

TLPSF 17.3.2 VI

8/01/04

**Tacoma Landfill
Second Five-Year Closure Extension Request**

August 2004

Prepared by

**City of Tacoma Public Works Department
Science and Engineering Division
And Solid Waste Management**

USEPA SF



1322779



City of Tacoma
Public Works Department

August 25, 2004

Mr. Bob Kievit
EPA, Washington Operations Office
300 Desmond Drive Southeast
Lacey, WA 98503

Re: Tacoma Landfill Second Five-Year Closure Extension Request

Dear Mr. Kievit:

On April 14, 2004, City of Tacoma (Tacoma) submitted the draft document, Tacoma Landfill Second Five-Year Closure Extension Request, for your review and comment.

We appreciate your input and incorporated your comments and those received from the Department of Ecology and Tacoma-Pierce County Health Department, into the Tacoma Landfill Second Five-Year Closure Extension Request. This final document is Tacoma's formal request for the second five-year closure extension.

Tacoma's Solid Waste Management Utility believes the enclosed document provides the information needed and meets the requirements for extension request approval.

Please contact me with any questions about the attached document at (253) 593-7711.

Sincerely,

Calvin D. Taylor, P.G.
Tacoma Landfill Project Coordinator
Science and Engineering Division

Cc: Chris Maurer, Department of Ecology
Dave Bosch, Tacoma-Pierce County Health Department
Al Tebaldi, Solid Waste Management
Jim Parvey, Science and Engineering Division
Russ Prior, Pacific Groundwater Group



Calvin D. Taylor

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1.0 Introduction

"...We will provide innovative and cost-effective municipal services of the highest quality to enhance the lives of our citizens..."(excerpt from Tacoma's mission statement)

This excerpt provides the strategic direction for our City government and Solid Waste Management Utility. Solid Waste Management (SWM) strives to provide innovative and cost-effective services to City of Tacoma (Tacoma) citizens.

The first Tacoma Landfill operations five-year closure extension expires on December 31, 2004. This document will serve as application for the second of three possible five-year closure extensions allowed under Section 3.4.2.1 of the Consent Decree. Solid Waste Management operates under the following federal, state and local regulations and requirements:

- Federal - 40 CFR Part 258, RCRA Subtitle D, CERCLA Section 105, Record of Decision, and Consent Decree.
- State - RCW 70.95, WAC 173-304 & 351, and Ecology Solid Waste Management Plan.
- County and City – Tacoma Pierce County Health Department (TPCHD) Operating Permit, and TPCHD Solid Waste Management Plan.

Solid Waste Management's goals are based on the Washington State Department of Ecology (DOE) and Tacoma-Pierce County Solid Waste Management Plans. These plans were approved by the Environmental Protection Agency (EPA) and DOE. The plans waste control and disposal methods hierarchy follows:

- Waste Reduction
- Recycling
- Energy Recovery, incineration or land filling of separated waste
- Energy Recovery, incineration or land filling of mixed waste

Request approval will allow Tacoma, through the use of integrated waste management practices, to continue to support state and county solid waste management priorities. The remaining Central Area volume provides a bridge between current operations a planned future SWM developments, gives the utility the ability to negotiate cost effective long haul rates, which reduce the cost of service to our citizens, and provides Tacoma a back up for problems such as; transportation strikes, shutdown at the 304th Street landfill, major South Compactor breakdown or shutdown for upgrade.

2.0 Requirements for Closure Extension

Consent Decree Scope of Work Section 3.4.2.1 provides for closure extension. The section lists the following requirements that Tacoma must demonstrate to the satisfaction of the government plaintiffs (EPA and DOE) for an extension to be granted:

1. That the continued operation of the landfill shall not result in a release or substantial threat of release of hazardous substances, pollutants or contaminants to the environment;
2. That the performance standards for the extraction/treatment system have been achieved;
3. That since the effective date of the Consent Decree, the Settling Defendant has instituted and is operating an aggressive solid waste recycling and hazardous materials collection program; and
4. That other feasible solid waste management alternatives to disposal at the landfill do not exist.

This request will demonstrate that Solid Waste Management again meets these requirements for closure extension.

Although the language of this section seems straightforward, a few terms need further definition. The word "*landfill*" with respect to this section, is defined by Tacoma as the active Central Area (approximately 31 acres).

