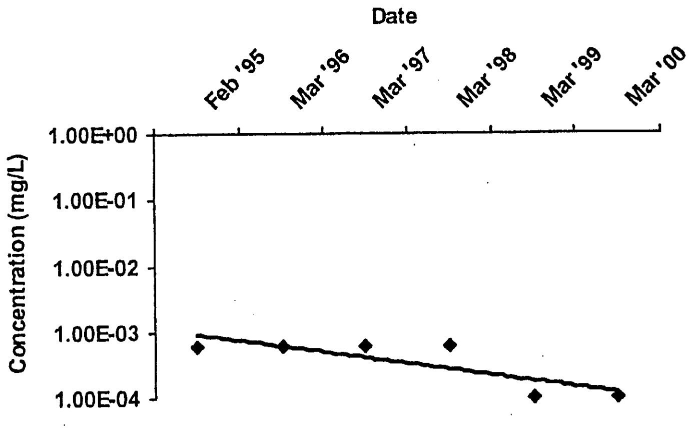
Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well: LC-149c

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type: (•) Log ( ) Linear

COV: 0.596

Confidence in Trend: 100.0%

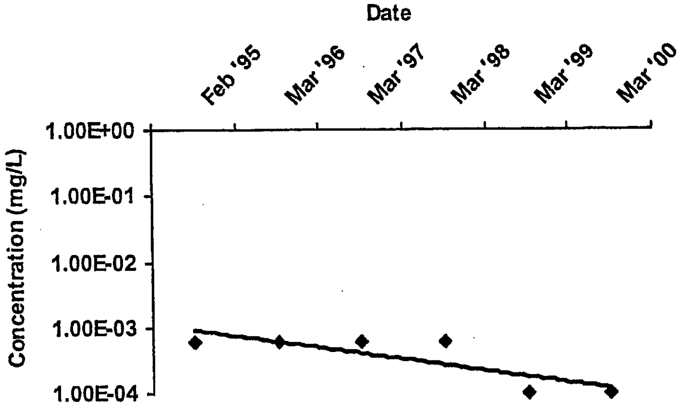
Ln Slope: -1.1E-03

Concentration Trend: D

Linear Regression Plot

Well: LC-149d

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.596

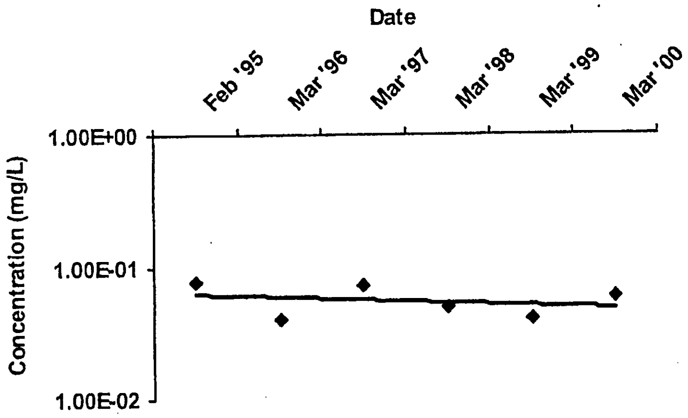
Confidence in Trend: 100.0%

Ln Slope: -1.1E-03

Concentration Trend: D

Linear Regression Plot

Well LC-14a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.285

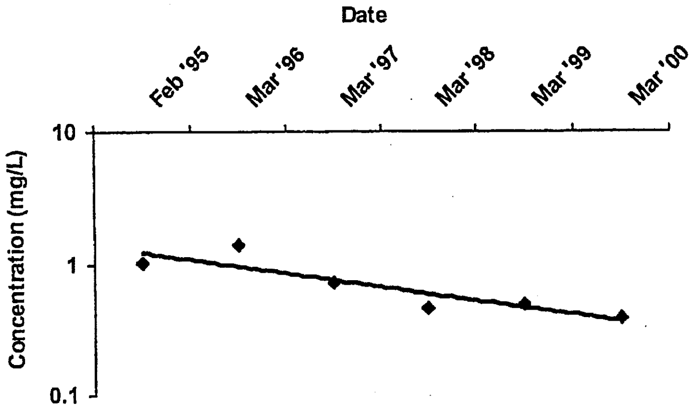
Confidence in Trend: 100.0%

Ln Slope: -1.5E-04

Concentration Trend: D

Linear Regression Plot

Well LC-162 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.528

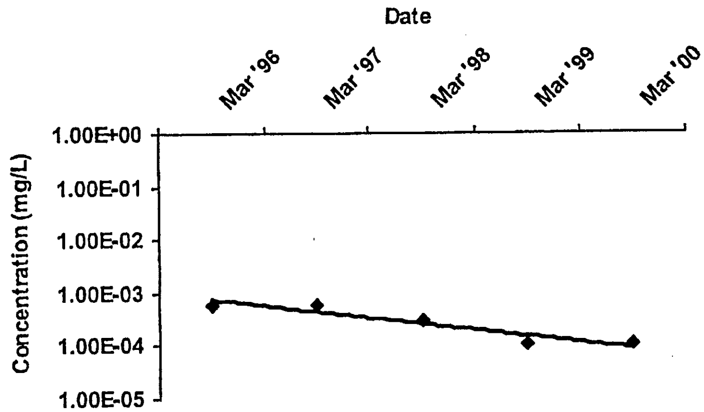
Confidence in Trend: 100.0%

Ln Slope: -6.5E-04

Concentration Trend: D

Linear Regression Plot

Well: LC-165   Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.744

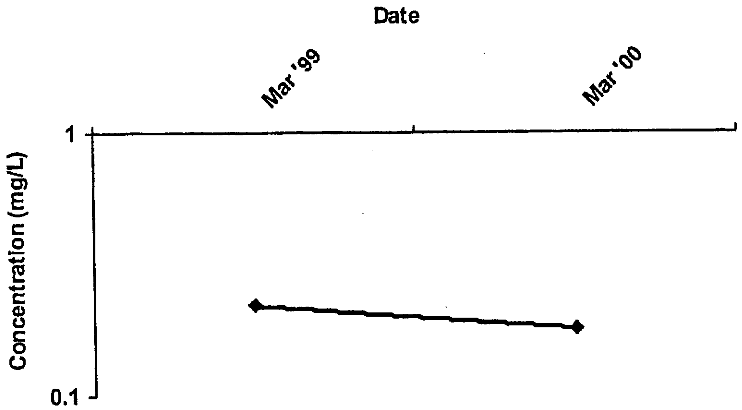
Confidence in Trend: 100.0%

Ln Slope: -1.5E-03

Concentration Trend: D

Linear Regression Plot

Well LC-19a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.000

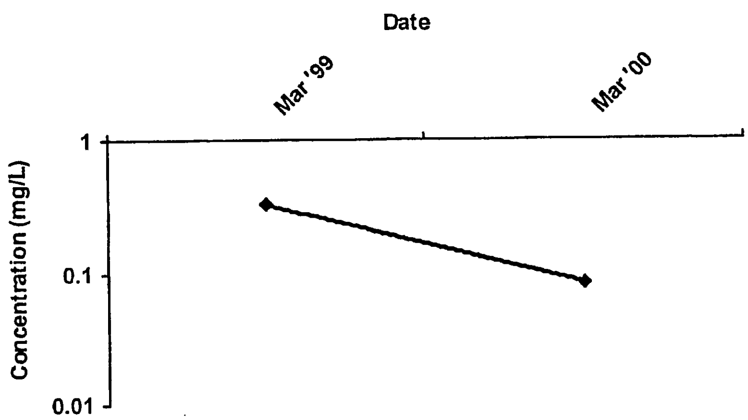
Confidence In Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well LC-19b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.000

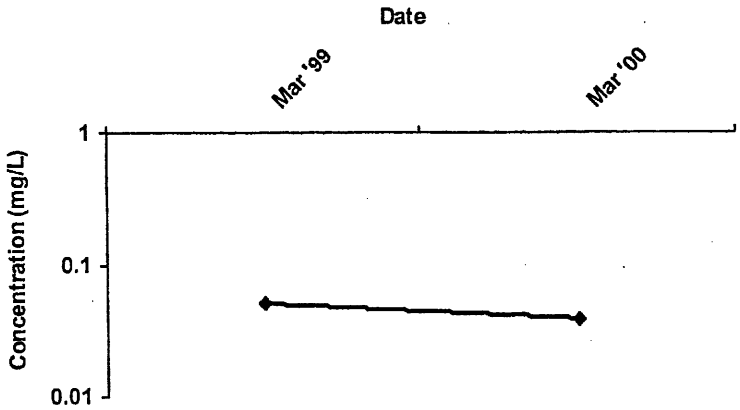
Confidence in Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well LC-19c **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.000

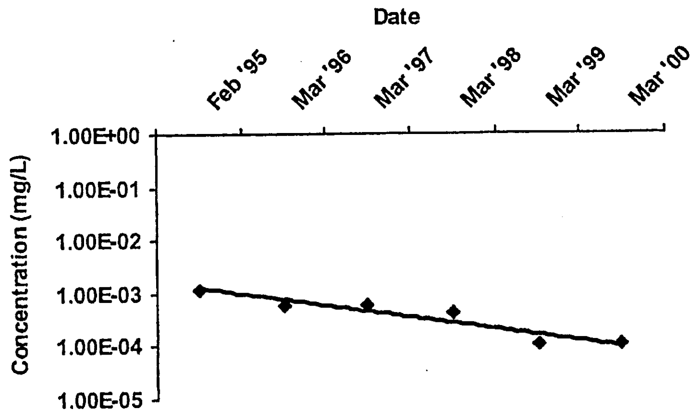
Confidence in Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well LC-26 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.816

Confidence in Trend: 100.0%

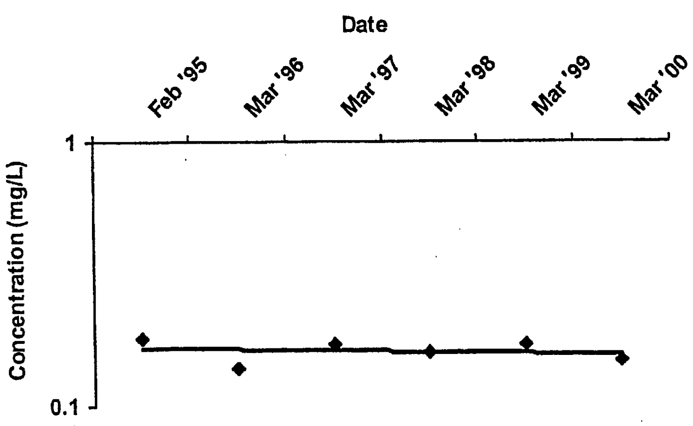
Ln Slope: -1.4E-03

Concentration Trend: D

Linear Regression Plot

Well: LC-41a

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.091

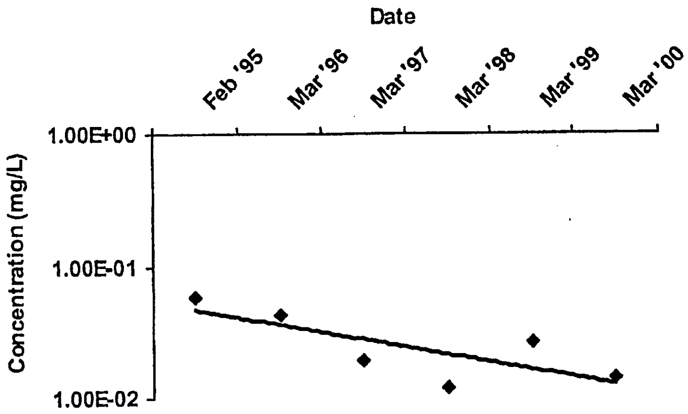
Confidence in Trend: 100.0%

Ln Slope: -3.1E-05

Concentration Trend: D

Linear Regression Plot

Well LC-44a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.643

Confidence in Trend: 100.0%

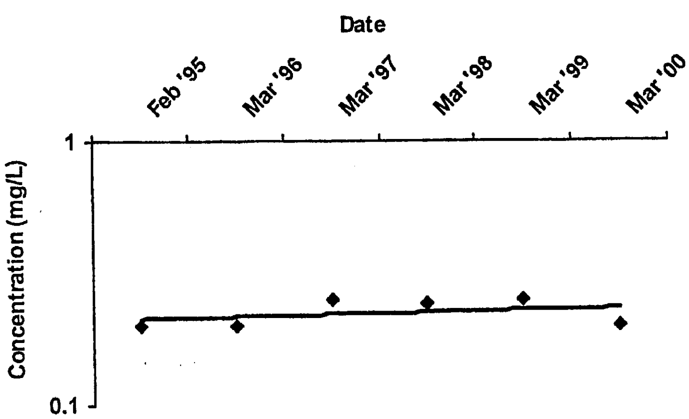
Ln Slope: -7.1E-04

Concentration Trend: D

Linear Regression Plot

Well: LC-49

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.116

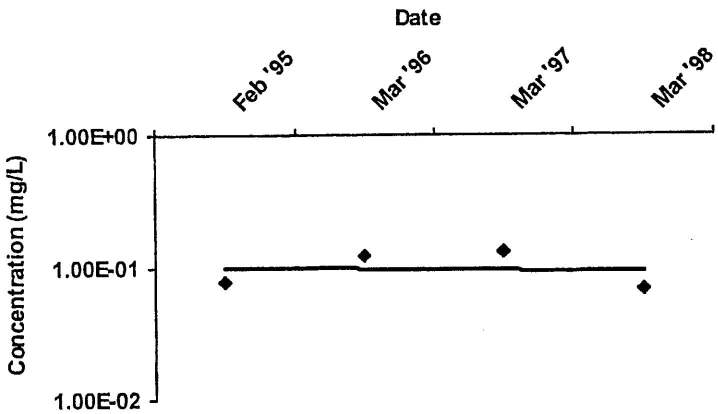
Confidence in Trend: 71.4%

Ln Slope: 4.9E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-49a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.312

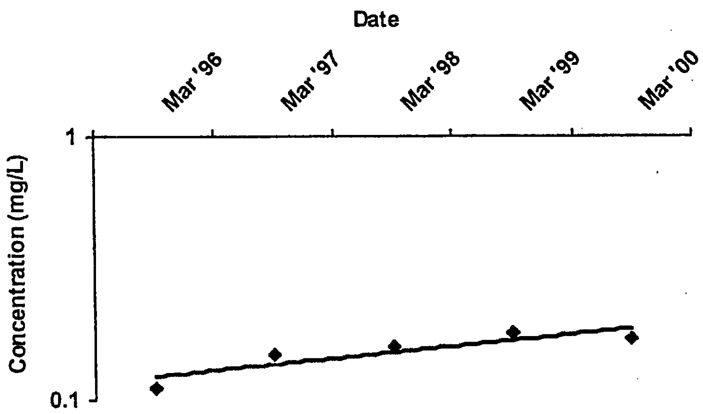
Confidence in Trend: 100.0%

Ln Slope: -6.8E-05

Concentration Trend: D

Linear Regression Plot

Well LC-51 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.175

Confidence in Trend: 97.0%

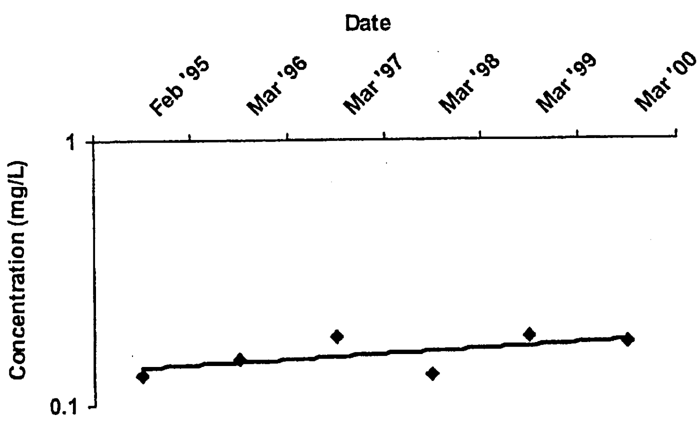
Ln Slope: 2.9E-04

Concentration Trend: I

Linear Regression Plot

Well: LC-53

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.149

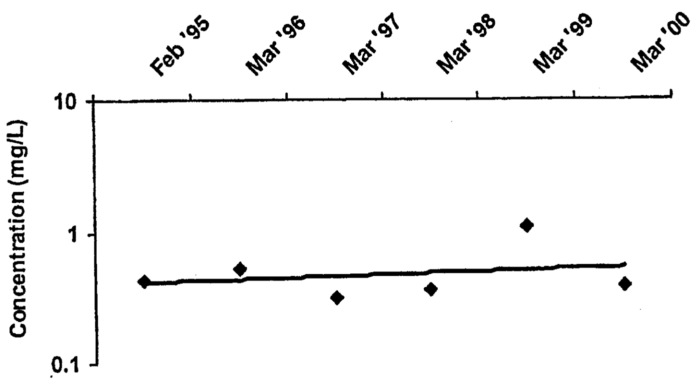
Confidence in Trend: 87.2%

Ln Slope: 1.2E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-64a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.565

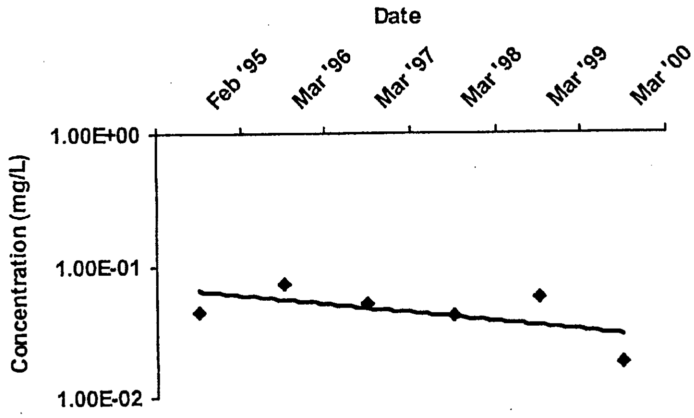
Confidence in Trend: 66.1%

Ln Slope: 1.4E-04

Concentration Trend: NT

Linear Regression Plot

Well LC-64b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.379

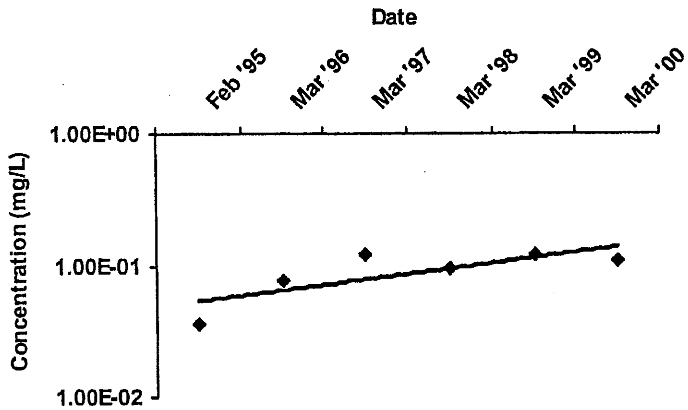
Confidence in Trend: 100.0%

Ln Slope: -4.1E-04

Concentration Trend: D

Linear Regression Plot

Well LC-66a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.349

Confidence in Trend: 96.7%

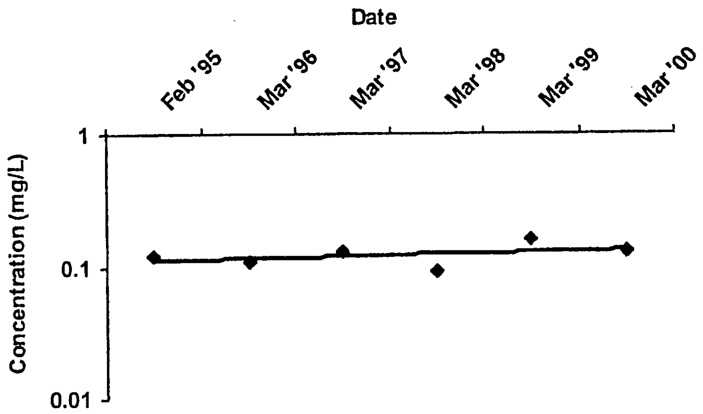
Ln Slope: 5.2E-04

Concentration Trend: I

Linear Regression Plot

Well LC-66b

Chemical TRICHLOROETHYLENE (TCE)