If this request is denied, the landfill operations center, which includes the recycling center, household hazardous waste facility, RDF facility, compactors, shredders, maintenance center, tipping buildings, scale house, and office space will continue to operate as the Tacoma Solid Waste Management Site and Transfer Station.

The final term requiring further definition is "*..other feasible solid waste management alternatives...*". We believe this statement means "better solid waste management alternatives". The rationale for this definition is that although other management alternatives are possible, they may not be the best alternative for the environment or the citizens of Tacoma.

Tacoma has aggressively sought the best solid waste management solutions for the environment and its citizens as defined by these plans. Allowing the Central Area to operate beyond the year 2004 would be the best solid waste management alternative.

3.0 First Consent Decree Requirement

"that the continued operation of the landfill shall not result in a release or substantial threat of release of hazardous substances, pollutants or contaminants to the environment"

The Central Area is the only operational landfill cell. The Central Area is lined and has successfully demonstrated compliance with WAC 173-351 and Resource Conservation and Recovery Act (RCRA) Subtitle "D" permit requirements. This section will describe the safeguards and environmental systems that guard against a contaminant release to the environment

3.1 Tacoma Landfill Remediation Systems

Tacoma landfill stage one and stage two closure areas were capped in accordance with Consent Decree requirements to prevent additional leachate generation. The gas extraction system was constructed to eliminate offsite gas migration. And the groundwater extraction treatment system was constructed to prevent further migration and reduce contaminant concentrations in the groundwater plume. The following are brief descriptions of these systems:

- **Landfill Cap:** The Public Receiving Facility Asphalt Cap, Stage One and Stage Two Geomembrane Cap, and Stage Three Cap which will be constructed upon closure of the Central Area.
- **Landfill Gas Extraction and Flare System:** Consists of 323 landfill gas extraction wells, 136 monitoring probe stations, and four gas flares.
- **Groundwater Extraction and Treatment System:** Consists of 22 Point of Compliance extraction wells, 14 Edge of Plume extraction wells, 11 Performance Monitoring Wells, 26 Monitoring Wells, and a Groundwater Air-stripping treatment system. This system will be discussed further in Section 4.0.

The above listed systems were approved by EPA and DOE. Extensive monitoring programs are operated to insure these systems are functioning properly. Monitoring programs include gas probes, groundwater wells, flare and air stripping tower emissions, leachate and condensate collection. The monitoring programs were approved by the responsible regulatory agencies. Periodic reports are sent to the agencies for review as required by approved monitoring programs.

Monitoring results presented in monthly, quarterly, and annual reports indicate the systems are functioning as designed and are fulfilling the first Consent Decree requirement.

3.2 Central Area Environmental Systems

The Central Area has two systems in place to protect the environment. The following are brief descriptions of these systems:

- **Central Area Liner:** Consists of Phase I and II construction. A geomembrane liner system with a double lined bottom, and leak detection system.

- **Leachate and Condensate Collection System:** Consists of collection piping, condensate tanks, pumps, manholes and flow monitoring equipment.

3.2.1 Central Area Liner

The Central Area liner systems purpose is to prevent leachate contact with groundwater. As rain falls into the Central Area it passes through the cell and contacts refuse creating leachate. This leachate is collected by the liner system and transported by the leachate collection system to the sanitary sewer for treatment.

The Central Area liner was constructed in two phases. First phase construction consisted of a geomembrane liner system double lined bottom and a leak detection system. The first phase was approximately 18 acres in area and became operational in late 1987. Phase 2 liner construction expanded the phase one liner system and increased the Central Area to approximately 31 acres.

Both liner phases were constructed to meet the Washington State Minimum Functional Standards for Solid Waste Handling (WAC 173-304). Additionally the Central Area has successfully demonstrated compliance with WAC 173-351 requirements for existing landfills.

3.2.2 Central Area Liner Integrity

Leakage calculations were performed on the liner system to demonstrate Central Area liner integrity and submitted with the first five-year extension request, *Tacoma Landfill Beyond 2000 Request, 1998*. The estimated leakage rate was nearly seven times better than the classification of a Great Liner by EPA Standards. Site conditions have not significantly changed since the calculations were performed so we submit that the conclusions are still valid.

3.2.3 Leachate & Condensate Collection System

Metered leachate flow data was collected from the leachate collection manhole during 1996 and 1997. The leachate flow data was plotted against rainfall data and presented in the *Tacoma Landfill Beyond 2000 Request, 1998*. The data showed the correlation between increased leachate flow with rainfall events followed by decreased flow. It also showed a correlation to seasonal rainfall.

The data qualitatively showed that the rainwater entering the liner system was leaving the system as leachate. This supported the assumption that the leachate collection system was keeping leachate head under the one-foot maximum required by the calculations in Section 3.2.2.

Tacoma requested that visual flow monitoring replace leachate flow metering during 1998. The leachate collection manhole environment resulted in meter malfunctions that would have required bi-monthly maintenance under particularly difficult and dangerous confined entry conditions. EPA, DOE, and TPCHD agreed visual leachate flow monitoring would be sufficient. Visual flow monitoring continues to indicate that the leachate collection system keeps leachate head under the one foot maximum. In addition, flow estimates in Table 1 show considerable yearly fluctuation, but do not indicate a steady flow increase over time.

Table 1- Estimated Annual Leachate Discharge to Sanitary Sewer

Year	Leachate (gallons)
1999	3,985,997
2000**	2,297,209
2001	3,873,502
2002	3,140,620
2003	4,181,464
Total	17,478,792

*Equation for Leachate and Central Area Flow in gallons: (runoff factor * area (acres) * rainfall (in) * 27154.4 (conversion factor)

Runoff Factor 0.09775

Area (acres) 31.7

**2000 was a dry year.

SWM will continue to visually monitor and report leachate flow monitoring. In addition, SWM started periodic leachate detection and collection manhole cleanouts during 2004. This monitoring provides an early warning system, in the unlikely event that a liner problem should occur.

3.3 First Consent Decree Requirement Satisfied

SWM operates and monitors landfill remediation and Central Area environmental protection systems. These systems were reviewed by the regulatory agencies responsible for extension request approval. Analytical data from the Central Area environmental protection systems indicate the Central Area poses no substantial threat of release. And analytical data from the remediation systems indicate no new release has occurred. These systems are maintained, monitored, and working to protect the environment. The first Consent Decree requirement is satisfied.

4.0 Second Consent Decree Requirement

“that performance standards for the extraction/ treatment system have been achieved”

This section will demonstrate compliance with the groundwater extraction, treatment, and monitoring program requirements specified in the Consent Decree.

4.1 Consent Decree

Consent Decree Section 3.4.2.1 states that Tacoma will demonstrate to the agencies satisfaction *“that the performance standards for the extraction/treatment system have been achieved.”* The performance standards were detailed in Section 3.3 and include:

- The goal of the groundwater extraction system is to prevent any further degradation of existing water quality beyond the existing boundaries of the plume.
- The extraction system shall continue to operate until the water quality at and beyond the point of compliance (defined in WAC 173-304-100(58)), consistently meets drinking water standards, or previously established and approved health-based criteria, as listed in the Consent Decree Scope of Work Table 3. The groundwater performance criteria listed in the table are the Chemicals of Concern (COC) to be monitored by the City to evaluate whether the extraction system must continue operation.

Scope of Work - Table 3	
Groundwater Performance Standards	
Contaminant	Performance Standard (ug/L)
1,1,1-Trichloroethane	200
1,1-Dichloroethane	20
1,2-Dichloroethane	5
Benzene	5
Chloroethane	20
Ethyle Benzene	320
Methylene Chloride	5
Tetrachloroethene	5
Toluene	175
total, 1,2-Dichloroethene	70
Vinyl Chloride	2
Xylenes	10

4.2 Groundwater Extraction and Treatment System (GETS)

In March 1992, Tacoma constructed the groundwater extraction and treatment system. The system consisted of 19 Point-of-Compliance (POC) wells, nine Edge-of-Plume (EOP) wells, and associated pipelines to transport the groundwater from the extraction wells to the

treatment facility. In addition, performance wells were installed to monitor extraction system groundwater plume capture effectiveness.

Groundwater extraction and treatment system construction were completed in three phases; POC wells, EOP wells, and treatment facility. The construction phases were completed during 1992. POC and EOP extraction well testing were completed by spring 1993. Tacoma formally certified the GETS completion in January 1994. The GETS was formally approved by EPA in March 1995.

4.2.1 POC Enhancements

Groundwater analytical data collected at monitoring well TL-1 indicated third quarter vinyl chloride increases during the period 1991 to 1996. Three additional POC extraction wells (W-20, W-21, and W-22) were installed to enhance POC capture along the northwest portion of the line. The wells became operational during February 1997. Vinyl chloride has not been detected in TL-01 groundwater samples since these wells became operational.