Graph Type

- (●) Log
- ( ) Linear

COV: 0.185

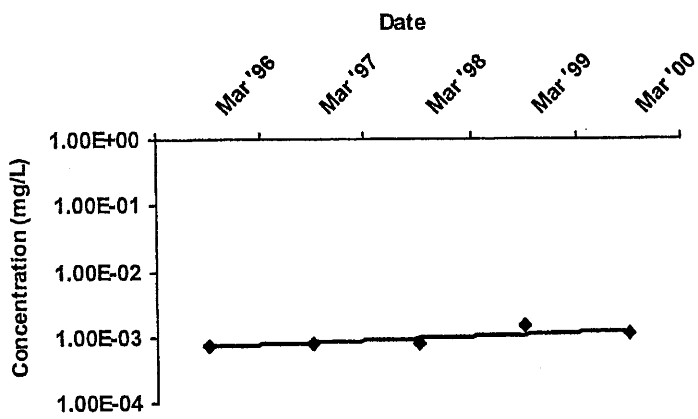
Confidence in Trend: 74.3%

Ln Slope: 9.0E-05

Concentration Trend: NT

Linear Regression Plot

Well LC-73a **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.324

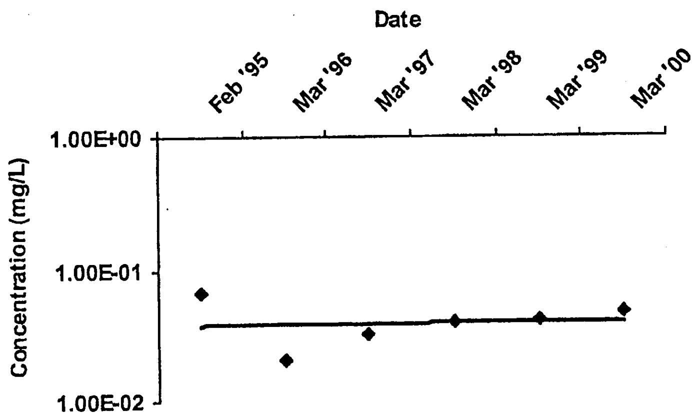
Confidence in Trend: 91.9%

Ln Slope: 3.7E-04

Concentration Trend: PI

Linear Regression Plot

Well PA-381 Chemical TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.379

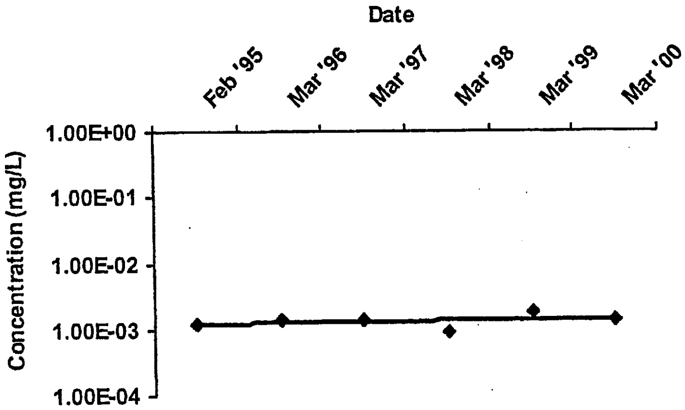
Confidence in Trend: 53.7%

Ln Slope: 2.8E-05

Concentration Trend: NT

Linear Regression Plot

Well PA-383 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.213

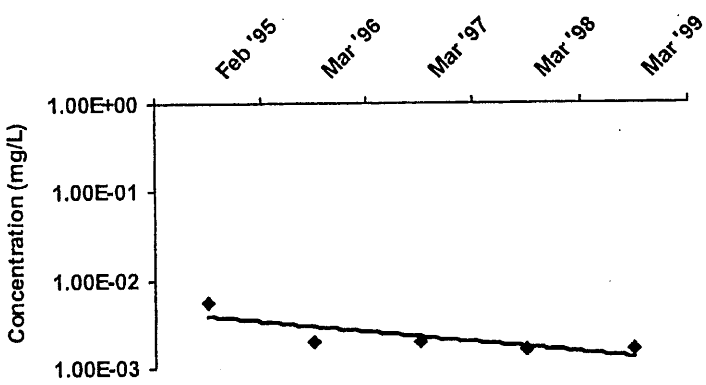
Confidence in Trend: 69.6%

Ln Slope: 8.6E-05

Concentration Trend: NT

Linear Regression Plot

Well T-01 Chemical TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.656

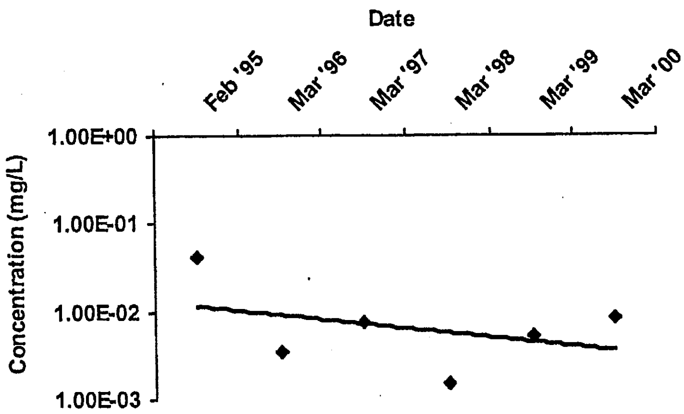
Confidence in Trend: 100.0%

Ln Slope: -7.3E-04

Concentration Trend: D

Linear Regression Plot

Well T-04 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

◉ **Log**

○ **Linear**

COV: 1.321

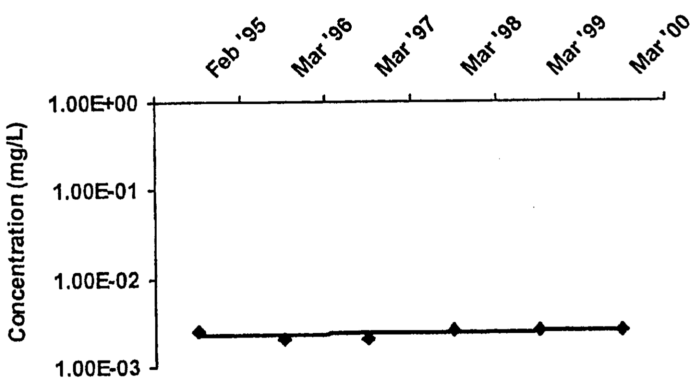
Confidence in Trend: 100.0%

Ln Slope: -6.5E-04

Concentration Trend: D

Linear Regression Plot

Well T-08 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.103

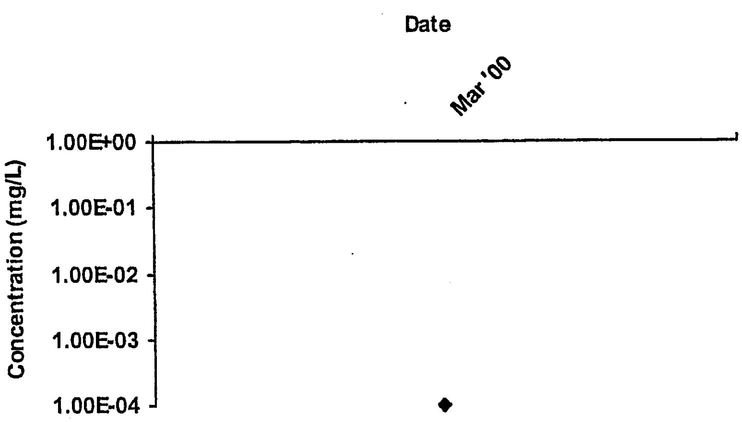
Confidence in Trend: 75.8%

Ln Slope: 5.5E-05

Concentration Trend: NT

Linear Regression Plot

Well T-12B **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.000

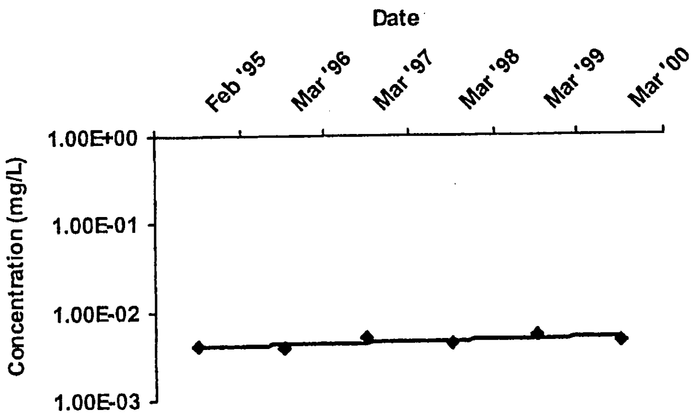
Confidence in Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

Linear Regression Plot

Well T-13b **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.132

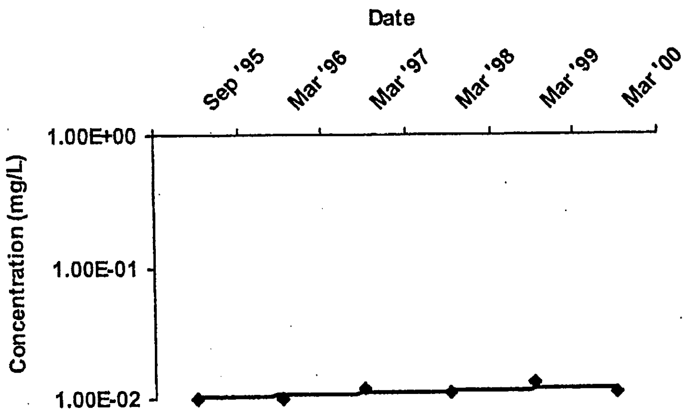
Confidence in Trend: 90.4%

Ln Slope: 1.2E-04

Concentration Trend: PI

Linear Regression Plot

Well LX-1 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.105

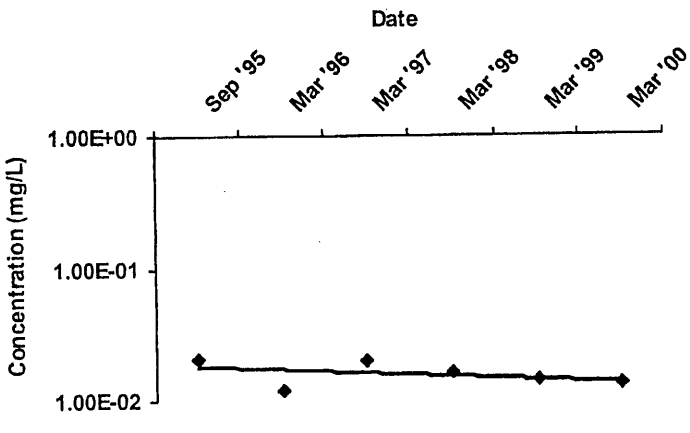
Confidence in Trend: 89.4%

Ln Slope: 9.6E-05

Concentration Trend: NT

Linear Regression Plot

Well LX-2 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.234

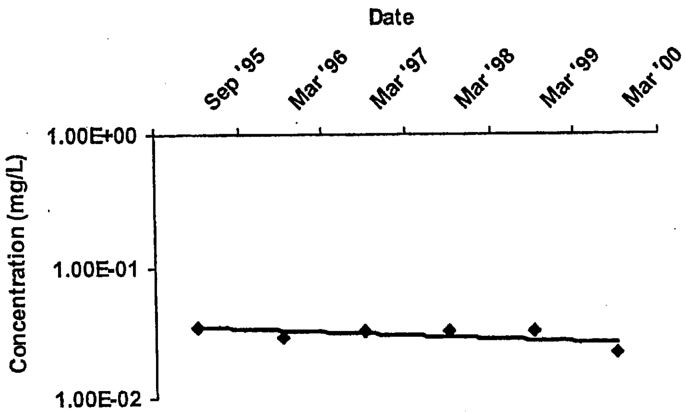
Confidence in Trend: 100.0%

Ln Slope: -1.7E-04

Concentration Trend: D

Linear Regression Plot

Well LX-3 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.151

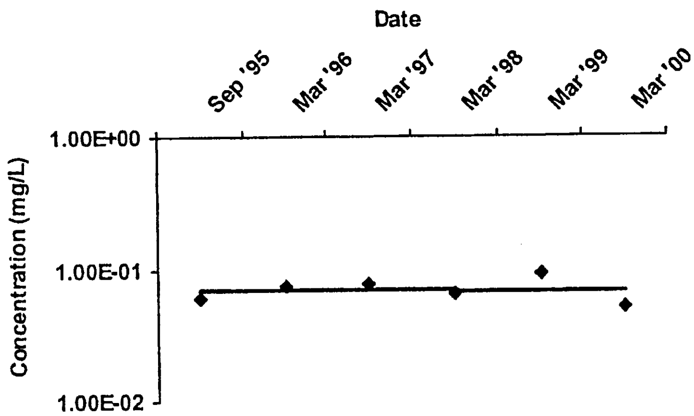
Confidence in Trend: 100.0%

Ln Slope: -1.7E-04

Concentration Trend: D

Linear Regression Plot

Well LX-4 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.204

Confidence in Trend: 100.0%

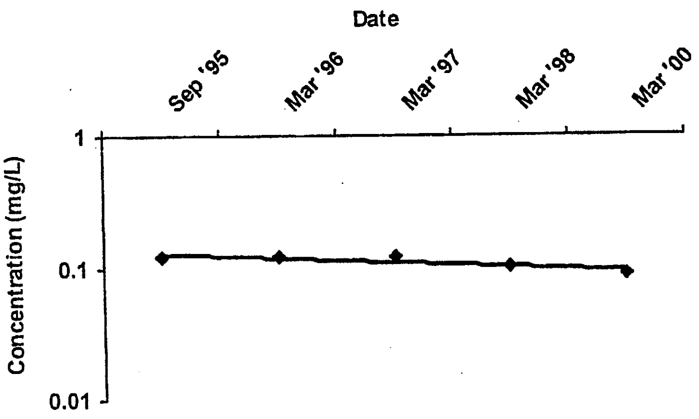
Ln Slope: -3.9E-05

Concentration Trend: D

Linear Regression Plot

Well: LX-5

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.129

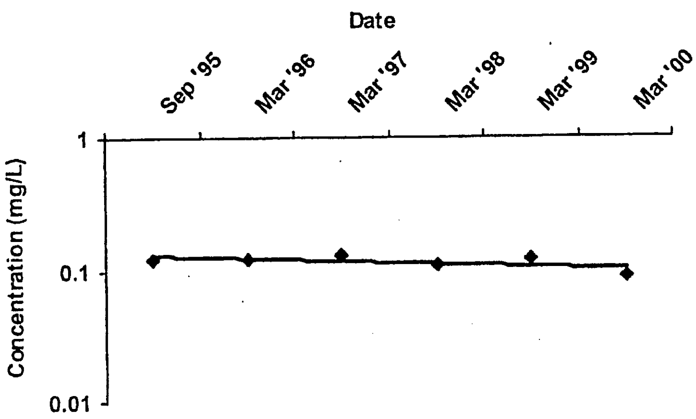
Confidence in Trend: 100.0%

Ln Slope: -1.9E-04

Concentration Trend: D

Linear Regression Plot

Well LX-6 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.127

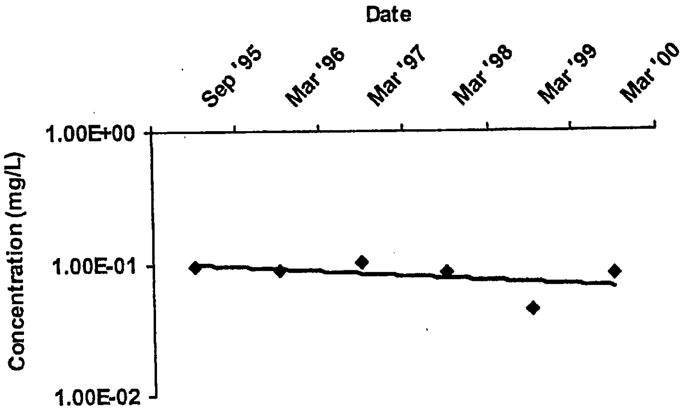
Confidence in Trend: 100.0%

Ln Slope: -1.5E-04

Concentration Trend: D

Linear Regression Plot

Well LX-7 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.236

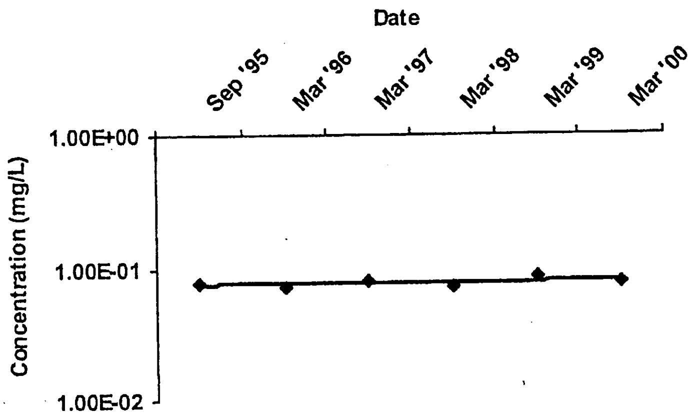
Confidence in Trend: 100.0%

Ln Slope: -2.4E-04

Concentration Trend: D

Linear Regression Plot

Well: LX-8 Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.066

Confidence in Trend: 70.5%

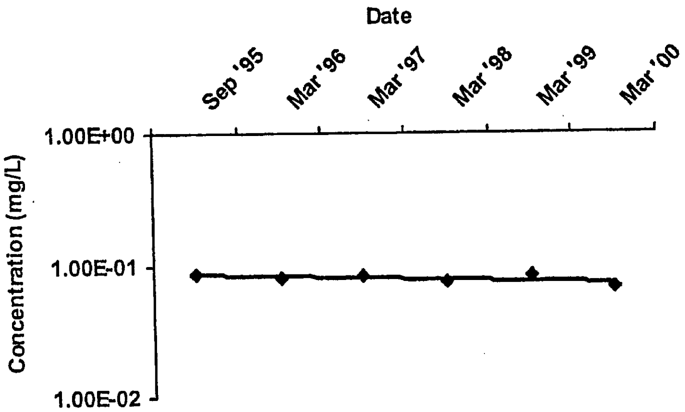
Ln Slope: 2.9E-05

Concentration Trend: NT

Linear Regression Plot

Well: LX-9

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.084

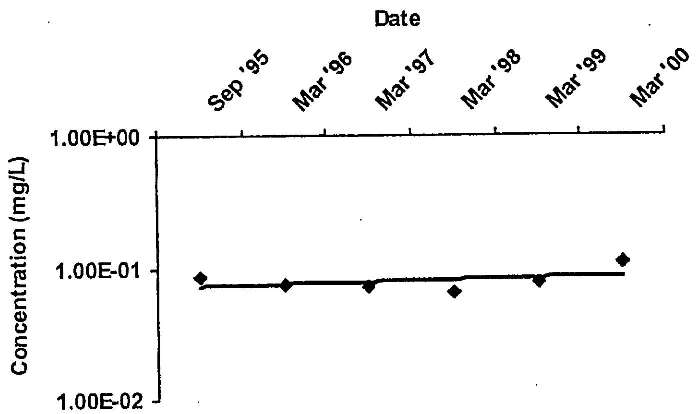
Confidence in Trend: 100.0%

Ln Slope: -9.3E-05

Concentration Trend: D

Linear Regression Plot

Well LX-10 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- ◉ **Log**
- ○ **Linear**

COV: 0.200

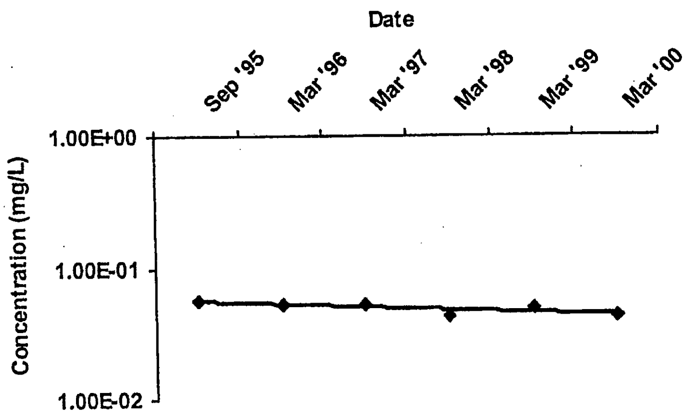
Confidence in Trend: 77.7%

Ln Slope: 1.2E-04

Concentration Trend: NT

Linear Regression Plot

Well LX-11 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.114

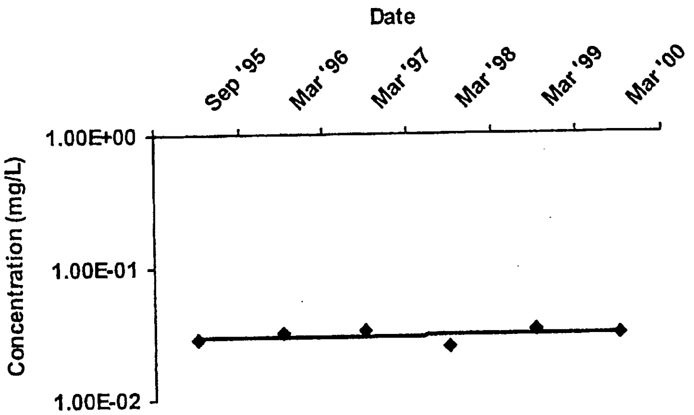
Confidence in Trend: 100.0%

Ln Slope: -1.5E-04

Concentration Trend: D

Linear Regression Plot

Well LX-12 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.098

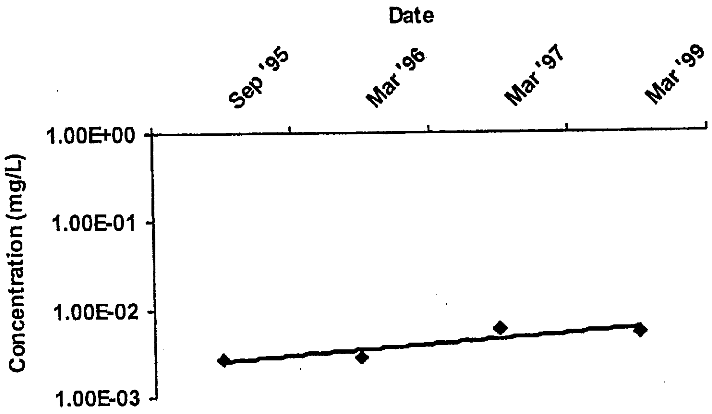
Confidence in Trend: 59.5%

Ln Slope: 2.0E-05

Concentration Trend: NT

Linear Regression Plot

Well LX-13 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.402

Confidence in Trend: 89.7%

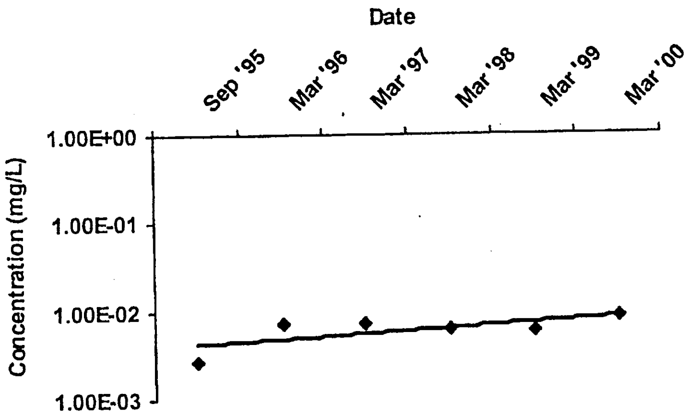
Ln Slope: 5.9E-04

Concentration Trend: NT

Linear Regression Plot

Well: LX-14

Chemical: TRICHLOROETHYLENE (TCE)