4.2.2 EOP Enhancements

Groundwater monitoring data indicated a study to determine whether additional extraction wells along the EOP would be appropriate. The City conducted tests, including pumping tests, and bromide tracer tests along the EOP to better understand capture at this location. The conclusions from these tests and groundwater quality data at PW-1, PW-2 and PW-3/4 indicated additional extraction wells would facilitate off site cleanup. Four new extraction wells (W-40, W-41, W-42 and W-43) were installed during the summer of 1996. The wells became operations during June 1997. Analytical data indicate enhanced EOP plume capture.

4.2.3 GETS Status

During 1998, extracted groundwater combined effluent contaminant concentrations decreased to below groundwater performance standards. This indicated the landfill cap emplaced during 1991 and 1992 prevented additional leachate generation. Tacoma requested and received permission to shutdown the treatment system during 1998. The system remains on standby in the event groundwater contaminant concentrations again exceed groundwater performance standards.

The extraction well rehabilitation method was changed to a carbon dioxide freezing method in 2001. The method provided significant production improvements in most rehabilitated wells.

4.3 Groundwater Plume

Groundwater monitoring data collected during the past five years indicated the GETS and cap system continue to effectively to restore groundwater quality to cleanup requirements. Few wells still have contaminants detections above cleanup levels. Remaining groundwater performance criteria exceedances are consistent with POC and EOP systems design expectations. The remediation systems have considerably decreased groundwater volatile organic compound concentrations in the on and off site plume areas.