Graph Type
- (•) Log
- ( ) Linear

COV: 0.308

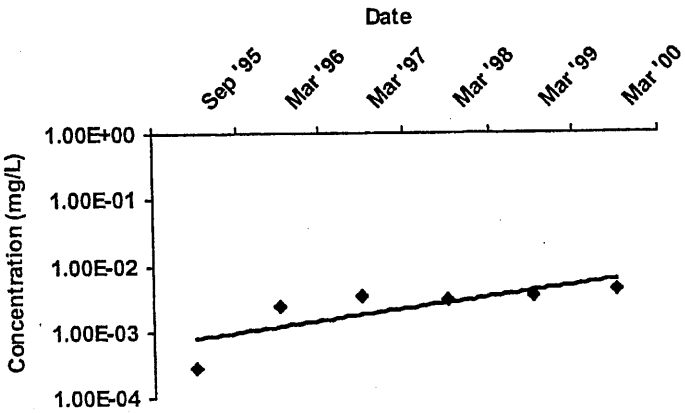
Confidence in Trend: 88.5%

Ln Slope: 3.6E-04

Concentration Trend: NT

Linear Regression Plot

Well LX-15 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.488

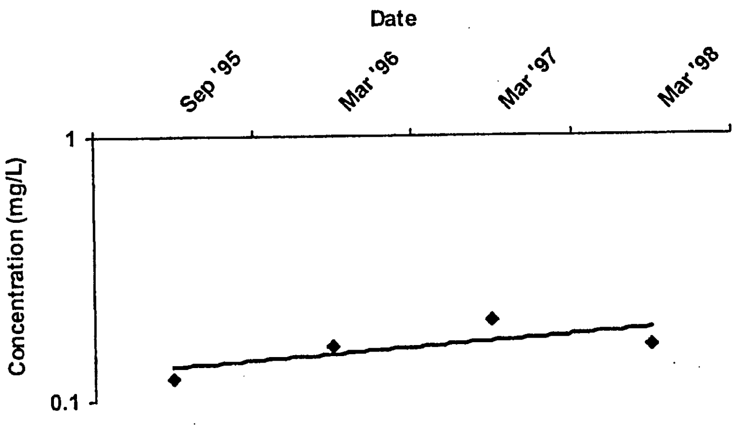
Confidence in Trend: 93.9%

Ln Slope: 1.1E-03

Concentration Trend: PI

Linear Regression Plot

Well LX-16 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.204

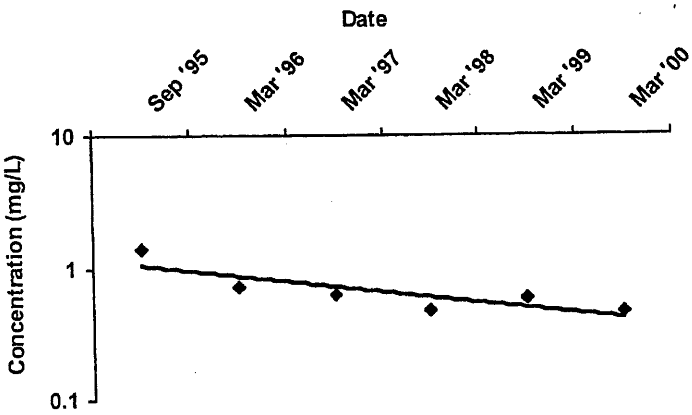
Confidence in Trend: 79.2%

Ln Slope: 3.0E-04

Concentration Trend: NT

Linear Regression Plot

Well LX-17 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.496

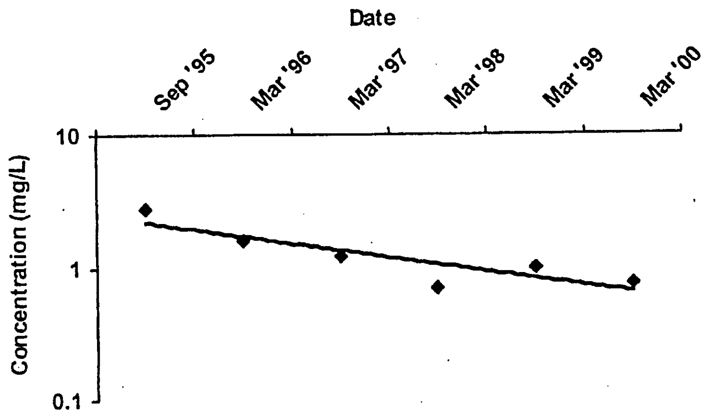
Confidence in Trend: 100.0%

Ln Slope: -5.2E-04

Concentration Trend: D

Linear Regression Plot

Well LX-18 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type

- (•) **Log**
- ( ) **Linear**

COV: 0.589

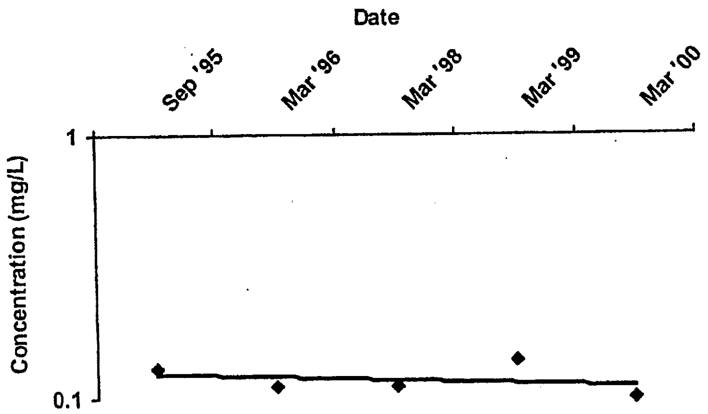
Confidence in Trend: 100.0%

Ln Slope: -7.0E-04

Concentration Trend: D

Linear Regression Plot

Well LX-19 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (●) **Log**
- ( ) **Linear**

COV: 0.139

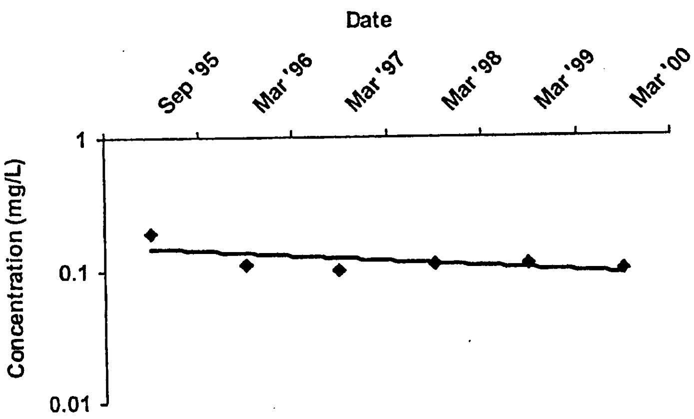
Confidence in Trend: 100.0%

Ln Slope: -5.1E-05

Concentration Trend: D

Linear Regression Plot

Well LX-21 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (selected) **Log**
- **Linear**

COV: 0.296

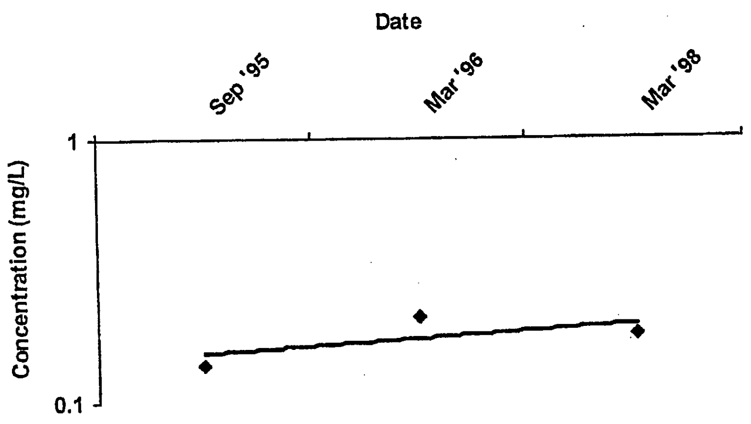
Confidence in Trend: 100.0%

Ln Slope: -2.5E-04

Concentration Trend: D

Linear Regression Plot

Well RW-1 **Chemical** TRICHLOROETHYLENE (TCE)



Graph Type
- (•) **Log**
- ( ) **Linear**

COV: 0.000

Confidence in Trend: 0.0%

Ln Slope: 0.0E+00

Concentration Trend: N/A

A.3. Annual RAM Data (June).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-137c	S	1.3E+00	-13	99.2%	D
LC-21c	S	0.0E+00	0	0.0%	N/A
LC-19c	S	0.0E+00	0	0.0%	N/A
LC-19a	S	0.0E+00	0	0.0%	N/A
LC-162	S	4.8E-01	-15	99.9%	D
LC-149d	S	5.2E-01	-9	93.2%	PD
LC-149c	S	5.2E-01	-9	93.2%	PD
LC-26	S	8.7E-01	-13	99.2%	D
LC-144a	S	8.1E-01	0	37.5%	S
LC-19b	S	0.0E+00	0	0.0%	N/A
LC-137b	S	5.2E-01	-9	93.2%	PD
LC-137a	S	1.2E+00	-5	76.5%	NT
LC-136b	S	5.2E-01	-3	64.0%	S
LC-136a	S	5.8E-01	13	99.2%	I
LC-134	S	1.5E+00	-7	86.4%	NT
LC-108	S	2.2E-01	-5	76.5%	S
LC-06	S	8.1E-01	6	81.5%	NT
LC-144b	S	7.8E-01	-3	72.9%	S
LC-51	S	1.8E-01	12	98.2%	I
LC-53	S	1.7E-01	9	93.2%	PI
LC-64a	S	3.8E-01	1	50.0%	NT
LC-64b	S	3.5E-01	3	64.0%	NT
LC-66b	T	8.4E-02	0	42.3%	S
LC-05	T	5.8E-01	-11	97.2%	D
T-12B	T	0.0E+00	0	0.0%	N/A
T-08	T	1.9E-01	4	70.3%	NT
LC-111b	T	6.3E-01	-9	93.2%	PD
LC-116b	T	1.6E+00	-7	86.4%	NT
LC-122b	T	6.0E-01	-11	97.2%	D
LC-128	T	8.4E-02	13	99.2%	I
LC-132	T	4.6E-01	15	99.9%	I
T-04	T	9.9E-01	1	50.0%	NT
T-01	T	7.2E-01	-4	75.8%	S
PA-383	T	2.6E-01	3	64.0%	NT
LC-165	T	6.8E-01	-6	88.3%	S
LC-73a	T	2.3E-01	3	67.5%	NT
LC-41a	T	1.5E-01	-2	57.0%	S
LC-66a	T	2.9E-01	12	98.2%	I
LC-14a	T	1.6E-01	-5	76.5%	S
LC-03	T	4.5E-01	1	50.0%	NT
LC-49a	T	1.3E-01	2	62.5%	NT
T-13b	T	1.6E-01	9	93.2%	PI
LC-49	T	1.1E-01	4	70.3%	NT
LC-44a	T	6.5E-01	-4	70.3%	S
PA-381	T	3.9E-01	5	76.5%	NT

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-50D	S	0.0E+00	0	0.0%	N/A
LC-26D	S	6.0E-01	-8	89.8%	S
LC-35D	S	0.0E+00	0	0.0%	N/A
LC-41D	S	1.3E-01	5	76.5%	NT
LC-47D	S	0.0E+00	0	0.0%	N/A
LC-166D	T	1.3E-01	0	40.8%	S
LC-40D	T	5.6E-01	-4	70.3%	S
LC-126	T	7.6E-02	-3	64.0%	S
LC-67D	T	1.4E-01	5	76.5%	NT
LC-77D	T	0.0E+00	0	0.0%	N/A
LC-71D	T	5.2E-01	-7	86.4%	S
LC-72D	T	3.3E-01	0	42.3%	S
LC-73D	T	2.1E-01	1	50.0%	NT
LC-74D	T	2.5E-01	8	95.8%	I
LC-75D	T	0.0E+00	0	0.0%	N/A
LC-76D	T	0.0E+00	0	0.0%	N/A
LC-66D	T	4.6E-01	3	64.0%	NT

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LX-19	S	1.1E-01	-9	93.2%	PD
LX-16	S	0.0E+00	0	0.0%	N/A
LX-17	S	6.1E-01	-13	99.2%	D
LX-18	S	7.1E-01	-13	99.2%	D
RW-1	S	5.4E-02	5	89.5%	NT
LX-21	S	6.7E-01	1	50.0%	NT
LX-4	T	1.1E-01	-7	86.4%	S
LX-3	T	1.9E-01	-12	98.2%	D
LX-5	T	1.1E-01	-8	89.8%	S
LX-6	T	9.7E-02	-9	93.2%	PD
LX-7	T	1.2E-01	0	42.3%	S
LX-1	T	7.0E-02	-7	86.4%	S
LX-8	T	1.2E-01	3	64.0%	NT
LX-9	T	1.1E-01	-3	64.0%	S
LX-15	T	5.0E-01	11	97.2%	I
LX-14	T	3.1E-01	9	93.2%	PI
LX-13	T	3.2E-01	8	95.8%	I
LX-12	T	1.8E-01	0	42.3%	S
LX-11	T	1.6E-01	-5	76.5%	S
LX-10	T	1.9E-01	-2	57.0%	S
LX-2	T	2.4E-01	-12	98.2%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-149c	S	4.5E-04	2.3E-04	-8.9E-04	5.2E-01	100.0%	D
	LC-64a	S	4.5E-01	1.7E-01	9.4E-05	3.8E-01	64.5%	NT
	LC-53	S	1.6E-01	2.8E-02	2.0E-04	1.7E-01	98.0%	I
	LC-51	S	1.4E-01	2.5E-02	2.2E-04	1.8E-01	98.9%	I
	LC-26	S	4.8E-04	4.2E-04	-1.4E-03	8.7E-01	100.0%	D
	LC-21c	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-19c	S	4.8E-02	8.5E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-19b	S	1.3E-01	7.8E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-19a	S	1.8E-01	7.1E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-06	S	6.9E-02	5.6E-02	1.8E-04	8.1E-01	61.3%	NT
	LC-149d	S	4.5E-04	2.3E-04	-8.9E-04	5.2E-01	100.0%	D
	LC-64b	S	4.8E-02	1.6E-02	-2.7E-04	3.5E-01	100.0%	D
	LC-144b	S	2.5E-01	1.9E-01	-1.0E-03	7.8E-01	100.0%	D
	LC-144a	S	9.1E-02	7.4E-02	4.8E-04	8.1E-01	62.0%	NT
	LC-137c	S	1.1E-02	1.5E-02	-2.7E-03	1.3E+00	100.0%	D
	LC-137b	S	1.7E-01	8.7E-02	-4.4E-04	5.2E-01	100.0%	D
	LC-137a	S	1.6E-01	2.0E-01	-8.6E-04	1.2E+00	100.0%	D
	LC-136b	S	1.1E-01	5.6E-02	-3.3E-04	5.2E-01	100.0%	D
	LC-136a	S	8.1E+01	4.7E+01	8.9E-04	5.8E-01	99.9%	I
	LC-134	S	4.4E+00	6.7E+00	-1.2E-03	1.5E+00	100.0%	D
	LC-108	S	2.4E-02	5.2E-03	-1.8E-04	2.2E-01	100.0%	D
	LC-162	S	5.7E-01	2.8E-01	-6.6E-04	4.8E-01	100.0%	D
	LC-44a	T	2.8E-02	1.8E-02	-2.1E-04	6.5E-01	100.0%	D
	T-12B	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	T-08	T	2.4E-03	4.5E-04	8.4E-05	1.9E-01	73.2%	NT
	T-04	T	1.4E-02	1.4E-02	-4.8E-04	9.9E-01	100.0%	D
	T-01	T	2.4E-03	1.7E-03	-6.4E-04	7.2E-01	100.0%	D
	PA-383	T	1.5E-03	3.8E-04	1.1E-04	2.6E-01	71.0%	NT
	PA-381	T	4.6E-02	1.8E-02	1.1E-04	3.9E-01	64.6%	NT
	LC-73a	T	7.9E-04	1.8E-04	3.4E-04	2.3E-01	95.3%	I
	LC-66b	T	1.2E-01	1.0E-02	-2.6E-06	8.4E-02	100.0%	D
	LC-66a	T	8.7E-02	2.5E-02	4.2E-04	2.9E-01	95.2%	I
	LC-03	T	6.6E-04	2.9E-04	1.5E-04	4.5E-01	64.9%	NT
	LC-49	T	2.2E-01	2.4E-02	4.7E-05	1.1E-01	72.8%	NT
	LC-05	T	3.7E-02	2.2E-02	-5.6E-04	5.8E-01	100.0%	D
	LC-41a	T	1.7E-01	2.5E-02	-4.1E-05	1.5E-01	100.0%	D
	LC-165	T	4.0E-04	2.7E-04	-1.5E-03	6.8E-01	100.0%	D
	LC-14a	T	6.4E-02	1.1E-02	-1.2E-04	1.6E-01	100.0%	D
	LC-132	T	6.0E-02	2.7E-02	7.0E-04	4.6E-01	100.0%	I
	LC-128	T	1.9E-02	1.6E-03	1.1E-04	8.4E-02	99.9%	I
	LC-122b	T	4.4E-04	2.6E-04	-1.1E-03	6.0E-01	100.0%	D
	LC-116b	T	1.0E-03	1.7E-03	-1.2E-03	1.6E+00	100.0%	D
	LC-111b	T	3.9E-04	2.5E-04	-1.0E-03	6.3E-01	100.0%	D
	T-13b	T	4.4E-03	7.0E-04	1.5E-04	1.6E-01	93.3%	PI
	LC-49a	T	7.6E-02	9.7E-03	9.8E-05	1.3E-01	70.4%	NT

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-35D	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-41D	S	1.3E-01	1.7E-02	7.0E-05	1.3E-01	77.8%	NT
	LC-47D	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-50D	S	1.3E-03	2.1E-04	0.0E+00	0.0E+00	0.0%	N/A
	LC-26D	S	4.3E-04	2.6E-04	-1.0E-03	6.0E-01	100.0%	D
	LC-67D	T	5.4E-02	7.8E-03	8.9E-05	1.4E-01	81.4%	NT
	LC-126	T	1.1E-01	8.0E-03	-4.9E-05	7.6E-02	100.0%	D
	LC-166D	T	5.7E-04	7.2E-05	4.7E-08	1.3E-01	100.0%	I
	LC-66D	T	4.2E-02	1.9E-02	-9.6E-04	4.6E-01	100.0%	D
	LC-77D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-71D	T	4.5E-04	2.3E-04	-8.0E-04	5.2E-01	100.0%	D
	LC-72D	T	4.7E-02	1.6E-02	-3.8E-04	3.3E-01	100.0%	D
	LC-73D	T	2.9E-02	6.1E-03	-6.7E-05	2.1E-01	100.0%	D
	LC-74D	T	5.3E-02	1.3E-02	4.2E-04	2.5E-01	99.6%	I
	LC-75D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-76D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-40D	T	1.3E-02	7.5E-03	-5.5E-04	5.6E-01	100.0%	D

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LX-17	S	6.4E-01	3.9E-01	-6.2E-04	6.1E-01	100.0%	D
	LX-18	S	1.2E+00	8.7E-01	-9.2E-04	7.1E-01	100.0%	D
	LX-19	S	1.1E-01	1.3E-02	-1.4E-04	1.1E-01	100.0%	D
	LX-21	S	9.2E-02	6.2E-02	9.8E-04	6.7E-01	73.7%	NT
	RW-1	S	1.5E-01	8.2E-03	1.2E-04	5.4E-02	97.2%	I
	LX-16	S	1.4E-01	1.7E-02	0.0E+00	0.0E+00	0.0%	N/A
	LX-14	T	6.1E-03	1.9E-03	4.0E-04	3.1E-01	92.6%	PI
	LX-1	T	1.0E-02	7.1E-04	-5.6E-05	7.0E-02	100.0%	D
	LX-10	T	6.7E-02	1.3E-02	-4.9E-05	1.9E-01	100.0%	D
	LX-11	T	5.0E-02	8.1E-03	-1.3E-04	1.6E-01	100.0%	D
	LX-13	T	4.6E-03	1.5E-03	5.5E-04	3.2E-01	98.0%	I
	LX-9	T	7.3E-02	7.8E-03	-2.7E-05	1.1E-01	100.0%	D
	LX-15	T	3.1E-03	1.5E-03	1.1E-03	5.0E-01	94.0%	PI
	LX-2	T	1.7E-02	3.9E-03	-3.5E-04	2.4E-01	100.0%	D
	LX-3	T	2.9E-02	5.4E-03	-2.8E-04	1.9E-01	100.0%	D
	LX-4	T	6.1E-02	6.7E-03	-1.1E-04	1.1E-01	100.0%	D
	LX-5	T	1.0E-01	1.1E-02	-1.1E-04	1.1E-01	100.0%	D
	LX-6	T	1.0E-01	1.0E-02	-1.1E-04	9.7E-02	100.0%	D
	LX-7	T	8.7E-02	1.1E-02	-3.4E-05	1.2E-01	100.0%	D
	LX-8	T	7.4E-02	9.0E-03	8.2E-05	1.2E-01	82.2%	NT
	LX-12	T	2.8E-02	5.2E-03	5.1E-05	1.8E-01	63.1%	NT

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-137c	S	D	D	N/A	N/A
	LC-21c	S	N/A	N/A	N/A	N/A
	LC-19c	S	N/A	N/A	N/A	N/A
	LC-19a	S	N/A	N/A	N/A	N/A
	LC-162	S	D	D	N/A	N/A
	LC-149d	S	PD	D	N/A	N/A
	LC-149c	S	PD	D	N/A	N/A
	LC-26	S	D	D	N/A	N/A
	LC-144a	S	S	NT	N/A	N/A
	LC-19b	S	N/A	N/A	N/A	N/A
	LC-137b	S	PD	D	N/A	N/A
	LC-137a	S	NT	D	N/A	N/A
	LC-136b	S	S	D	N/A	N/A
	LC-136a	S	I	I	N/A	N/A
	LC-134	S	NT	D	N/A	N/A
	LC-108	S	S	D	N/A	N/A
	LC-06	S	NT	NT	N/A	N/A
	LC-144b	S	S	D	N/A	N/A
	LC-51	S	I	I	N/A	N/A
	LC-53	S	PI	I	N/A	N/A
	LC-64a	S	NT	NT	N/A	N/A
	LC-64b	S	NT	D	N/A	N/A
	LC-66b	T	S	D	N/A	N/A
	LC-05	T	D	D	N/A	N/A
	T-12B	T	N/A	N/A	N/A	N/A
	T-08	T	NT	NT	N/A	N/A
	LC-111b	T	PD	D	N/A	N/A
	LC-116b	T	NT	D	N/A	N/A
	LC-122b	T	D	D	N/A	N/A
	LC-128	T	I	I	N/A	N/A
	LC-132	T	I	I	N/A	N/A
	T-04	T	NT	D	N/A	N/A
	T-01	T	S	D	N/A	N/A
	PA-383	T	NT	NT	N/A	N/A
	LC-165	T	S	D	N/A	N/A
	LC-73a	T	NT	I	N/A	N/A
	LC-41a	T	S	D	N/A	N/A
	LC-66a	T	I	I	N/A	N/A
	LC-14a	T	S	D	N/A	N/A
	LC-03	T	NT	NT	N/A	N/A
	LC-49a	T	NT	NT	N/A	N/A
	T-13b	T	PI	PI	N/A	N/A
	LC-49	T	NT	NT	N/A	N/A

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-44a	T	S	D	N/A	N/A
	PA-381	T	NT	NT	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-50D	S	N/A	N/A	N/A	N/A
	LC-26D	S	S	D	N/A	N/A
	LC-35D	S	N/A	N/A	N/A	N/A
	LC-41D	S	NT	NT	N/A	N/A
	LC-47D	S	N/A	N/A	N/A	N/A
	LC-166D	T	S	I	N/A	N/A
	LC-40D	T	S	D	N/A	N/A
	LC-126	T	S	D	N/A	N/A
	LC-67D	T	NT	NT	N/A	N/A
	LC-77D	T	N/A	N/A	N/A	N/A
	LC-71D	T	S	D	N/A	N/A
	LC-72D	T	S	D	N/A	N/A
	LC-73D	T	NT	D	N/A	N/A
	LC-74D	T	I	I	N/A	N/A
	LC-75D	T	N/A	N/A	N/A	N/A
	LC-76D	T	N/A	N/A	N/A	N/A
	LC-66D	T	NT	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LX-19	S	PD	D	N/A	N/A
	LX-16	S	N/A	N/A	N/A	N/A
	LX-17	S	D	D	N/A	N/A
	LX-18	S	D	D	N/A	N/A
	RW-1	S	NT	I	N/A	N/A
	LX-21	S	NT	NT	N/A	N/A
	LX-4	T	S	D	N/A	N/A
	LX-3	T	D	D	N/A	N/A
	LX-5	T	S	D	N/A	N/A
	LX-6	T	PD	D	N/A	N/A
	LX-7	T	S	D	N/A	N/A
	LX-1	T	S	D	N/A	N/A
	LX-8	T	NT	NT	N/A	N/A
	LX-9	T	S	D	N/A	N/A
	LX-15	T	I	PI	N/A	N/A
	LX-14	T	PI	PI	N/A	N/A
	LX-13	T	I	I	N/A	N/A
	LX-12	T	S	NT	N/A	N/A
	LX-11	T	S	D	N/A	N/A
	LX-10	T	S	D	N/A	N/A
	LX-2	T	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center | **User Name:** Seattle District

Location: Ft Lewis | **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 22 **Number of Tail Wells:** 23

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 5 **Number of Tail Wells:** 12

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: No Current Site Treatment **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Sample 4 more years	Biannually (6 months)	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 6 **Number of Tail Wells:** 15

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

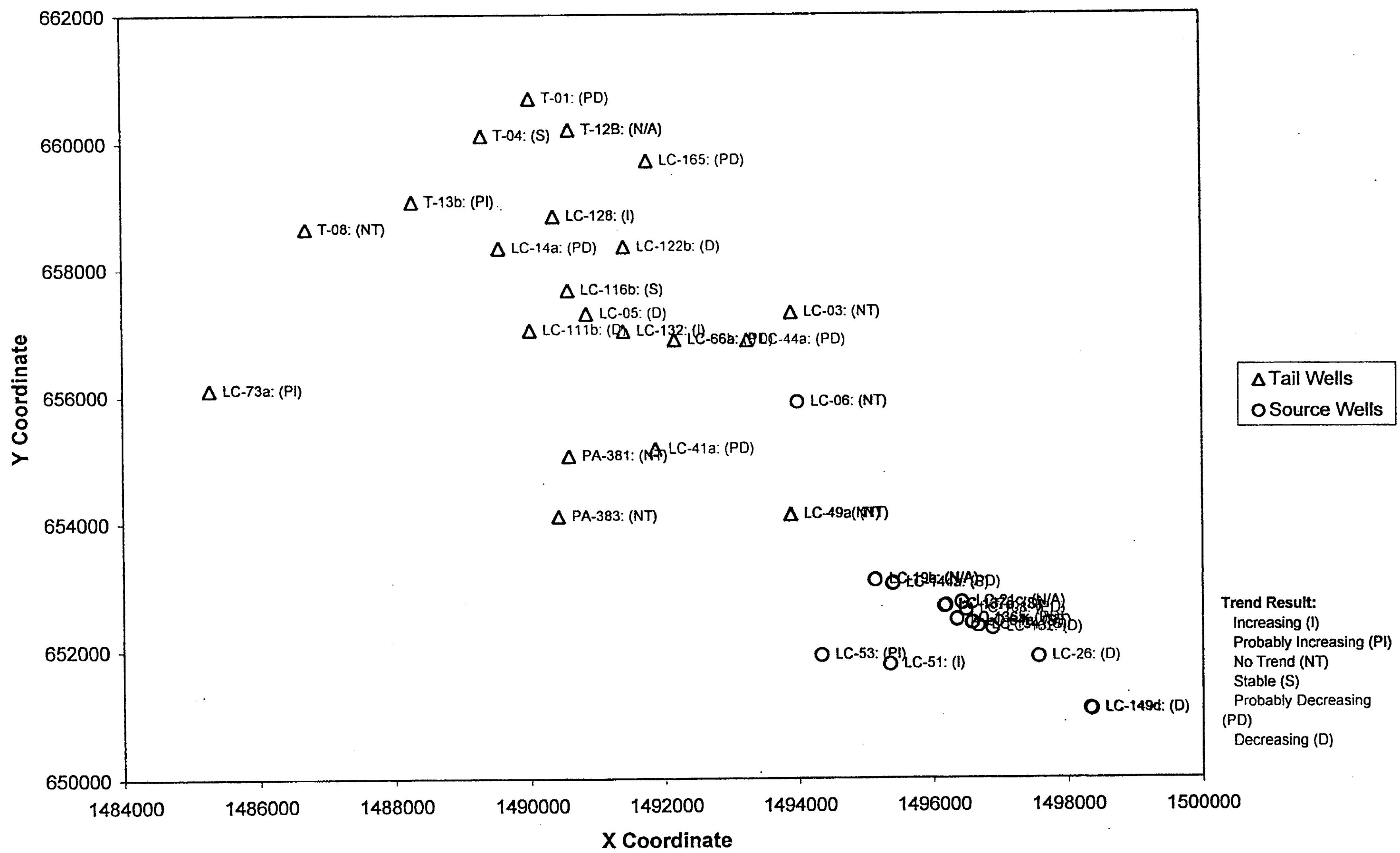
COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	PD	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

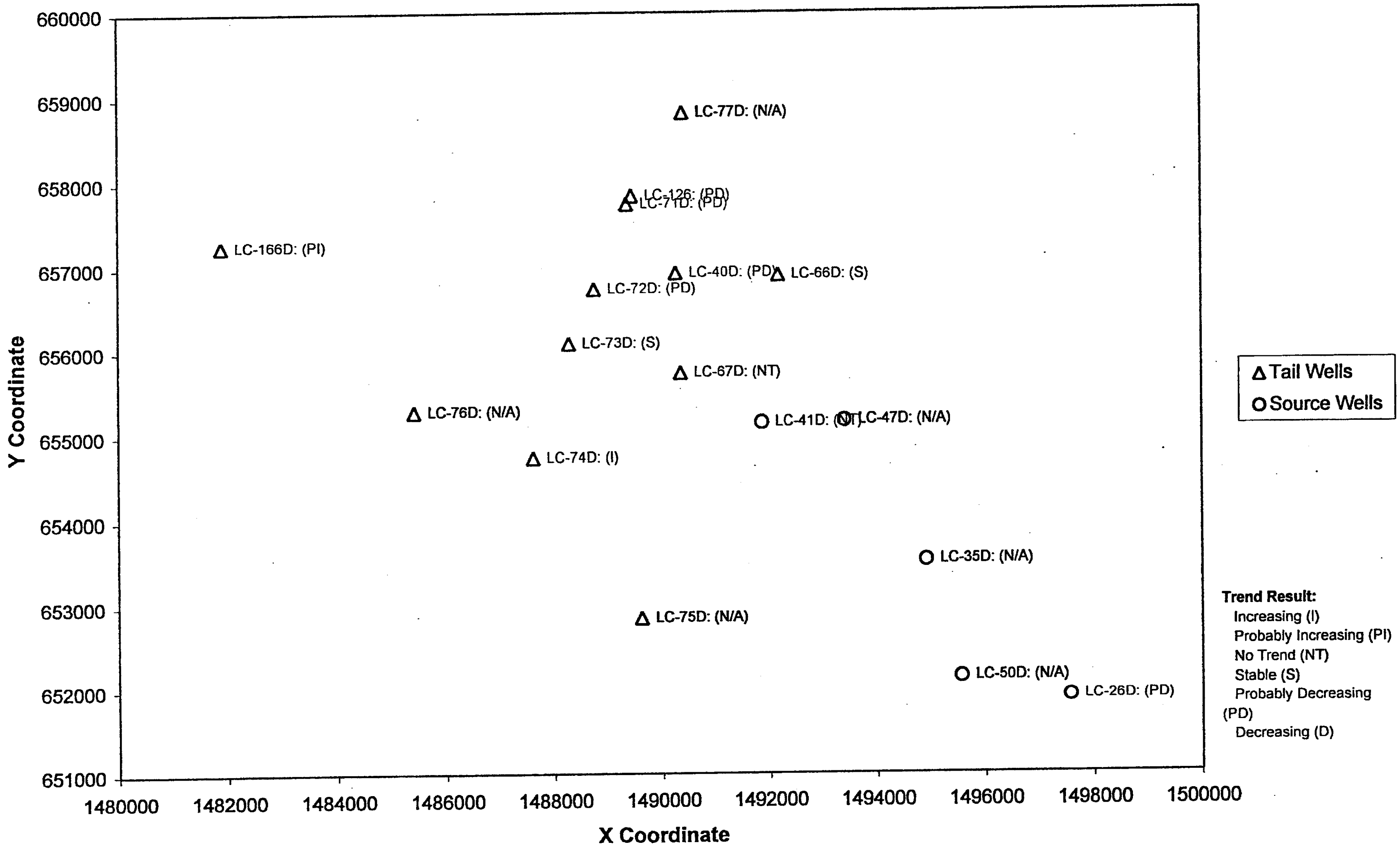
Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Trend Results for TRICHLOROETHYLENE (TCE)

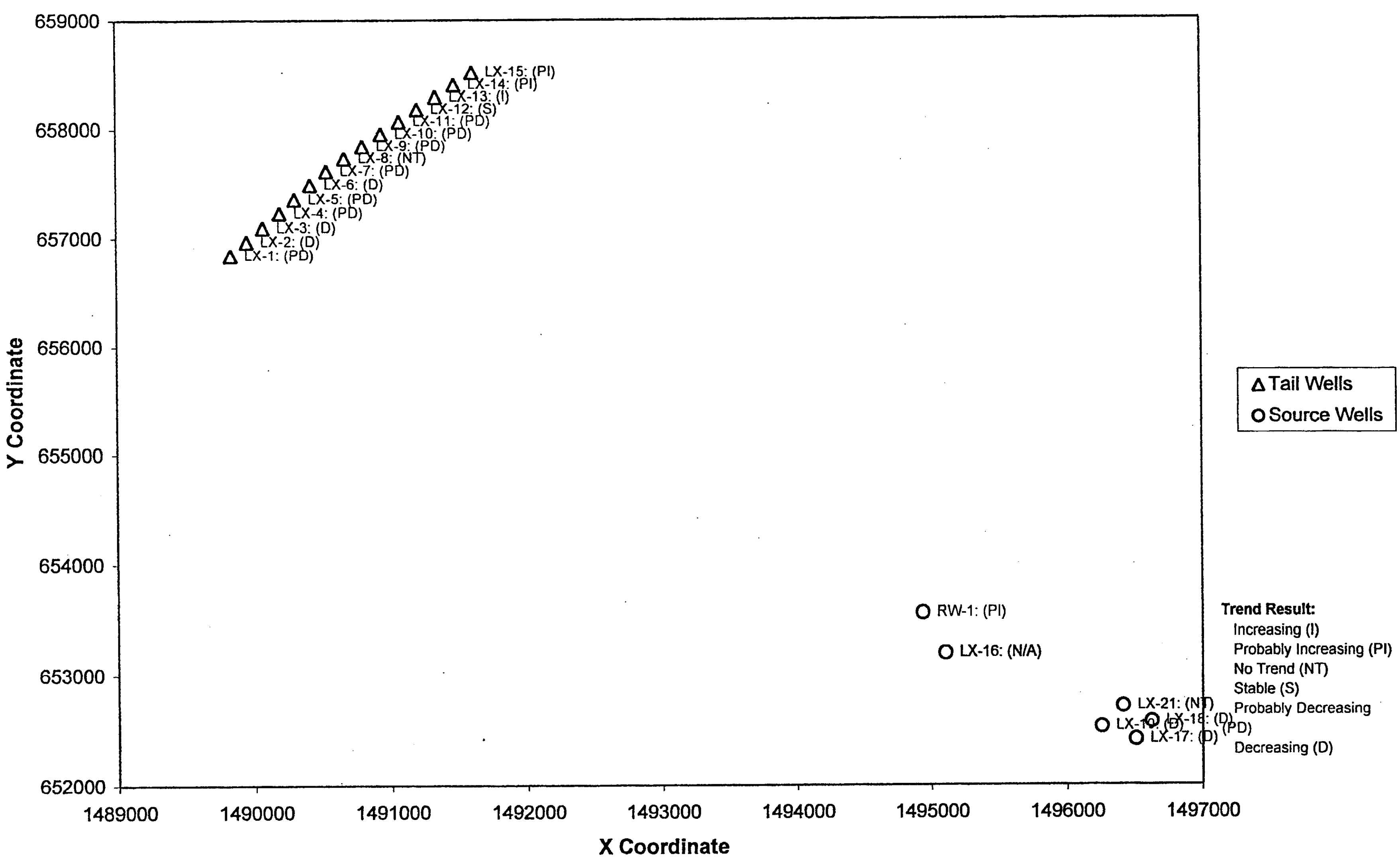


Trend Results for TRICHLOROETHYLENE (TCE)



Trend Result:
Increasing (I)
Probably Increasing (PI)
No Trend (NT)
Stable (S)
Probably Decreasing (PD)
Decreasing (D)

Trend Results for TRICHLOROETHYLENE (TCE)



MAROS Sampling Frequency Optimization Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Analysis by Modified CES Method

Number of Sampling Events Analyzed: 6

Recent Sampling Events:	**From**	baseline	2/1/95
	To	Q19	6/1/00

Constituent	Well Name	Sampling Frequency	Frequency based on current period	Frequency based on overall period
TRICHLOROETHYLENE (TCE)	LC-03	Annual	Annual	Annual
	LC-05	Annual	Annual	Annual
	LC-06	Annual	Annual	Annual
	LC-108	Annual	Annual	Annual
	LC-111b	Annual	Annual	Annual
	LC-116b	Annual	Annual	Annual
	LC-122b	Biennial	Annual	Annual
	LC-128	Annual	Annual	Annual
	LC-132	Quarterly	Quarterly	Quarterly
	LC-134	Annual	Annual	Annual
	LC-136a	Quarterly	Quarterly	Quarterly
	LC-136b	Annual	Annual	Annual
	LC-137a	Annual	Annual	Annual
	LC-137b	Annual	Annual	Annual
	LC-137c	Annual	Annual	Annual
	LC-144a	Annual	Annual	Annual
	LC-144b	Annual	Annual	Annual
	LC-149c	Annual	Annual	Annual
	LC-149d	Annual	Annual	Annual
	LC-14a	Annual	Annual	Annual
	LC-162	Annual	Annual	Annual
	LC-165	Biennial	Annual	Annual
	LC-19a	Quarterly	Quarterly	Quarterly
	LC-19b	Quarterly	Quarterly	Quarterly

LC-132	Quarterly
LC-134	Annual
LC-136a	Quarterly
LC-136b	Annual
LC-137a	Annual
LC-137b	Annual
LC-137c	Annual
LC-144a	Annual
LC-144b	Annual
LC-149c	Annual
LC-149d	Annual
LC-14a	Annual
LC-162	Annual
LC-165	Biennial
LC-19a	Quarterly
LC-19b	Quarterly
LC-19c	Quarterly
LC-21c	SemiAnnual
LC-26	Biennial
LC-41a	Annual
LC-44a	Annual
LC-49	Annual
LC-49a	Annual
LC-51	Quarterly
LC-53	SemiAnnual
LC-64a	SemiAnnual
LC-64b	Annual
LC-66a	SemiAnnual
LC-66b	Annual
LC-73a	Annual
PA-381	Annual
PA-383	Annual
T-01	Annual
T-04	Annual
T-08	Annual
T-12B	Annual
T-13b	Annual

Note: the most stringent sampling frequency was chosen among all COCs.

A.4. Annual RAM Data (September).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-137c	S	8.4E-01	-11	97.2%	D
LC-21c	S	0.0E+00	0	0.0%	N/A
LC-19c	S	0.0E+00	0	0.0%	N/A
LC-19a	S	0.0E+00	0	0.0%	N/A
LC-162	S	6.4E-01	-15	99.9%	D
LC-149d	S	8.2E-01	-9	93.2%	PD
LC-149c	S	9.9E-01	-11	97.2%	D
LC-26	S	1.3E+00	-10	95.2%	D
LC-144a	S	0.0E+00	0	0.0%	N/A
LC-19b	S	0.0E+00	0	0.0%	N/A
LC-137b	S	5.1E-01	0	42.3%	S
LC-137a	S	5.5E-01	-1	50.0%	S
LC-136b	S	5.0E-01	-5	76.5%	S
LC-136a	S	6.2E-01	15	99.9%	I
LC-134	S	1.4E+00	-3	64.0%	NT
LC-108	S	7.3E-01	-6	81.5%	S
LC-06	S	3.1E-01	-8	89.8%	S
LC-144b	S	0.0E+00	0	0.0%	N/A
LC-51	S	2.0E-01	9	93.2%	PI
LC-53	S	1.8E-01	8	89.8%	NT
LC-64a	S	3.2E-01	-5	76.5%	S
LC-64b	S	4.8E-01	-6	81.5%	S
LC-66b	T	7.9E-01	-4	70.3%	S
LC-05	T	3.4E-01	4	70.3%	NT
T-12B	T	0.0E+00	0	0.0%	N/A
T-08	T	2.1E-01	3	64.0%	NT
LC-111b	T	6.5E-01	-5	76.5%	S
LC-116b	T	1.2E+00	-5	76.5%	NT
LC-122b	T	1.0E+00	-11	97.2%	D
LC-128	T	5.7E-01	8	89.8%	NT
LC-132	T	3.8E-01	8	89.8%	NT
T-04	T	7.9E-01	-9	93.2%	PD
T-01	T	6.2E-01	-2	59.2%	S
PA-383	T	5.6E-01	-3	64.0%	S
LC-165	T	3.3E-01	-6	88.3%	S
LC-73a	T	2.5E-01	-3	67.5%	S
LC-41a	T	1.8E-01	-2	57.0%	S
LC-66a	T	3.3E-01	1	50.0%	NT
LC-14a	T	2.8E-01	-7	86.4%	S
LC-03	T	1.8E+00	8	89.8%	NT
LC-49a	T	0.0E+00	0	0.0%	N/A
T-13b	T	1.9E-01	3	64.0%	NT
LC-49	T	1.5E-01	0	42.3%	S
LC-44a	T	5.3E-01	-7	86.4%	S
PA-381	T	2.6E-01	-11	97.2%	D