Figure 1 - Tetrachloroethene vs Time

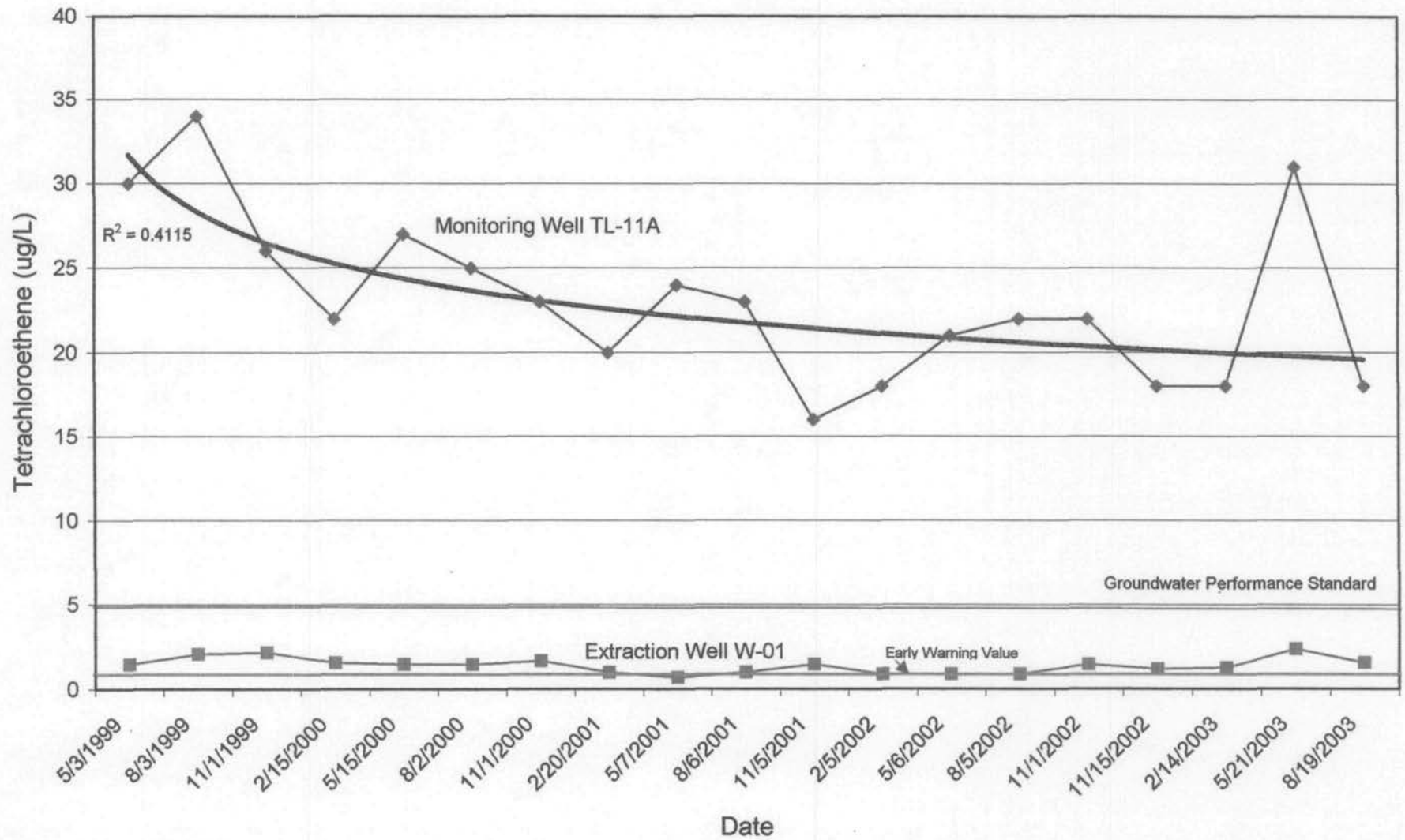


Figure 2 - Trichloroethene vs Time