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-50D	S	0.0E+00	0	0.0%	N/A
LC-26D	S	9.9E-01	-11	97.2%	D
LC-35D	S	0.0E+00	0	0.0%	N/A
LC-41D	S	9.6E-02	1	50.0%	NT
LC-47D	S	0.0E+00	0	0.0%	N/A
LC-166D	T	6.4E-01	7	92.0%	PI
LC-40D	T	5.2E-01	-9	93.2%	PD
LC-126	T	2.0E-01	-9	93.2%	PD
LC-67D	T	9.1E-02	8	89.8%	NT
LC-77D	T	0.0E+00	0	0.0%	N/A
LC-71D	T	8.7E-01	0	42.3%	S
LC-72D	T	4.1E-01	-4	75.8%	S
LC-73D	T	6.5E-01	-10	95.2%	D
LC-74D	T	1.8E-01	-2	59.2%	S
LC-75D	T	0.0E+00	0	0.0%	N/A
LC-76D	T	0.0E+00	0	0.0%	N/A
LC-66D	T	7.3E-01	-5	76.5%	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LX-19	S	1.8E-01	-10	95.2%	D
LX-16	S	0.0E+00	0	0.0%	N/A
LX-17	S	4.9E-01	-11	97.2%	D
LX-18	S	7.2E-01	-8	95.8%	D
RW-1	S	0.0E+00	0	0.0%	N/A
LX-21	S	4.9E-01	-10	95.2%	D
LX-4	T	2.2E-01	-6	88.3%	S
LX-3	T	2.4E-01	-10	95.2%	D
LX-5	T	1.8E-01	-10	95.2%	D
LX-6	T	1.5E-01	-10	95.2%	D
LX-7	T	1.2E-01	-8	89.8%	S
LX-1	T	2.1E-01	-2	57.0%	S
LX-8	T	1.0E-01	-4	75.8%	S
LX-9	T	1.5E-01	-11	97.2%	D
LX-15	T	4.6E-01	4	70.3%	NT
LX-14	T	3.8E-01	7	86.4%	NT
LX-13	T	2.6E-01	8	95.8%	I
LX-12	T	1.4E-01	-4	75.8%	S
LX-11	T	2.4E-01	-10	95.2%	D
LX-10	T	2.1E-01	-5	76.5%	S
LX-2	T	3.0E-01	-14	99.6%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-149c	S	2.0E-04	2.0E-04	-8.0E-04	9.9E-01	100.0%	D
	LC-64a	S	3.7E-01	1.2E-01	-1.2E-04	3.2E-01	100.0%	D
	LC-53	S	1.8E-01	3.1E-02	1.8E-04	1.8E-01	94.5%	PI
	LC-51	S	1.5E-01	3.0E-02	2.0E-04	2.0E-01	95.4%	I
	LC-26	S	3.3E-04	4.3E-04	-1.2E-03	1.3E+00	100.0%	D
	LC-21c	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-19c	S	3.4E-02	2.7E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-19b	S	1.1E-01	1.3E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-19a	S	1.5E-01	4.4E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-06	S	1.1E-01	3.4E-02	-8.7E-05	3.1E-01	100.0%	D
	LC-149d	S	2.5E-04	2.0E-04	-7.0E-04	8.2E-01	100.0%	D
	LC-64b	S	5.1E-02	2.4E-02	-4.0E-04	4.8E-01	100.0%	D
	LC-144b	S	2.9E-01	2.1E-01	0.0E+00	0.0E+00	0.0%	N/A
	LC-144a	S	9.7E-02	6.6E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-137c	S	1.4E-02	1.2E-02	-1.6E-03	8.4E-01	100.0%	D
	LC-137b	S	2.2E-01	1.1E-01	1.7E-05	5.1E-01	51.7%	NT
	LC-137a	S	3.9E-01	2.1E-01	-1.4E-04	5.5E-01	100.0%	D
	LC-136b	S	1.1E-01	5.5E-02	-4.0E-04	5.0E-01	100.0%	D
	LC-136a	S	9.6E+01	6.0E+01	9.9E-04	6.2E-01	100.0%	I
	LC-134	S	4.7E+00	6.5E+00	-7.9E-04	1.4E+00	100.0%	D
	LC-108	S	1.5E-02	1.1E-02	-8.8E-04	7.3E-01	100.0%	D
	LC-162	S	4.6E-01	2.9E-01	-7.1E-04	6.4E-01	100.0%	D
	LC-44a	T	3.0E-02	1.6E-02	-4.4E-04	5.3E-01	100.0%	D
	T-12B	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	T-08	T	3.0E-03	6.4E-04	1.6E-05	2.1E-01	54.1%	NT
	T-04	T	1.6E-02	1.3E-02	-6.5E-04	7.9E-01	100.0%	D
	T-01	T	2.6E-03	1.6E-03	-4.7E-04	6.2E-01	100.0%	D
	PA-383	T	1.2E-03	6.7E-04	-1.9E-04	5.6E-01	100.0%	D
	PA-381	T	5.1E-02	1.3E-02	-2.8E-04	2.6E-01	100.0%	D
	LC-73a	T	7.4E-04	1.8E-04	-1.6E-04	2.5E-01	100.0%	D
	LC-66b	T	1.8E-01	1.5E-01	4.7E-05	7.9E-01	54.6%	NT
	LC-66a	T	8.6E-02	2.8E-02	3.1E-04	3.3E-01	86.9%	NT
	LC-03	T	3.9E-03	6.9E-03	1.1E-03	1.8E+00	93.8%	PI
	LC-49	T	2.2E-01	3.4E-02	-3.9E-06	1.5E-01	100.0%	D
	LC-05	T	4.8E-02	1.6E-02	-1.6E-04	3.4E-01	100.0%	D
	LC-41a	T	1.8E-01	3.2E-02	-6.0E-05	1.8E-01	100.0%	D
	LC-165	T	1.5E-04	5.0E-05	-4.9E-04	3.3E-01	100.0%	D
	LC-14a	T	7.5E-02	2.1E-02	-1.7E-04	2.8E-01	100.0%	D
	LC-132	T	6.8E-02	2.5E-02	5.1E-04	3.8E-01	96.5%	I
	LC-128	T	2.9E-02	1.7E-02	4.6E-04	5.7E-01	96.0%	I
	LC-122b	T	2.1E-04	2.1E-04	-8.3E-04	1.0E+00	100.0%	D
	LC-116b	T	1.7E-03	2.0E-03	-2.3E-04	1.2E+00	100.0%	D
	LC-111b	T	3.8E-04	2.5E-04	-8.7E-04	6.5E-01	100.0%	D
	T-13b	T	4.8E-03	9.2E-04	3.3E-05	1.9E-01	59.8%	NT
	LC-49a	T	9.5E-02	1.7E-02	0.0E+00	0.0E+00	0.0%	N/A

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-35D	S	1.0E-04	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-41D	S	1.2E-01	1.2E-02	1.6E-05	9.6E-02	59.3%	NT
	LC-47D	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-50D	S	1.4E-03	1.6E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-26D	S	2.0E-04	2.0E-04	-8.0E-04	9.9E-01	100.0%	D
	LC-67D	T	5.0E-02	4.5E-03	9.9E-05	9.1E-02	97.4%	I
	LC-126	T	1.0E-01	2.1E-02	-2.0E-04	2.0E-01	100.0%	D
	LC-166D	T	3.6E-04	2.3E-04	1.2E-03	6.4E-01	97.7%	I
	LC-66D	T	4.1E-02	3.0E-02	-1.5E-03	7.3E-01	100.0%	D
	LC-77D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-71D	T	2.4E-04	2.1E-04	-2.5E-04	8.7E-01	100.0%	D
	LC-72D	T	4.2E-02	1.8E-02	-5.6E-04	4.1E-01	100.0%	D
	LC-73D	T	2.1E-02	1.4E-02	-9.3E-04	6.5E-01	100.0%	D
	LC-74D	T	7.1E-02	1.3E-02	-8.3E-05	1.8E-01	100.0%	D
	LC-75D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-76D	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-40D	T	1.4E-02	7.4E-03	-8.6E-04	5.2E-01	100.0%	D

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LX-17	S	7.2E-01	3.5E-01	-4.9E-04	4.9E-01	100.0%	D
	LX-18	S	1.3E+00	9.3E-01	-7.9E-04	7.2E-01	100.0%	D
	LX-19	S	1.1E-01	2.0E-02	-2.2E-04	1.8E-01	100.0%	D
	LX-21	S	1.2E-01	5.8E-02	-6.8E-04	4.9E-01	100.0%	D
	RW-1	S	1.7E-01	3.5E-02	0.0E+00	0.0E+00	0.0%	N/A
	LX-16	S	1.5E-01	4.2E-02	0.0E+00	0.0E+00	0.0%	N/A
	LX-14	T	5.3E-03	2.0E-03	3.4E-04	3.8E-01	86.9%	NT
	LX-1	T	1.1E-02	2.2E-03	-8.8E-05	2.1E-01	100.0%	D
	LX-10	T	7.0E-02	1.4E-02	-2.2E-04	2.1E-01	100.0%	D
	LX-11	T	4.6E-02	1.1E-02	-3.2E-04	2.4E-01	100.0%	D
	LX-13	T	4.7E-03	1.2E-03	3.2E-04	2.6E-01	91.9%	PI
	LX-9	T	7.7E-02	1.2E-02	-1.7E-04	1.5E-01	100.0%	D
	LX-15	T	2.8E-03	1.3E-03	9.4E-04	4.6E-01	91.8%	PI
	LX-2	T	1.6E-02	4.8E-03	-4.6E-04	3.0E-01	100.0%	D
	LX-3	T	3.1E-02	7.6E-03	-3.4E-04	2.4E-01	100.0%	D
	LX-4	T	6.9E-02	1.5E-02	-1.5E-04	2.2E-01	100.0%	D
	LX-5	T	1.1E-01	2.0E-02	-2.3E-04	1.8E-01	100.0%	D
	LX-6	T	1.1E-01	1.7E-02	-2.0E-04	1.5E-01	100.0%	D
	LX-7	T	9.3E-02	1.1E-02	-1.1E-04	1.2E-01	100.0%	D
	LX-8	T	7.7E-02	7.7E-03	-9.3E-05	1.0E-01	100.0%	D
	LX-12	T	2.4E-02	3.5E-03	-1.4E-04	1.4E-01	100.0%	D

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-137c	S	D	D	N/A	N/A
	LC-21c	S	N/A	N/A	N/A	N/A
	LC-19c	S	N/A	N/A	N/A	N/A
	LC-19a	S	N/A	N/A	N/A	N/A
	LC-162	S	D	D	N/A	N/A
	LC-149d	S	PD	D	N/A	N/A
	LC-149c	S	D	D	N/A	N/A
	LC-26	S	D	D	N/A	N/A
	LC-144a	S	N/A	N/A	N/A	N/A
	LC-19b	S	N/A	N/A	N/A	N/A
	LC-137b	S	S	NT	N/A	N/A
	LC-137a	S	S	D	N/A	N/A
	LC-136b	S	S	D	N/A	N/A
	LC-136a	S	I	I	N/A	N/A
	LC-134	S	NT	D	N/A	N/A
	LC-108	S	S	D	N/A	N/A
	LC-06	S	S	D	N/A	N/A
	LC-144b	S	N/A	N/A	N/A	N/A
	LC-51	S	PI	I	N/A	N/A
	LC-53	S	NT	PI	N/A	N/A
	LC-64a	S	S	D	N/A	N/A
	LC-64b	S	S	D	N/A	N/A
	LC-66b	T	S	NT	N/A	N/A
	LC-05	T	NT	D	N/A	N/A
	T-12B	T	N/A	N/A	N/A	N/A
	T-08	T	NT	NT	N/A	N/A
	LC-111b	T	S	D	N/A	N/A
	LC-116b	T	NT	D	N/A	N/A
	LC-122b	T	D	D	N/A	N/A
	LC-128	T	NT	I	N/A	N/A
	LC-132	T	NT	I	N/A	N/A
	T-04	T	PD	D	N/A	N/A
	T-01	T	S	D	N/A	N/A
	PA-383	T	S	D	N/A	N/A
	LC-165	T	S	D	N/A	N/A
	LC-73a	T	S	D	N/A	N/A
	LC-41a	T	S	D	N/A	N/A
	LC-66a	T	NT	NT	N/A	N/A
	LC-14a	T	S	D	N/A	N/A
	LC-03	T	NT	PI	N/A	N/A
	LC-49a	T	N/A	N/A	N/A	N/A
	T-13b	T	NT	NT	N/A	N/A
	LC-49	T	S	D	N/A	N/A

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LX-19	S	D	D	N/A	N/A
	LX-16	S	N/A	N/A	N/A	N/A
	LX-17	S	D	D	N/A	N/A
	LX-18	S	D	D	N/A	N/A
	RW-1	S	N/A	N/A	N/A	N/A
	LX-21	S	D	D	N/A	N/A
	LX-4	T	S	D	N/A	N/A
	LX-3	T	D	D	N/A	N/A
	LX-5	T	D	D	N/A	N/A
	LX-6	T	D	D	N/A	N/A
	LX-7	T	S	D	N/A	N/A
	LX-1	T	S	D	N/A	N/A
	LX-8	T	S	D	N/A	N/A
	LX-9	T	D	D	N/A	N/A
	LX-15	T	NT	PI	N/A	N/A
	LX-14	T	NT	NT	N/A	N/A
	LX-13	T	I	PI	N/A	N/A
	LX-12	T	S	D	N/A	N/A
	LX-11	T	D	D	N/A	N/A
	LX-10	T	S	D	N/A	N/A
	LX-2	T	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 22 **Number of Tail Wells:** 23

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	PD	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Limited

Number of Source Wells: 5 **Number of Tail Wells:** 12

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: No Current Site Treatment **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	PD	S	L	Sample 4 more years	Annually	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Limited

Number of Source Wells: 6 **Number of Tail Wells:** 15

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

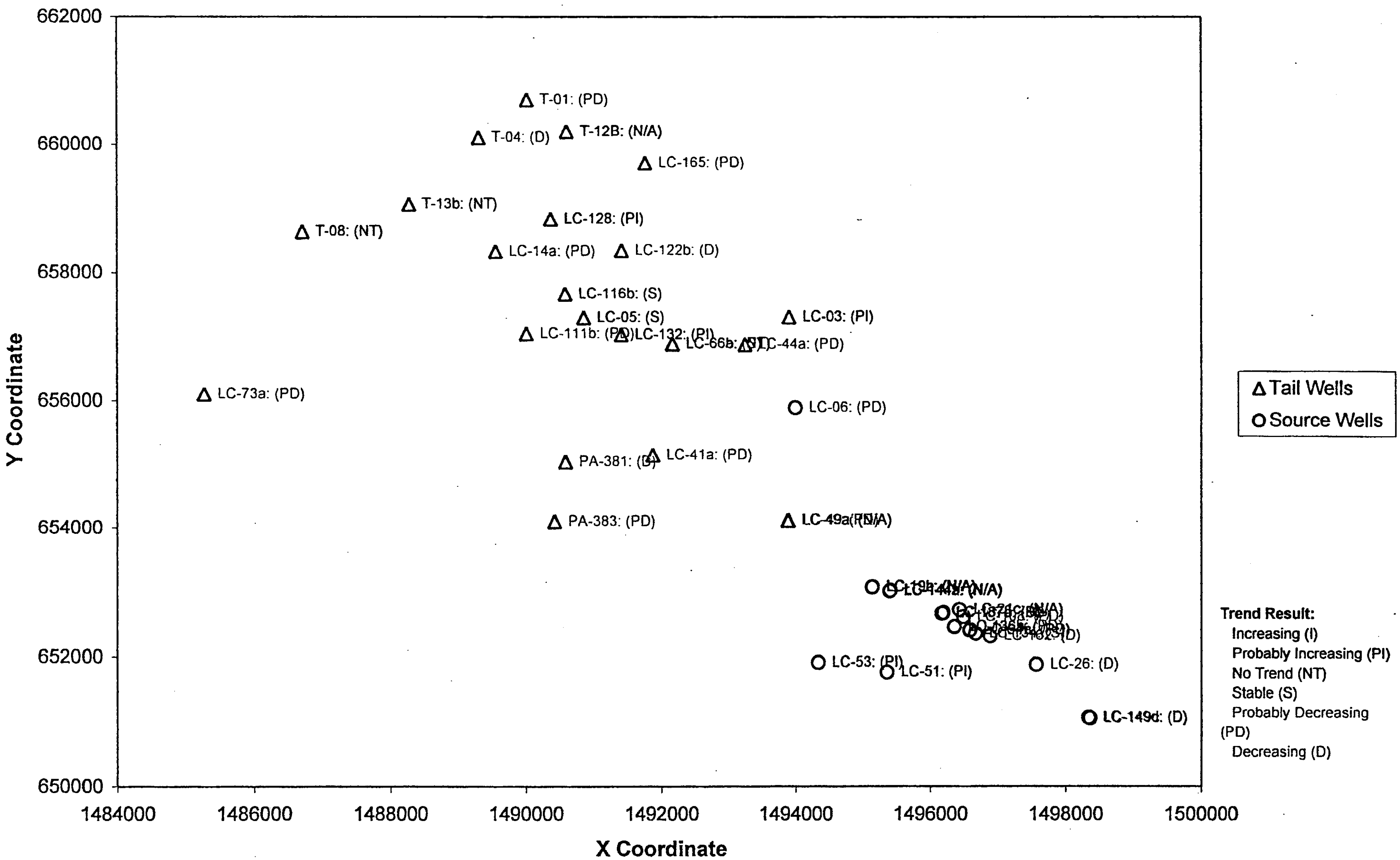
COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	PD	D	L	Continue remediation mechanism unitl reach stable trend or	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

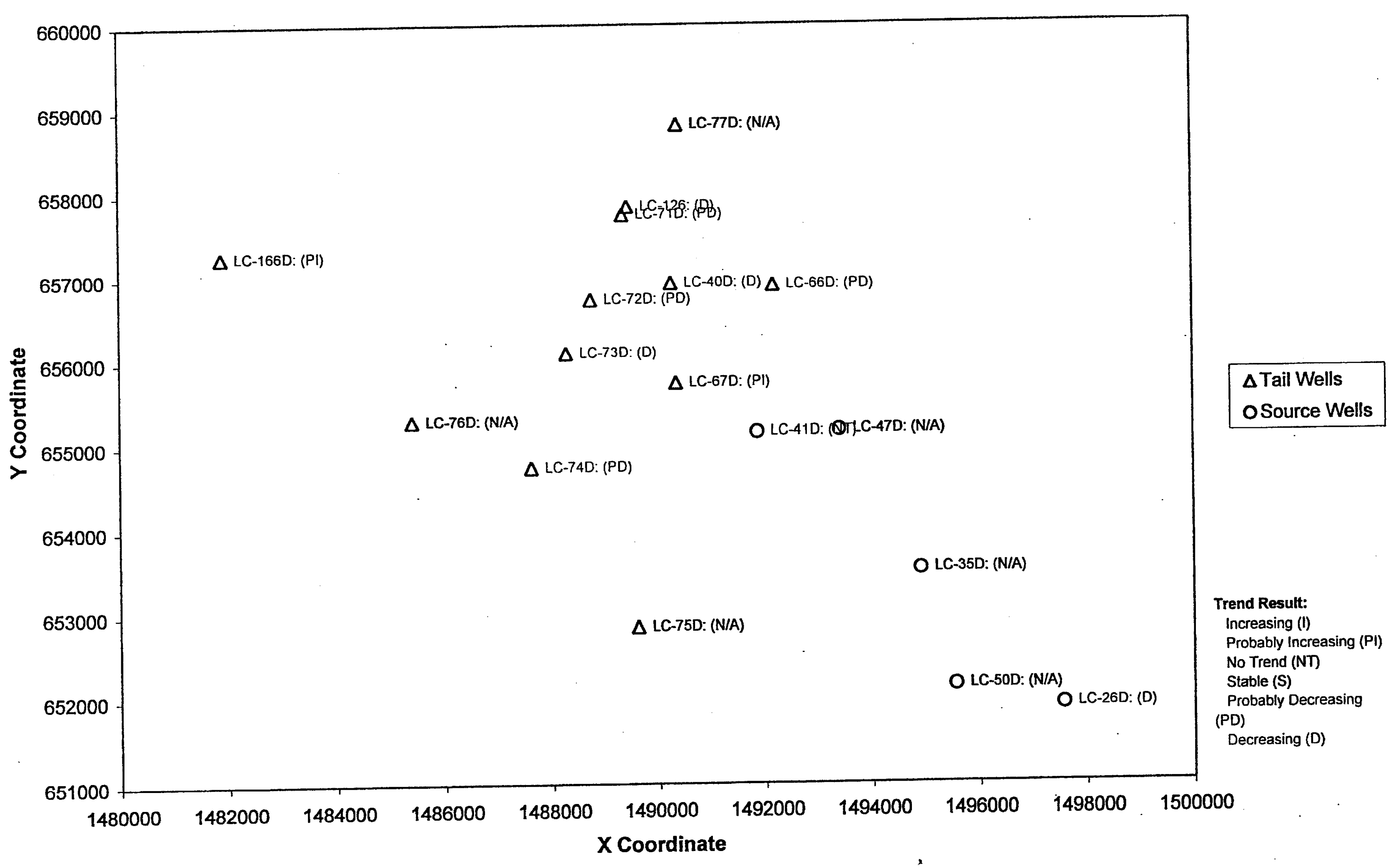
Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Trend Results for TRICHLOROETHYLENE (TCE)

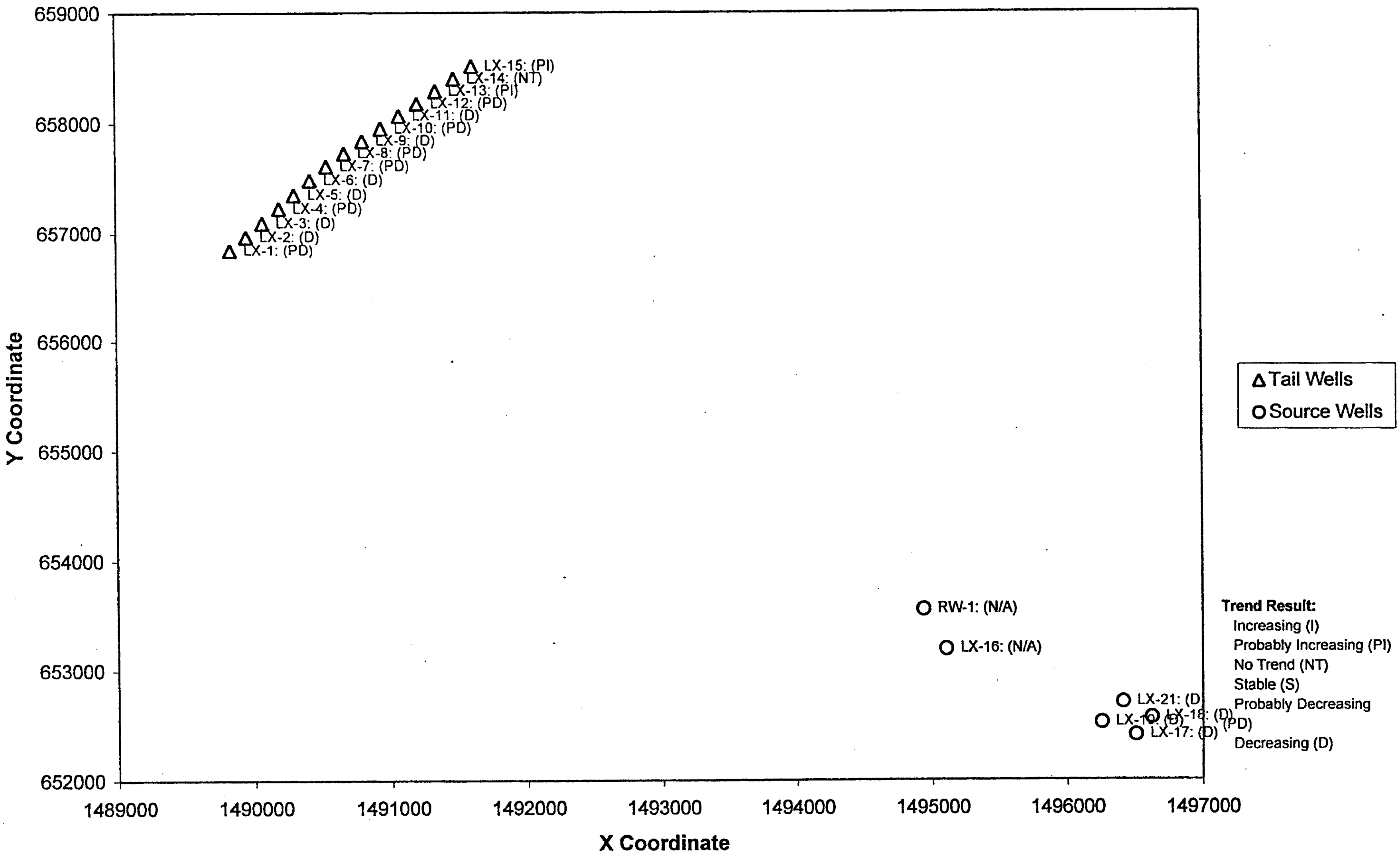


Trend Result:
Increasing (I)
Probably Increasing (PI)
No Trend (NT)
Stable (S)
Probably Decreasing (PD)
Decreasing (D)

Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



MAROS Sampling Frequency Optimization Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Analysis by Modified CES Method

Number of Sampling Events Analyzed: 6

Recent Sampling Events: **From** BASELINE 2/1/95

To Q20 9/1/00

Constituent	Well Name	Sampling Frequency	Frequency based on current period	Frequency based on overall period
TRICHLOROETHYLENE (TCE)	LC-03	Annual	Annual	Annual
	LC-05	Annual	Annual	Annual
	LC-06	Annual	Annual	Annual
	LC-108	Annual	Annual	Annual
	LC-111b	Biennial	Annual	Annual
	LC-116b	Annual	Annual	Annual
	LC-122b	Biennial	Annual	Annual
	LC-128	Annual	Annual	Annual
	LC-132	SemiAnnual	SemiAnnual	SemiAnnual
	LC-134	Annual	Annual	Annual
	LC-136a	Quarterly	Quarterly	Quarterly
	LC-136b	Annual	Annual	Annual
	LC-137a	Annual	Annual	Annual
	LC-137b	Annual	Annual	Annual
	LC-137c	Annual	Annual	Annual
	LC-144a	Quarterly	Quarterly	Quarterly
	LC-144b	Quarterly	Quarterly	Quarterly
	LC-149c	Biennial	Annual	Annual
	LC-149d	Annual	Annual	Annual
	LC-14a	Annual	Annual	Annual
	LC-162	Annual	Annual	Annual
	LC-165	Biennial	Annual	Annual
	LC-19a	Quarterly	Quarterly	Quarterly
	LC-19b	Quarterly	Quarterly	Quarterly

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

LC-19c	Quarterly	Quarterly	Quarterly
LC-21c	Annual	Annual	Annual
LC-26	Biennial	Annual	Annual
LC-41a	Annual	Annual	Annual
LC-44a	Annual	Annual	Annual
LC-49	Annual	Annual	Annual
LC-49a	Quarterly	Quarterly	Quarterly
LC-51	SemiAnnual	SemiAnnual	SemiAnnual
LC-53	SemiAnnual	SemiAnnual	SemiAnnual
LC-64a	Annual	Annual	Annual
LC-64b	Annual	Annual	Annual
LC-66a	Annual	Annual	Annual
LC-66b	Annual	Annual	Annual
LC-73a	Biennial	Annual	Annual
PA-381	Annual	Annual	Annual
PA-383	Biennial	Annual	Annual
T-01	Annual	Annual	Annual
T-04	Annual	Annual	Annual
T-08	Annual	Annual	Annual
T-12B	Annual	Annual	Annual
T-13b	Annual	Annual	Annual

Note:Modified CES (LLNL) method results in a recommended sampling interval for each well. This is based on analysis of concentration trend, so looks at specified sampling interval.

Summary - Final Recommendation for Sampling Frequency

Well Name	Sampling Frequency
LC-03	Annual
LC-05	Annual
LC-06	Annual
LC-108	Annual
LC-111b	Biennial
LC-116b	Annual
LC-122b	Biennial
LC-128	Annual

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

LC-132	SemiAnnual
LC-134	Annual
LC-136a	Quarterly
LC-136b	Annual
LC-137a	Annual
LC-137b	Annual
LC-137c	Annual
LC-144a	Quarterly
LC-144b	Quarterly
LC-149c	Biennial
LC-149d	Annual
LC-14a	Annual
LC-162	Annual
LC-165	Biennial
LC-19a	Quarterly
LC-19b	Quarterly
LC-19c	Quarterly
LC-21c	Annual
LC-26	Biennial
LC-41a	Annual
LC-44a	Annual
LC-49	Annual
LC-49a	Quarterly
LC-51	SemiAnnual
LC-53	SemiAnnual
LC-64a	Annual
LC-64b	Annual
LC-66a	Annual
LC-66b	Annual
LC-73a	Biennial
PA-381	Annual
PA-383	Biennial
T-01	Annual
T-04	Annual
T-08	Annual
T-12B	Annual
T-13b	Annual

Note: the most stringent sampling frequency was chosen among all COCs.

A.5. Annual RAM Data (December).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-137c	S	7.1E-01	-1	50.0%	S
LC-21c	S	0.0E+00	0	0.0%	N/A
LC-19c	S	0.0E+00	0	0.0%	N/A
LC-19a	S	0.0E+00	0	0.0%	N/A
LC-162	S	5.2E-01	-11	97.2%	D
LC-149d	S	4.6E-01	-9	93.2%	PD
LC-149c	S	6.0E-01	-8	89.8%	S
LC-26	S	8.2E-01	-12	98.2%	D
LC-144a	S	6.5E-01	3	72.9%	NT
LC-19b	S	0.0E+00	0	0.0%	N/A
LC-137b	S	7.3E-01	-5	76.5%	S
LC-137a	S	1.5E+00	-1	50.0%	NT
LC-136b	S	4.1E-01	-5	82.1%	S
LC-136a	S	7.9E-01	13	99.2%	I
LC-134	S	9.3E-01	-8	89.8%	S
LC-108	S	1.0E+00	3	64.0%	NT
LC-06	S	6.9E-01	3	64.0%	NT
LC-144b	S	8.0E-01	-2	62.5%	S
LC-51	S	2.1E-01	8	89.8%	NT
LC-53	S	2.8E-01	9	93.2%	PI
LC-64a	S	9.2E-01	9	93.2%	PI
LC-64b	S	4.2E-01	-9	93.2%	PD
LC-66b	T	1.4E-01	3	64.0%	NT
LC-05	T	8.6E-01	-1	50.0%	S
T-12B	T	0.0E+00	0	0.0%	N/A
T-08	T	1.8E-01	6	81.5%	NT
LC-111b	T	8.7E-01	-9	93.2%	PD
LC-116b	T	1.7E+00	-11	97.2%	D
LC-122b	T	8.2E-01	-10	95.2%	D
LC-128	T	2.7E-01	6	81.5%	NT
LC-132	T	5.5E-01	13	99.2%	I
T-04	T	1.1E+00	-7	86.4%	NT
T-01	T	5.5E-01	-8	95.8%	D
PA-383	T	2.6E-01	2	57.0%	NT
LC-165	T	5.9E-01	-7	92.0%	PD
LC-73a	T	6.2E-01	-4	75.8%	S
LC-41a	T	8.3E-02	-2	57.0%	S
LC-66a	T	4.4E-01	8	89.8%	NT
LC-14a	T	1.9E-01	-6	81.5%	S
LC-03	T	2.6E-01	2	57.0%	NT
LC-49a	T	1.5E-01	0	37.5%	S
T-13b	T	1.1E-01	14	99.6%	I
LC-49	T	1.7E-01	9	93.2%	PI
LC-44a	T	5.6E-01	-5	76.5%	S
PA-381	T	3.4E-01	-5	76.5%	S

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-50D	S	0.0E+00	0	0.0%	N/A
LC-47D	S	0.0E+00	0	0.0%	N/A
LC-41D	S	1.6E-01	2	57.0%	NT
LC-35D	S	0.0E+00	0	0.0%	N/A
LC-26D	S	6.0E-01	-8	89.8%	S
LC-74D	T	2.4E-01	10	99.2%	I
LC-73D	T	4.5E-01	3	64.0%	NT
LC-72D	T	3.8E-01	1	50.0%	NT
LC-71D	T	6.0E-01	-8	89.8%	S
LC-67D	T	1.9E-01	6	81.5%	NT
LC-66D	T	4.8E-01	3	64.0%	NT
LC-40D	T	4.2E-01	-2	57.0%	S
LC-166D	T	0.0E+00	0	40.8%	S
LC-126	T	1.9E-01	0	42.3%	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LX-19	S	2.8E-01	-3	67.5%	S
LX-16	S	1.2E-01	3	72.9%	NT
LX-17	S	4.0E-01	-6	88.3%	S
LX-18	S	5.8E-01	-11	97.2%	D
RW-1	S	0.0E+00	0	0.0%	N/A
LX-21	S	2.7E-01	-7	86.4%	S
LX-4	T	1.6E-01	-3	67.5%	S
LX-3	T	1.3E-01	-4	70.3%	S
LX-5	T	1.3E-01	-6	88.3%	S
LX-6	T	9.5E-02	-5	76.5%	S
LX-7	T	8.0E-02	-1	50.0%	S
LX-1	T	7.5E-02	0	40.8%	S
LX-8	T	7.7E-02	-2	57.0%	S
LX-9	T	1.1E-01	-4	75.8%	S
LX-15	T	5.4E-01	11	97.2%	I
LX-14	T	2.8E-01	11	97.2%	I
LX-13	T	3.7E-01	3	72.9%	NT
LX-12	T	1.9E-01	-8	89.8%	S
LX-11	T	2.5E-01	-11	97.2%	D
LX-10	T	2.0E-01	-5	76.5%	S
LX-2	T	1.5E-01	-12	98.2%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-149c	S	4.3E-04	2.6E-04	-1.2E-03	6.0E-01	100.0%	D
	LC-64a	S	8.5E-01	7.8E-01	6.9E-04	9.2E-01	93.1%	PI
	LC-53	S	1.6E-01	4.4E-02	3.3E-04	2.8E-01	96.8%	I
	LC-51	S	1.3E-01	2.8E-02	2.6E-04	2.1E-01	95.9%	I
	LC-26	S	5.0E-04	4.1E-04	-1.5E-03	8.2E-01	100.0%	D
	LC-21c	S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-19c	S	5.0E-02	4.2E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-19b	S	7.6E-02	3.5E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-19a	S	1.8E-01	1.4E-02	0.0E+00	0.0E+00	0.0%	N/A
	LC-06	S	6.9E-02	4.7E-02	1.7E-04	6.9E-01	60.3%	NT
	LC-149d	S	4.7E-04	2.2E-04	-8.9E-04	4.6E-01	100.0%	D
	LC-64b	S	4.6E-02	1.9E-02	-5.3E-04	4.2E-01	100.0%	D
	LC-144b	S	2.4E-01	1.9E-01	-9.9E-04	8.0E-01	100.0%	D
	LC-144a	S	7.1E-02	4.6E-02	1.1E-03	6.5E-01	81.1%	NT
	LC-137c	S	1.5E-02	1.0E-02	-1.2E-03	7.1E-01	100.0%	D
	LC-137b	S	1.4E-01	1.1E-01	-5.0E-04	7.3E-01	100.0%	D
	LC-137a	S	1.4E-01	2.1E-01	-6.2E-04	1.5E+00	100.0%	D
	LC-136b	S	1.4E-01	5.9E-02	-3.7E-04	4.1E-01	100.0%	D
	LC-136a	S	7.5E+01	5.9E+01	1.2E-03	7.9E-01	99.9%	I
	LC-134	S	6.5E+00	6.1E+00	-9.6E-04	9.3E-01	100.0%	D
	LC-108	S	9.6E-02	9.8E-02	2.5E-04	1.0E+00	61.4%	NT
	LC-162	S	5.4E-01	2.8E-01	-7.1E-04	5.2E-01	100.0%	D
	LC-44a	T	3.0E-02	1.7E-02	-3.6E-04	5.6E-01	100.0%	D
	T-12B	T	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	T-08	T	2.4E-03	4.4E-04	1.4E-04	1.8E-01	84.0%	NT
	T-04	T	1.3E-02	1.5E-02	-8.8E-04	1.1E+00	100.0%	D
	T-01	T	3.0E-03	1.6E-03	-8.3E-04	5.5E-01	100.0%	D
	PA-383	T	1.3E-03	3.4E-04	-3.1E-05	2.6E-01	100.0%	D
	PA-381	T	4.5E-02	1.5E-02	-2.0E-04	3.4E-01	100.0%	D
	LC-73a	T	1.0E-03	6.2E-04	-8.8E-04	6.2E-01	100.0%	D
	LC-66b	T	1.2E-01	1.6E-02	5.1E-05	1.4E-01	68.2%	NT
	LC-66a	T	9.5E-02	4.2E-02	6.4E-04	4.4E-01	96.7%	I
	LC-03	T	8.1E-04	2.1E-04	1.1E-04	2.6E-01	68.3%	NT
	LC-49	T	2.4E-01	4.2E-02	2.3E-04	1.7E-01	98.7%	I
	LC-05	T	3.0E-02	2.6E-02	-2.4E-04	8.6E-01	100.0%	D
	LC-41a	T	1.7E-01	1.4E-02	-6.7E-06	8.3E-02	100.0%	D
	LC-165	T	4.2E-04	2.5E-04	-1.3E-03	5.9E-01	100.0%	D
	LC-14a	T	5.8E-02	1.1E-02	-1.9E-04	1.9E-01	100.0%	D
	LC-132	T	5.5E-02	3.0E-02	8.8E-04	5.5E-01	99.8%	I
	LC-128	T	2.2E-02	6.1E-03	1.3E-04	2.7E-01	74.8%	NT
	LC-122b	T	5.1E-04	4.1E-04	-1.3E-03	8.2E-01	100.0%	D
	LC-116b	T	9.9E-04	1.7E-03	-1.6E-03	1.7E+00	100.0%	D
	LC-111b	T	5.5E-04	4.8E-04	-1.3E-03	8.7E-01	100.0%	D
	T-13b	T	4.6E-03	5.0E-04	1.5E-04	1.1E-01	99.8%	I
	LC-49a	T	7.1E-02	1.1E-02	4.8E-05	1.5E-01	56.9%	NT

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-50D	S	4.5E-03	5.0E-03	0.0E+00	0.0E+00	0.0%	N/A
	LC-47D	S	1.0E-04	0.0E+00	0.0E+00	0.0E+00	0.0%	N/A
	LC-41D	S	1.2E-01	1.9E-02	1.2E-04	1.6E-01	80.6%	NT
	LC-35D	S	2.0E-04	1.4E-04	0.0E+00	0.0E+00	0.0%	N/A
	LC-26D	S	4.3E-04	2.6E-04	-1.2E-03	6.0E-01	100.0%	D
	LC-74D	T	5.5E-02	1.3E-02	4.1E-04	2.4E-01	100.0%	I
	LC-73D	T	2.7E-02	1.3E-02	-4.7E-04	4.5E-01	100.0%	D
	LC-72D	T	4.5E-02	1.7E-02	-4.4E-04	3.8E-01	100.0%	D
	LC-71D	T	4.3E-04	2.6E-04	-1.2E-03	6.0E-01	100.0%	D
	LC-67D	T	5.9E-02	1.1E-02	1.5E-04	1.9E-01	85.8%	NT
	LC-66D	T	4.2E-02	2.0E-02	-9.0E-04	4.8E-01	100.0%	D
	LC-40D	T	1.5E-02	6.1E-03	-5.1E-04	4.2E-01	100.0%	D
	LC-166D	T	6.0E-04	0.0E+00	0.0E+00	0.0E+00	100.0%	S
	LC-126	T	1.1E-01	2.0E-02	4.2E-06	1.9E-01	100.0%	I

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LX-17	S	8.4E-01	3.4E-01	-4.4E-04	4.0E-01	100.0%	D
	LX-18	S	1.4E+00	8.2E-01	-7.2E-04	5.8E-01	100.0%	D
	LX-19	S	1.3E-01	3.8E-02	4.5E-05	2.8E-01	57.0%	NT
	LX-21	S	1.4E-01	3.8E-02	-3.1E-04	2.7E-01	100.0%	D
	RW-1	S	1.6E-01	2.1E-02	0.0E+00	0.0E+00	0.0%	N/A
	LX-16	S	1.5E-01	1.7E-02	1.9E-04	1.2E-01	78.6%	NT
	LX-14	T	5.2E-03	1.5E-03	3.7E-04	2.8E-01	93.5%	PI
	LX-1	T	1.1E-02	8.4E-04	3.1E-05	7.5E-02	65.6%	NT
	LX-10	T	6.9E-02	1.4E-02	-1.8E-04	2.0E-01	100.0%	D
	LX-11	T	4.3E-02	1.1E-02	-3.5E-04	2.5E-01	100.0%	D
	LX-13	T	3.9E-03	1.4E-03	5.7E-04	3.7E-01	90.6%	PI
	LX-9	T	7.5E-02	7.9E-03	-1.1E-04	1.1E-01	100.0%	D
	LX-15	T	2.2E-03	1.2E-03	1.1E-03	5.4E-01	95.3%	I
	LX-2	T	1.8E-02	2.6E-03	-2.2E-04	1.5E-01	100.0%	D
	LX-3	T	3.2E-02	4.3E-03	-1.4E-04	1.3E-01	100.0%	D
	LX-4	T	6.8E-02	1.1E-02	-1.1E-04	1.6E-01	100.0%	D
	LX-5	T	1.1E-01	1.4E-02	-1.7E-04	1.3E-01	100.0%	D
	LX-6	T	1.2E-01	1.1E-02	-1.2E-04	9.5E-02	100.0%	D
	LX-7	T	9.7E-02	7.7E-03	-4.6E-06	8.0E-02	100.0%	D
	LX-8	T	7.7E-02	5.9E-03	-1.5E-05	7.7E-02	100.0%	D
	LX-12	T	2.4E-02	4.4E-03	-2.3E-04	1.9E-01	100.0%	D

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-137c	S	S	D	N/A	N/A
	LC-21c	S	N/A	N/A	N/A	N/A
	LC-19c	S	N/A	N/A	N/A	N/A
	LC-19a	S	N/A	N/A	N/A	N/A
	LC-162	S	D	D	N/A	N/A
	LC-149d	S	PD	D	N/A	N/A
	LC-149c	S	S	D	N/A	N/A
	LC-26	S	D	D	N/A	N/A
	LC-144a	S	NT	NT	N/A	N/A
	LC-19b	S	N/A	N/A	N/A	N/A
	LC-137b	S	S	D	N/A	N/A
	LC-137a	S	NT	D	N/A	N/A
	LC-136b	S	S	D	N/A	N/A
	LC-136a	S	I	I	N/A	N/A
	LC-134	S	S	D	N/A	N/A
	LC-108	S	NT	NT	N/A	N/A
	LC-06	S	NT	NT	N/A	N/A
	LC-144b	S	S	D	N/A	N/A
	LC-51	S	NT	I	N/A	N/A
	LC-53	S	PI	I	N/A	N/A
	LC-64a	S	PI	PI	N/A	N/A
	LC-64b	S	PD	D	N/A	N/A
	LC-66b	T	NT	NT	N/A	N/A
	LC-05	T	S	D	N/A	N/A
	T-12B	T	N/A	N/A	N/A	N/A
	T-08	T	NT	NT	N/A	N/A
	LC-111b	T	PD	D	N/A	N/A
	LC-116b	T	D	D	N/A	N/A
	LC-122b	T	D	D	N/A	N/A
	LC-128	T	NT	NT	N/A	N/A
	LC-132	T	I	I	N/A	N/A
	T-04	T	NT	D	N/A	N/A
	T-01	T	D	D	N/A	N/A
	PA-383	T	NT	D	N/A	N/A
	LC-165	T	PD	D	N/A	N/A
	LC-73a	T	S	D	N/A	N/A
	LC-41a	T	S	D	N/A	N/A
	LC-66a	T	NT	I	N/A	N/A
	LC-14a	T	S	D	N/A	N/A
	LC-03	T	NT	NT	N/A	N/A
	LC-49a	T	S	NT	N/A	N/A
	T-13b	T	I	I	N/A	N/A
	LC-49	T	PI	I	N/A	N/A

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-44a	T	S	D	N/A	N/A
	PA-381	T	S	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-50D	S	N/A	N/A	N/A	N/A
	LC-47D	S	N/A	N/A	N/A	N/A
	LC-41D	S	NT	NT	N/A	N/A
	LC-35D	S	N/A	N/A	N/A	N/A
	LC-26D	S	S	D	N/A	N/A
	LC-74D	T	I	I	N/A	N/A
	LC-73D	T	NT	D	N/A	N/A
	LC-72D	T	NT	D	N/A	N/A
	LC-71D	T	S	D	N/A	N/A
	LC-67D	T	NT	NT	N/A	N/A
	LC-66D	T	NT	D	N/A	N/A
	LC-40D	T	S	D	N/A	N/A
	LC-166D	T	S	S	N/A	N/A
	LC-126	T	S	I	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LX-19	S	S	NT	N/A	N/A
	LX-16	S	NT	NT	N/A	N/A
	LX-17	S	S	D	N/A	N/A
	LX-18	S	D	D	N/A	N/A
	RW-1	S	N/A	N/A	N/A	N/A
	LX-21	S	S	D	N/A	N/A
	LX-4	T	S	D	N/A	N/A
	LX-3	T	S	D	N/A	N/A
	LX-5	T	S	D	N/A	N/A
	LX-6	T	S	D	N/A	N/A
	LX-7	T	S	D	N/A	N/A
	LX-1	T	S	NT	N/A	N/A
	LX-8	T	S	D	N/A	N/A
	LX-9	T	S	D	N/A	N/A
	LX-15	T	I	I	N/A	N/A
	LX-14	T	I	PI	N/A	N/A
	LX-13	T	NT	PI	N/A	N/A
	LX-12	T	S	D	N/A	N/A
	LX-11	T	D	D	N/A	N/A
	LX-10	T	S	D	N/A	N/A
	LX-2	T	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 22 **Number of Tail Wells:** 23

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent

Groundwater Seepage Velocity: 132 ft/yr

Current Plume Length: 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: Pump and Treat

NAPL is not present at this site.

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 5 **Number of Tail Wells:** 12

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft

Current Plume Width: 3000 ft

Source Information:

Source Treatment: No Current Site Treatment **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:		Distance from Edge of Tail to Nearest:	
Down-gradient receptor:	12300 ft	**Down-gradient receptor:**	1500 ft
Down-gradient property:	10900 ft	**Down-gradient property:**	100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	S	M	Sample 4 more years	Biannually (6 months)	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Moderate

Number of Source Wells: 6 **Number of Tail Wells:** 15

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft **Current Plume Width:** 3000 ft

Source Information:

Source Treatment: Pump and Treat **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

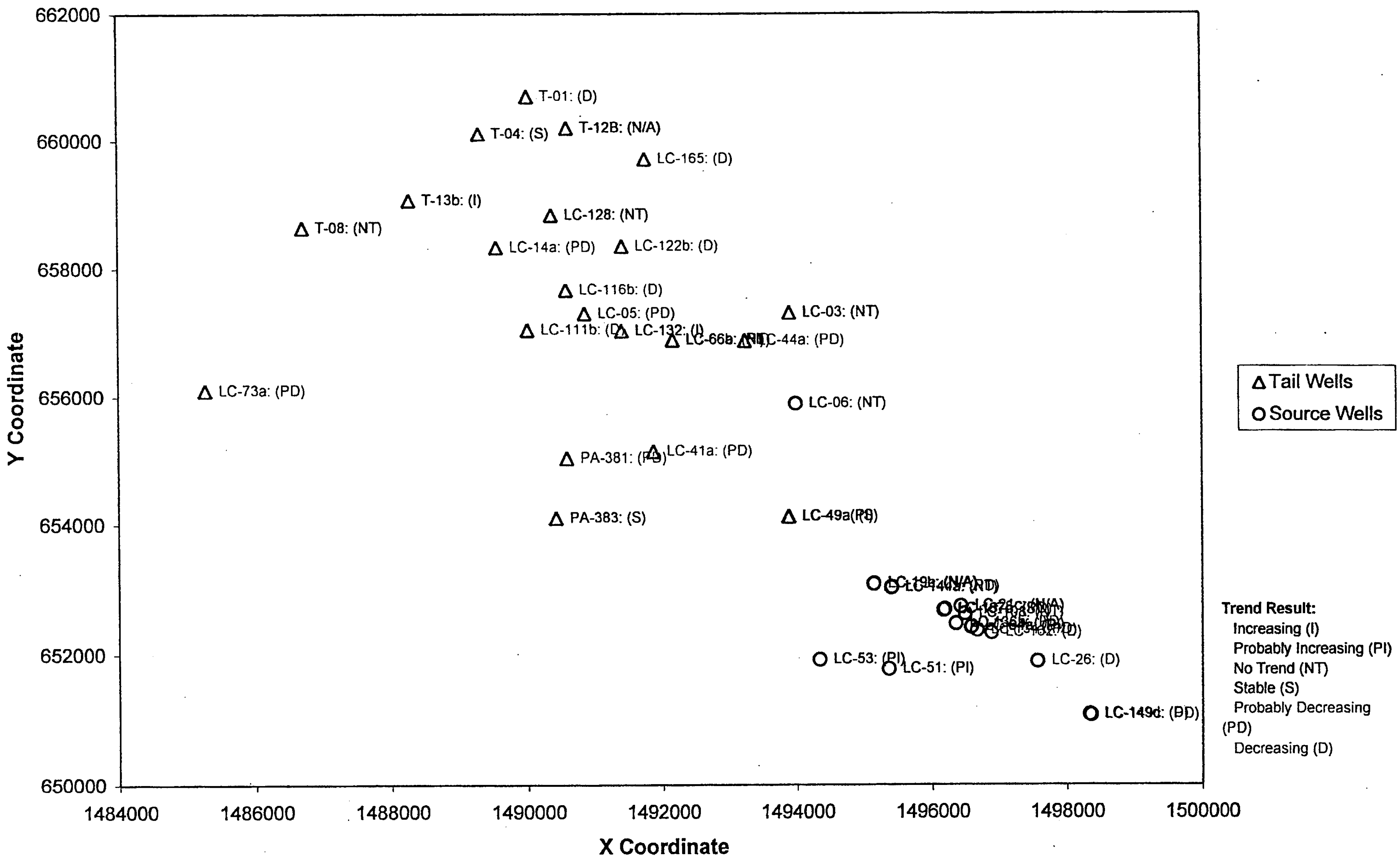
COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	S	PD	M	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

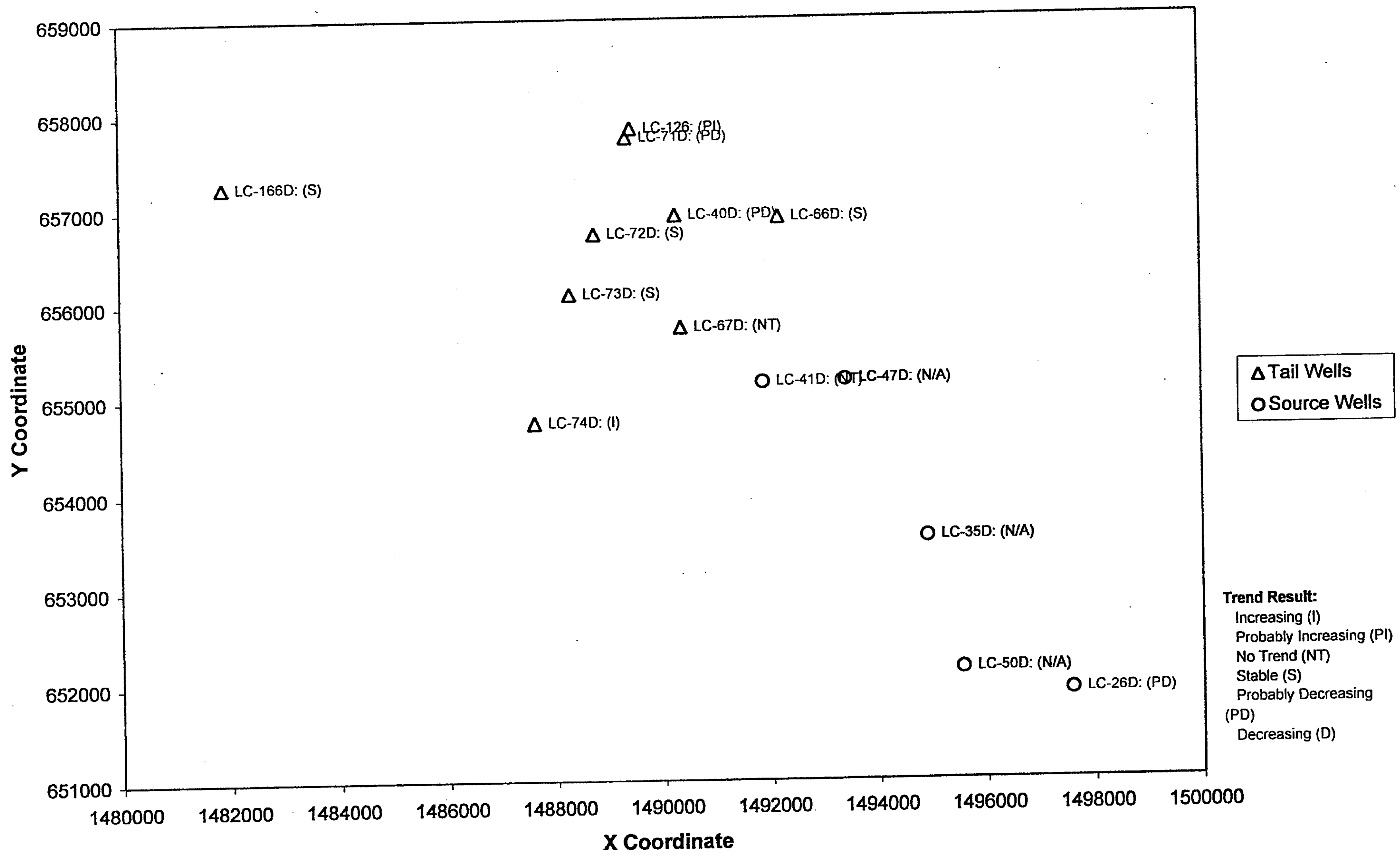
Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

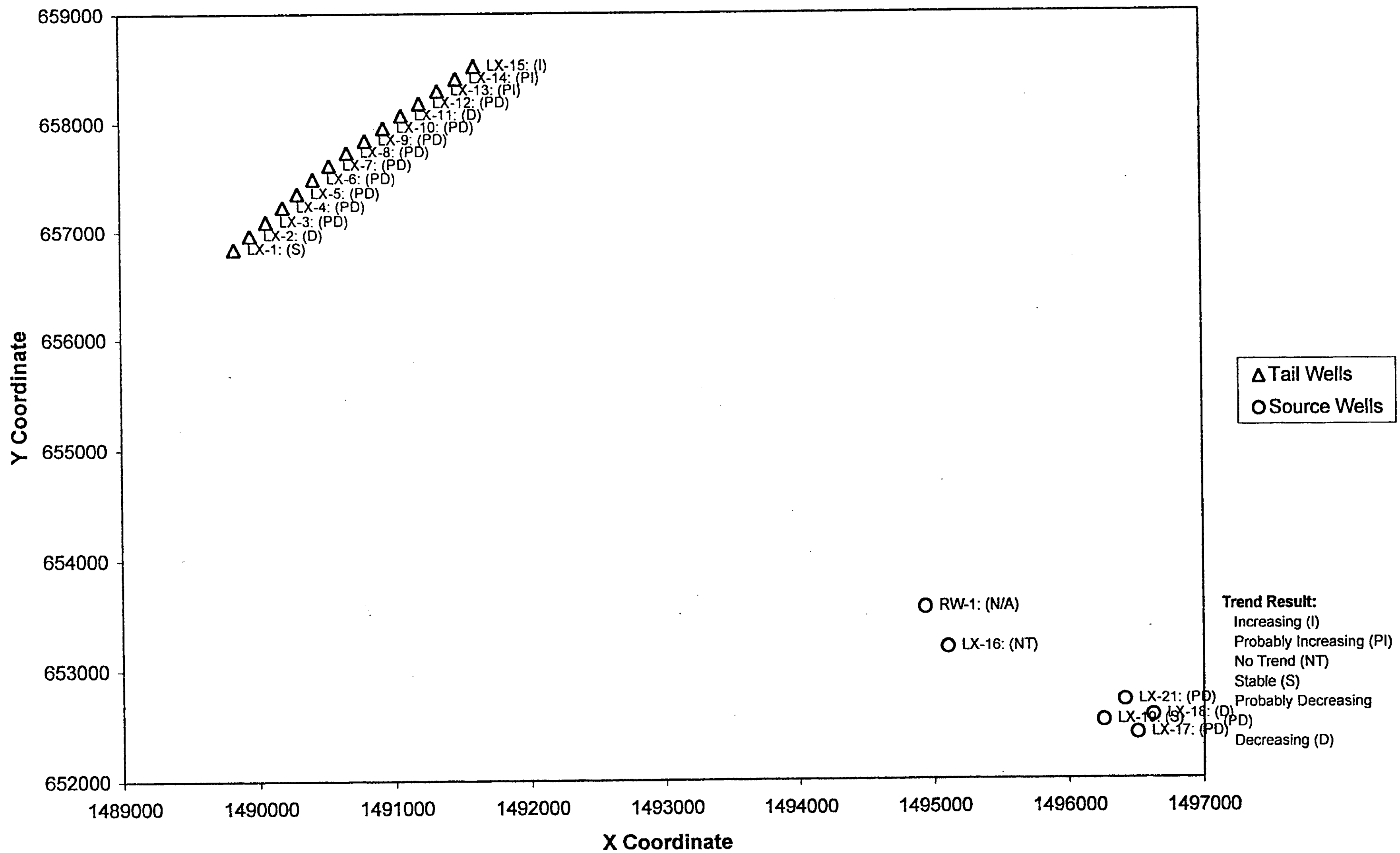
Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



Trend Results for TRICHLOROETHYLENE (TCE)



MAROS Sampling Frequency Optimization Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Analysis by Modified CES Method

Number of Sampling Events Analyzed: 6

Recent Sampling Events: **From** BASELINE 2/1/95

To Q17 12/1/99

Constituent	Well Name	Sampling Frequency	Frequency based on current period	Frequency based on overall period
TRICHLOROETHYLENE (TCE)	LC-03	Annual	Annual	Annual
	LC-05	Annual	Annual	Annual
	LC-06	Annual	Annual	Annual
	LC-108	Annual	Annual	Annual
	LC-111b	Annual	Annual	Annual
	LC-116b	Annual	Annual	Annual
	LC-122b	Biennial	Annual	Annual
	LC-128	Annual	Annual	Annual
	LC-132	Quarterly	Quarterly	Quarterly
	LC-134	Annual	Annual	Annual
	LC-136a	Quarterly	Quarterly	Quarterly
	LC-136b	Annual	Annual	Annual
	LC-137a	Annual	Annual	Annual
	LC-137b	Annual	Annual	Annual
	LC-137c	Annual	Annual	Annual
	LC-144a	Quarterly	Quarterly	Quarterly
	LC-144b	Annual	Annual	Annual
	LC-149c	Biennial	Annual	Annual
	LC-149d	Annual	Annual	Annual
	LC-14a	Annual	Annual	Annual
	LC-162	Annual	Annual	Annual
	LC-165	Annual	Annual	Annual
	LC-19a	Quarterly	Quarterly	Quarterly
	LC-19b	Quarterly	Quarterly	Quarterly

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

LC-19c	Quarterly	Quarterly	Quarterly
LC-21c	Annual	Annual	Annual
LC-26	Biennial	Annual	Annual
LC-41a	Annual	Annual	Annual
LC-44a	Annual	Annual	Annual
LC-49	SemiAnnual	SemiAnnual	SemiAnnual
LC-49a	Annual	Annual	Annual
LC-51	SemiAnnual	SemiAnnual	SemiAnnual
LC-53	SemiAnnual	SemiAnnual	SemiAnnual
LC-64a	Quarterly	Quarterly	Quarterly
LC-64b	Annual	Annual	Annual
LC-66a	SemiAnnual	SemiAnnual	SemiAnnual
LC-66b	Annual	Annual	Annual
LC-73a	Biennial	Annual	Annual
PA-381	Annual	Annual	Annual
PA-383	Annual	Annual	Annual
T-01	Annual	Annual	Annual
T-04	Annual	Annual	Annual
T-08	Annual	Annual	Annual
T-12B	SemiAnnual	SemiAnnual	SemiAnnual
T-13b	Annual	Annual	Annual

Note:Modified CES (LLNL) method results in a recommended sampling interval for each well. This is based on analysis of concentration trend, so looks at specified sampling interval.

Summary - Final Recommendation for Sampling Frequency

Well Name	Sampling Frequency
LC-03	Annual
LC-05	Annual
LC-06	Annual
LC-108	Annual
LC-111b	Annual
LC-116b	Annual
LC-122b	Biennial
LC-128	Annual

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

LC-132	Quarterly
LC-134	Annual
LC-136a	Quarterly
LC-136b	Annual
LC-137a	Annual
LC-137b	Annual
LC-137c	Annual
LC-144a	Quarterly
LC-144b	Annual
LC-149c	Biennial
LC-149d	Annual
LC-14a	Annual
LC-162	Annual
LC-165	Annual
LC-19a	Quarterly
LC-19b	Quarterly
LC-19c	Quarterly
LC-21c	Annual
LC-26	Biennial
LC-41a	Annual
LC-44a	Annual
LC-49	SemiAnnual
LC-49a	Annual
LC-51	SemiAnnual
LC-53	SemiAnnual
LC-64a	Quarterly
LC-64b	Annual
LC-66a	SemiAnnual
LC-66b	Annual
LC-73a	Biennial
PA-381	Annual
PA-383	Annual
T-01	Annual
T-04	Annual
T-08	Annual
T-12B	SemiAnnual
T-13b	Annual

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Note: the most stringent sampling frequency was chosen among all COCs.

A.6. Semiannual RAM Data (June & December).

MAROS Mann-Kendall Statistics

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Well	Source/ Tail	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)					
LC-134	S	1.2E+00	-24	96.4%	D
LC-108	S	1.3E+00	-1	50.0%	NT
LC-06	S	7.4E-01	22	94.9%	PI
T-13b	T	1.3E-01	36	99.8%	I
T-08	T	1.9E-01	23	95.7%	I
LC-73a	T	5.0E-01	-2	53.4%	S
LC-03	T	3.6E-01	9	72.9%	NT

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Linear Regression Statistics

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Constituent	Well	Source/ Tail	Average	Standard Deviation	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
TRICHLOROETHYLENE (TCE)								
	LC-134	S	4.3E+00	5.0E+00	-1.0E-03	1.2E+00	100.0%	D
	LC-108	S	6.2E-02	7.9E-02	-1.2E-04	1.3E+00	100.0%	D
	LC-06	S	6.3E-02	4.6E-02	4.7E-04	7.4E-01	87.3%	NT
	T-13b	T	4.5E-03	5.9E-04	1.5E-04	1.3E-01	99.4%	I
	T-08	T	2.4E-03	4.4E-04	1.6E-04	1.9E-01	95.9%	I
	LC-73a	T	9.0E-04	4.4E-04	-2.5E-04	5.0E-01	100.0%	D
	LC-03	T	7.1E-04	2.5E-04	2.3E-04	3.6E-01	84.1%	NT

MAROS Lines of Evidence Summary

Project: Ft Lewis Log Center

User Name: Seattle District

Location: Ft Lewis

State: Washington

Constituent	Well	Source/ Tail	Mann-Kendall	Linear Regression	Modeling	Empirical
TRICHLOROETHYLENE (TCE)						
	LC-134	S	D	D	N/A	N/A
	LC-108	S	NT	D	N/A	N/A
	LC-06	S	PI	NT	N/A	N/A
	T-13b	T	I	I	N/A	N/A
	T-08	T	I	I	N/A	N/A
	LC-73a	T	S	D	N/A	N/A
	LC-03	T	NT	NT	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

MAROS Site Results

Project: Ft Lewis Log Center **User Name:** Seattle District

Location: Ft Lewis **State:** Washington

Recommendation Basis:

Monitoring System Category from Compliance Monitoring Analysis Extensive

Number of Source Wells: 3 **Number of Tail Wells:** 4

Hydrogeology and Plume Information:

Main Constituents: Chlorinated Solvent **Groundwater Seepage Velocity:** 132 ft/yr **Current Plume Length:** 10800 ft **Current Plume Width:** 3000 ft

Source Information:

Source Treatment: Pump and Treat **NAPL is not present at this site.**

Down-gradient Information:

Distance from Source to Nearest:

Down-gradient receptor: 12300 ft

Down-gradient property: 10900 ft

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1500 ft

Down-gradient property: 100 ft

Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Design Category	Sampling Duration	Sampling Frequency	Sampling Density
TRICHLOROETHYLENE (TCE)	PI	S	E	Remove treatment system if previously reducing concentation	No Recommendation	> 50

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Appendix B – Statistical Analysis Summary.

Ft Lewis Log Center
RAM Network Optimization
Summary

Summary Sheet of Annual Sampling (Month Sampled Shown)
Compared to Quarterly Sampling (1995-2000)

Shallow Well (Vashon) Summary

Month of Annual Sample	# Total Trends	# Matching Trends	# Non-matching Trends	# Opposite Trends
Mar	39	30	9	0
Jun	40	31	9	0
Sep	37	23	14	1
Dec	40	30	10	0
Total	*156*	*114 (73%)*	*42 (27%)*	*1 (0.6%)*

Deep Well (Sea Level) Summary

Month of Annual Sample	# Total Trends	# Matching Trends	# Non-matching Trends	# Opposite Trends
Mar	11	9	2	0
Jun	11	8	3	0
Sep	11	8	3	1
Dec	11	7	4	1
Total	*44*	*32 (73%)*	*12 (27%)*	*2 (5%)*

Extraction Well Summary

Month of Annual Sample	# Total Trends	# Matching Trends	# Non-matching Trends	# Opposite Trends
Mar	20	14	6	0
Jun	20	17	3	1
Sep	19	17	2	0
Dec	20	17	3	0
Total	*79*	*65 (82%)*	*14 (18%)*	*1 (1%)*

Combined Shallow & Deep and Extraction Well Summary

Month of Annual Sample	# Total Trends	# Matching Trends	# Non-matching Trends	# Opposite Trends
Mar	70	53	17	0
Jun	71	56	15	1
Sep	67	48	19	2
Dec	71	54	17	1
Total	*279*	*211 (76%)*	*68 (24%)*	*4 (1%)*

Notes:
Matching Trends: Both Quarterly and Annual Trends Increased or Decreased or both had Stable/No Trends
Non-matching Trends: One Quarterly or Annual Trend Increased or Decreased, while the other either showed No Trend or Opposite Trend
Opposite Trend: One Quarterly or Annual Trend Increased, while the other Decreased
Oposite Trend is a subset of Non-matching Trend (The two data sets are not mutually exclusive)
Shading indicates worst relationship between annual and quarterly sampling

Ft Lewis Log Center
RAM Network Optimization
ANNUAL shallow (MAR)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LC-03	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-05	NT	NT	**Y**	NT	D	**N**	NT	S	**Y**
LC-06	I	NT	**N**	PI	D	**N(O)**	PI	S	**N**
LC-108	NT	D	**N**	D	D	**Y**	S	D	**N**
LC-111b	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-116b	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
LC-122b	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-128	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-132	I	PI	**Y**	I	I	**Y**	I	PI	**Y**
LC-134	D	NT	**N**	D	D	**Y**	D	S	**N**
LC-136a	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-136b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-137a	NT	NT	**Y**	NT	D	**N**	NT	S	**Y**
LC-137b	S	PD	**N**	D	D	**Y**	PD	D	**Y**
LC-137c	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-144a	S	S	**Y**	NT	NT	**Y**	S	S	**Y**
LC-144b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-149c	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-149d	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-14a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-162	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-165	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-19a	S	NA	**NA**	NT	NA	**NA**	S	NA	**NA**
LC-19b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-19c	S	NA	**NA**	PI	NA	**NA**	NT	NA	**NA**
LC-26	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-41a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-44a	S	PD	**N**	D	D	**Y**	PD	D	**Y**
LC-49	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-49a	NT	S	**Y**	NT	D	**N**	NT	PD	**N**
LC-51	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-53	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-64a	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-64b	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-66a	PI	NT	**N**	I	I	**Y**	PI	PI	**Y**
LC-66b	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-73a	NT	PI	**N**	D	PI	**N(O)**	S	PI	**N**
PA-381	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
PA-383	NT	NT	**Y**	D	NT	**N**	S	NT	**Y**
T-01	PD	D	**Y**	D	D	**Y**	D	D	**Y**
T-04	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
T-08	I	NT	**N**	I	NT	**N**	I	NT	**N**
T-12B	NT	NA	**NA**	D	NA	**NA**	S	NA	**NA**
T-13b	I	NT	**N**	I	PI	**Y**	I	PI	**Y**
			Y=23			Y=29			Y=30
			N=16			N=10			N=9
			N(O)=0			N(O)=2			N(O)=0
			NA=5			NA=5			NA=5

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

Ft Lewis Log Center
RAM Network Optimization
ANNUAL shallow (JUN)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LC-03	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-05	NT	D	**N**	NT	D	**N**	NT	D	**N**
LC-06	I	NT	**N**	PI	NT	**N**	PI	NT	**N**
LC-108	NT	S	**Y**	D	D	**Y**	S	PD	**N**
LC-111b	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-116b	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
LC-122b	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-128	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-132	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-134	D	NT	**N**	D	D	**Y**	D	S	**N**
LC-136a	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-136b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-137a	NT	NT	**Y**	NT	D	**N**	NT	S	**Y**
LC-137b	S	PD	**N**	D	D	**Y**	PD	D	**Y**
LC-137c	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-144a	S	S	**Y**	NT	NT	**Y**	S	S	**Y**
LC-144b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-149c	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-149d	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-14a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-162	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-165	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-19a	S	NA	**NA**	NT	NA	**NA**	S	NA	**NA**
LC-19b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-19c	S	NA	**NA**	PI	NA	**NA**	NT	NA	**NA**
LC-26	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-41a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-44a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-49	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-49a	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-51	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-53	I	PI	**Y**	I	I	**Y**	I	PI	**Y**
LC-64a	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-64b	D	NT	**N**	D	D	**Y**	D	S	**N**
LC-66a	PI	I	**Y**	I	I	**Y**	PI	I	**Y**
LC-66b	NT	S	**Y**	NT	D	**N**	NT	PD	**N**
LC-73a	NT	NT	**Y**	D	I	**N(O)**	S	PI	**N**
PA-381	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
PA-383	NT	NT	**Y**	D	NT	**N**	S	NT	**Y**
T-01	PD	S	**N**	D	D	**Y**	D	PD	**Y**
T-04	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
T-08	I	NT	**N**	I	NT	**N**	I	NT	**N**
T-12B	NT	NA	**NA**	D	NA	**NA**	S	NA	**NA**
T-13b	I	PI	**Y**	I	PI	**Y**	I	PI	**Y**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing

**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

	Mann-Kendall	Linear Regression	Combined LOE
	Y=31	Y=32	Y=31
	N=9	N=8	N=09
	N(O)=0	N(O)=1	N(O)=0
	NA=4	NA=4	NA=4

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RAM Network Optimization
ANNUAL shallow (SEP)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LC-03	I	NT	**N**	I	PI	**Y**	I	PI	**Y**
LC-05	NT	NT	**Y**	NT	D	**N**	NT	S	**Y**
LC-06	I	S	**N**	PI	D	**N(O)**	PI	PD	**N(O)**
LC-108	NT	S	**N**	D	D	**Y**	S	PD	**N**
LC-111b	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-116b	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
LC-122b	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-128	I	NT	**N**	I	I	**Y**	I	PI	**Y**
LC-132	I	NT	**N**	I	I	**Y**	I	PI	**Y**
LC-134	D	NT	**N**	D	D	**Y**	D	S	**N**
LC-136a	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-136b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-137a	NT	S	**N**	NT	D	**N**	NT	PD	**N**
LC-137b	S	S	**Y**	D	NT	**N**	PD	S	**N**
LC-137c	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-144a	S	NA	**NA**	NT	NA	**NA**	S	NA	**NA**
LC-144b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-149c	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-149d	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-14a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-162	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-165	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-19a	S	NA	**NA**	NT	NA	**NA**	S	NA	**NA**
LC-19b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-19c	S	NA	**NA**	PI	NA	**NA**	NT	NA	**NA**
LC-26	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-41a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-44a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-49	NT	S	**N**	NT	D	**N**	NT	PD	**N**
LC-49a	NT	NA	**NA**	NT	NA	**NA**	NT	NA	**NA**
LC-51	I	PI	**Y**	I	I	**Y**	I	PI	**Y**
LC-53	I	NT	**N**	I	PI	**Y**	I	PI	**Y**
LC-64a	NT	S	**N**	NT	D	**N**	NT	PD	**N**
LC-64b	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-66a	PI	NT	**N**	I	NT	**N**	PI	NT	**N**
LC-66b	NT	S	**N**	NT	NT	**Y**	NT	S	**Y**
LC-73a	NT	S	**N**	D	D	**Y**	S	PD	**N**
PA-381	NT	D	**N**	NT	D	**N**	NT	D	**N**
PA-383	NT	S	**N**	D	D	**Y**	S	PD	**N**
T-01	PD	S	**N**	D	D	**Y**	D	PD	**Y**
T-04	NT	PD	**N**	D	D	**Y**	S	D	**N**
T-08	I	NT	**N**	I	NT	**N**	I	NT	**N**
T-12B	NT	NA	**NA**	D	NA	**NA**	S	NA	**NA**
T-13b	I	NT	**N**	I	NT	**N**	I	NT	**N**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing

**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

	Mann-Kendall	Linear Regression	Combined LOE
	Y=15	Y=27	Y=23
	N=22	N=10	N=14
	N(O)=0	N(O)=1	N(O)=1
	NA=7	NA=7	NA=7

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ANNUAL shallow (DEC)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LC-03	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-05	NT	S	**Y**	NT	D	**N**	NT	PD	**N**
LC-06	I	NT	**N**	PI	NT	**N**	PI	NT	**N**
LC-108	NT	NT	**Y**	D	NT	**N**	S	NT	**Y**
LC-111b	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-116b	NT	D	**N**	D	D	**Y**	S	D	**N**
LC-122b	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-128	I	NT	**N**	I	NT	**N**	I	NT	**N**
LC-132	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-134	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-136a	I	I	**Y**	I	I	**Y**	I	I	**Y**
LC-136b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-137a	NT	NT	**Y**	NT	D	**N**	NT	S	**Y**
LC-137b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-137c	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-144a	S	NT	**Y**	NT	NT	**Y**	S	NT	**Y**
LC-144b	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-149c	D	S	**N**	D	D	**Y**	D	PD	**Y**
LC-149d	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-14a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-162	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-165	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-19a	S	NA	**NA**	NT	NA	**NA**	S	NA	**NA**
LC-19b	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**
LC-19c	S	NA	**NA**	PI	NA	**NA**	NT	NA	**NA**
LC-26	D	D	**Y**	D	D	**Y**	D	D	**Y**
LC-41a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-44a	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LC-49	NT	PI	**N**	NT	I	**N**	NT	PI	**N**
LC-49a	NT	S	**Y**	NT	NT	**Y**	NT	S	**Y**
LC-51	I	NT	**N**	I	I	**Y**	I	PI	**Y**
LC-53	I	PI	**Y**	I	I	**Y**	I	PI	**Y**
LC-64a	NT	PI	**N**	NT	PI	**N**	NT	PI	**N**
LC-64b	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LC-66a	PI	NT	**N**	I	I	**Y**	PI	PI	**Y**
LC-66b	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LC-73a	NT	S	**Y**	D	D	**Y**	S	PD	**N**
PA-381	NT	S	**Y**	NT	D	**N**	NT	PD	**N**
PA-383	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
T-01	PD	D	**Y**	D	D	**Y**	D	D	**Y**
T-04	NT	NT	**Y**	D	D	**Y**	S	S	**Y**
T-08	I	NT	**N**	I	NT	**N**	I	NT	**N**
T-12B	NT	NA	**NA**	D	NA	**NA**	S	NA	**NA**
T-13b	I	I	**Y**	I	I	**Y**	I	I	**Y**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

	Y=28	Y=30	Y=30
	N=12	N=10	N=10
	N(O)=0	N(O)=0	N(O)=0
	NA=4	NA=4	NA=4

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RAM Network Optimization
ANNUAL deep (MAR)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual
LC-50d	NT	NA	**NA**	NT	NA	**NA**	NT	NA
LC-26d	D	S	**N**	D	D	**Y**	D	PD
LC-35d	S	NA	**NA**	D	NA	**NA**	PD	NA
LC-41d	NT	S	**Y**	NT	D	**N**	NT	PD
LC-47d	S	NA	**NA**	S	NA	**NA**	S	NA
LC-166d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-40d	PD	S	**N**	D	D	**Y**	D	PD
LC-126	D	S	**N**	D	D	**Y**	D	PD
LC-67d	NT	NT	**Y**	NT	I	**N**	NT	S
LC-77d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-71d	D	S	**N**	D	D	**Y**	D	PD
LC-72d	S	NT	**Y**	D	D	**Y**	PD	S
LC-73d	PD	S	**N**	D	D	**Y**	D	PD
LC-74d	I	I	**Y**	I	I	**Y**	I	I
LC-75d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-76d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-66d	PD	S	**N**	D	D	**Y**	D	PD

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing

**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

Y=5	Y=9
N=6	N=2
N(O)=0	N(O)=0
NA=6	NA=6

Ft Lewis Log Center
RAM Network Optimization
ANNUAL deep (MAR)

Trend Agreement? Y/N/N(O) NA
NA
Y
NA
N
NA
Y
Y
Y
Y
NA
Y
N
Y
Y
NA
NA
Y

Y=9
N=2
N(O)=0
NA=6

Ft Lewis Log Center
RAM Network Optimization
ANNUAL deep (JUN)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual
LC-50d	NT	NA	**NA**	NT	NA	**NA**	NT	NA
LC-26d	D	S	**N**	D	D	**Y**	D	PD
LC-35d	S	NA	**NA**	D	NA	**NA**	PD	NA
LC-41d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-47d	S	NA	**NA**	S	NA	**NA**	S	NA
LC-166d	NT	S	**Y**	NT	I	**N**	NT	PI
LC-40d	PD	S	**N**	D	D	**Y**	D	PD
LC-126	D	S	**N**	D	D	**Y**	D	PD
LC-67d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-77d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-71d	D	S	**N**	D	D	**Y**	D	PD
LC-72d	S	S	**Y**	D	D	**Y**	PD	PD
LC-73d	PD	NT	**N**	D	D	**Y**	D	S
LC-74d	I	I	**Y**	I	I	**Y**	I	I
LC-75d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-76d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-66d	PD	NT	**N**	D	D	**Y**	D	S

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing

**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

Y=5	Y=10
N=6	N=1
N(O)=0	N(O)=0
NA=6	NA=6

Ft Lewis Log Center
RAM Network Optimization
ANNUAL deep (JUN)

Trend Agreement? Y/N/N(O) NA
NA
Y
NA
Y
NA
N
Y
Y
Y
NA
Y
Y
N
Y
NA
NA
N

Y=8
N=3
N(O)=0
NA=6

Ft Lewis Log Center
RAM Network Optimization
ANNUAL deep (SEP)

Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual
LC-50d	NT	NA	**NA**	NT	NA	**NA**	NT	NA
LC-26d	D	D	**Y**	D	D	**Y**	D	D
LC-35d	S	NA	**NA**	D	NA	**NA**	PD	NA
LC-41d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-47d	S	NA	**NA**	S	NA	**NA**	S	NA
LC-166d	NT	PI	**N**	NT	I	**N**	NT	PI
LC-40d	PD	PD	**Y**	D	D	**Y**	D	D
LC-126	D	PD	**Y**	D	D	**Y**	D	D
LC-67d	NT	NT	**Y**	NT	I	**N**	NT	PI
LC-77d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-71d	D	S	**N**	D	D	**Y**	D	PD
LC-72d	S	S	**Y**	D	D	**Y**	PD	PD
LC-73d	PD	D	**Y**	D	D	**Y**	D	D
LC-74d	I	S	**N**	I	D	**N(O)**	I	PD
LC-75d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-76d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-66d	PD	S	**N**	D	D	**Y**	D	PD

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

Y=7	Y=8
N=4	N=3
N(O)=0	N(O)=1
NA=6	NA=6

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Trend Agreement? Y/N/N(O) NA
NA
Y
NA
Y
NA
N
Y
Y
N
NA
Y
Y
Y
N(O)
NA
NA
Y

Y=8
N=3
N(O)=1
NA=6

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Well Name	Mann-Kendall Quarterly	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly	Combined LOE Annual
LC-50d	NT	NA	**NA**	NT	NA	**NA**	NT	NA
LC-26d	D	S	**N**	D	D	**Y**	D	PD
LC-35d	S	NA	**NA**	D	NA	**NA**	PD	NA
LC-41d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-47d	S	NA	**NA**	S	NA	**NA**	S	NA
LC-166d	NT	S	**Y**	NT	S	**Y**	NT	S
LC-40d	PD	S	**N**	D	D	**Y**	D	PD
LC-126	D	S	**N**	D	I	**N(O)**	D	PI
LC-67d	NT	NT	**Y**	NT	NT	**Y**	NT	NT
LC-77d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-71d	D	S	**N**	D	D	**Y**	D	PD
LC-72d	S	NT	**Y**	D	D	**Y**	PD	S
LC-73d	PD	NT	**N**	D	D	**Y**	D	S
LC-74d	I	I	**Y**	I	I	**Y**	I	I
LC-75d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-76d	NA	NA	**NA**	NA	NA	**NA**	NA	NA
LC-66d	PD	NT	**N**	D	D	**Y**	D	S

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing

**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)

Y=5	Y=10
N=6	N=1
N(O)=0	N(O)=1
NA=6	NA=6

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ANNUAL deep (DEC)

Trend Agreement? Y/N/N(O) NA
NA
Y
NA
Y
NA
Y
Y
N(O)
Y
NA
Y
N
N
Y
NA
NA
N

Y=7
N=4
N(O)=1
NA=6

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ANNUAL extraction (MAR)

Well Name	Mann-Kendall Quarterly Plus***	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly Plus***	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly Plus***	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LX-1	S	NT	**Y**	D	NT	**N**	PD	NT	**N**
LX-2	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-3	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-4	D	NT	**N**	D	D	**Y**	D	S	**N**
LX-5	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LX-6	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-7	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LX-8	NT	NT	**Y**	D	NT	**N**	S	NT	**Y**
LX-9	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-10	PD	NT	**N**	D	NT	**N**	D	NT	**N**
LX-11	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-12	D	NT	**N**	D	NT	**N**	D	NT	**N**
LX-13	I	NT	**N**	I	NT	**N**	I	NT	**N**
LX-14	PI	NT	**N**	PI	NT	**N**	PI	NT	**N**
LX-15	I	I	**Y**	I	PI	**Y**	I	PI	**Y**
LX-16	NT	NT	**Y**	NT	NT	**N**	NT	NT	**Y**
LX-17	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-18	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-19	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-21	D	S	**N**	D	D	**Y**	D	PD	**Y**
RW-1	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)
***Complete data set includes monthly sampling 9/95 to 8/96, then quarterly sampling 8/96 to 9/00

	Mann-Kendall	Linear Regression	Combined LOE
	Y=9	Y=13	Y=14
	N=11	N=7	N=6
	N(O)=0	N(O)=0	N(O)=0
	NA=1	NA=1	NA=1

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ANNUAL extraction (JUN)

Well Name	Mann-Kendall Quarterly Plus***	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly Plus***	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly Plus***	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LX-1	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LX-2	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-3	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-4	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-5	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-6	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LX-7	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-8	NT	NT	**Y**	D	NT	**N**	S	NT	**Y**
LX-9	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-10	PD	S	**N**	D	D	**Y**	D	PD	**Y**
LX-11	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-12	D	S	**N**	D	NT	**N**	D	S	**N**
LX-13	I	I	**Y**	I	I	**Y**	I	I	**Y**
LX-14	PI	PI	**Y**	PI	PI	**Y**	PI	PI	**Y**
LX-15	I	I	**Y**	I	PI	**Y**	I	PI	**Y**
LX-16	NT	NA	**NA**	NT	NA	**NA**	NT	NA	**NA**
LX-17	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-18	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-19	D	PD	**Y**	D	D	**Y**	D	D	**Y**
LX-21	D	NT	**N**	D	NT	**N**	D	NT	**N**
RW-1	S	NT	**Y**	D	I	**N(O)**	PD	PI	**N(O)**
			Y=12 N=8 N(O)=0 NA=1			Y=16 N=4 N(O)=1 NA=1			Y=17 N=3 N(O)=1 NA=1

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)
***Complete data set includes monthly sampling 9/95 to 8/96, then quarterly sampling 8/96 to 9/00

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Well Name	Mann-Kendall Quarterly Plus***	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly Plus***	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly Plus***	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LX-1	S	S	**Y**	D	D	**Y**	PD	PD	**Y**
LX-2	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-3	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-4	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-5	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-6	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-7	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-8	NT	S	**Y**	D	D	**Y**	S	PD	**N**
LX-9	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-10	PD	S	**N**	D	D	**Y**	D	PD	**Y**
LX-11	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-12	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-13	I	I	**Y**	I	PI	**Y**	I	PI	**Y**
LX-14	PI	NT	**N**	PI	NT	**N**	PI	NT	**N**
LX-15	I	NT	**N**	I	PI	**Y**	I	PI	**Y**
LX-16	NT	NA	**NA**	NT	NA	**NA**	NT	NA	**NA**
LX-17	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-18	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-19	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-21	D	D	**Y**	D	D	**Y**	D	D	**Y**
RW-1	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)
***Complete data set includes monthly sampling 9/95 to 8/96, then quarterly sampling 8/96 to 9/00

Mann-Kendall	Linear Regression	Combined LOE
Y=13	Y=18	Y=17
N=6	N=1	N=2
N(O)=0	N(O)=0	N(O)=0
NA=2	NA=2	NA=2

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ANNUAL extraction (DEC)

Well Name	Mann-Kendall Quarterly Plus***	Mann-Kendall Annual	Trend Agreement? Y/N/N(O) NA	Linear Regression Quarterly Plus***	Linear Regression Annual	Trend Agreement? Y/N/N(O) NA	Combined LOE Quarterly Plus***	Combined LOE Annual	Trend Agreement? Y/N/N(O) NA
LX-1	S	S	**Y**	D	NT	**N**	PD	S	**N**
LX-2	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-3	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-4	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-5	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-6	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-7	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-8	NT	S	**Y**	D	D	**Y**	S	PD	**N**
LX-9	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-10	PD	S	**N**	D	D	**Y**	D	PD	**Y**
LX-11	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-12	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-13	I	NT	**N**	I	PI	**Y**	I	PI	**Y**
LX-14	PI	I	**Y**	PI	PI	**Y**	PI	PI	**Y**
LX-15	I	I	**Y**	I	I	**Y**	I	I	**Y**
LX-16	NT	NT	**Y**	NT	NT	**Y**	NT	NT	**Y**
LX-17	D	S	**N**	D	D	**Y**	D	PD	**Y**
LX-18	D	D	**Y**	D	D	**Y**	D	D	**Y**
LX-19	D	S	**N**	D	NT	**N**	D	S	**N**
LX-21	D	S	**N**	D	D	**Y**	D	PD	**Y**
RW-1	S	NA	**NA**	D	NA	**NA**	PD	NA	**NA**

*Trends: I = Increasing, PI = Probably Increasing, NT = No Trend, S = Stable, PD = Probably Decreasing, D = Decreasing
**Trend Comparison: Y = Same Trend, N = Different Trend, N(0) = Opposite Trend, NA = Not Applicable (Insufficient data)
***Complete data set includes monthly sampling 9/95 to 8/96, then quarterly sampling 8/96 to 9/00

	Mann-Kendall	Linear Regression	Combined LOE
	Y=8	Y=18	Y=17
	N=12	N=2	N=3
	N(O)=0	N(O)=0	N(O)=0
	NA=1	NA=1	NA=1