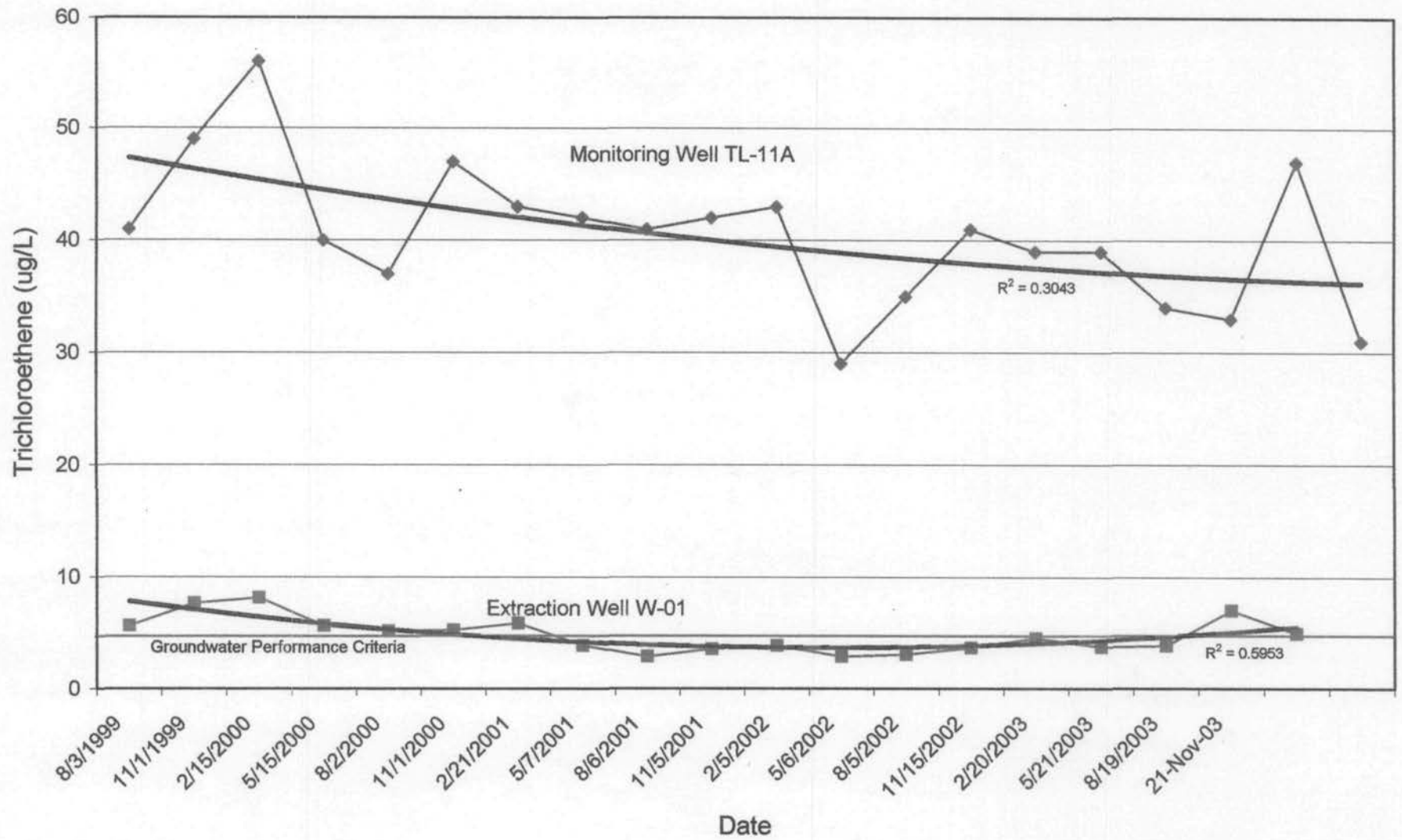


Figure 4 - 1,2-Dichloroethane vs Time

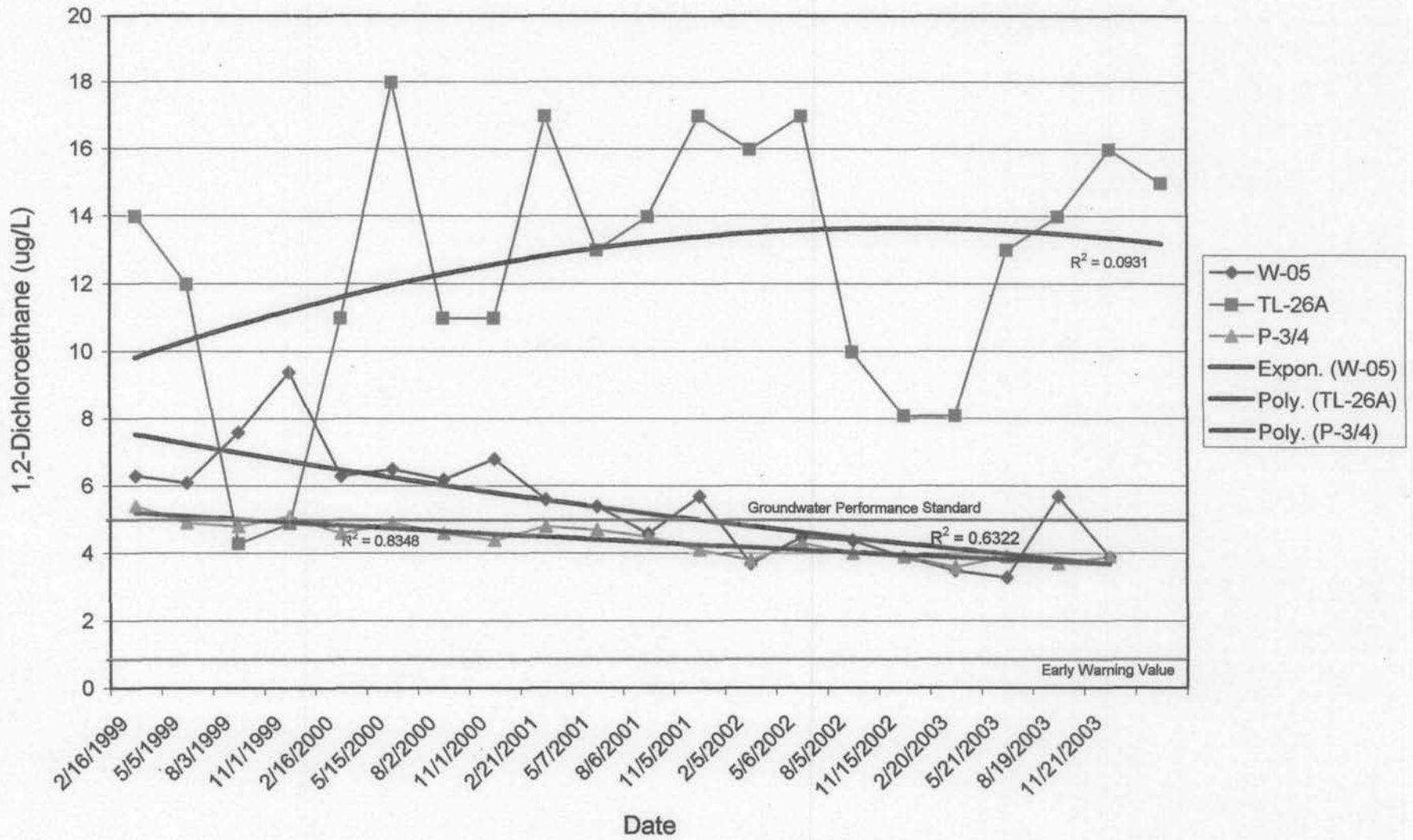
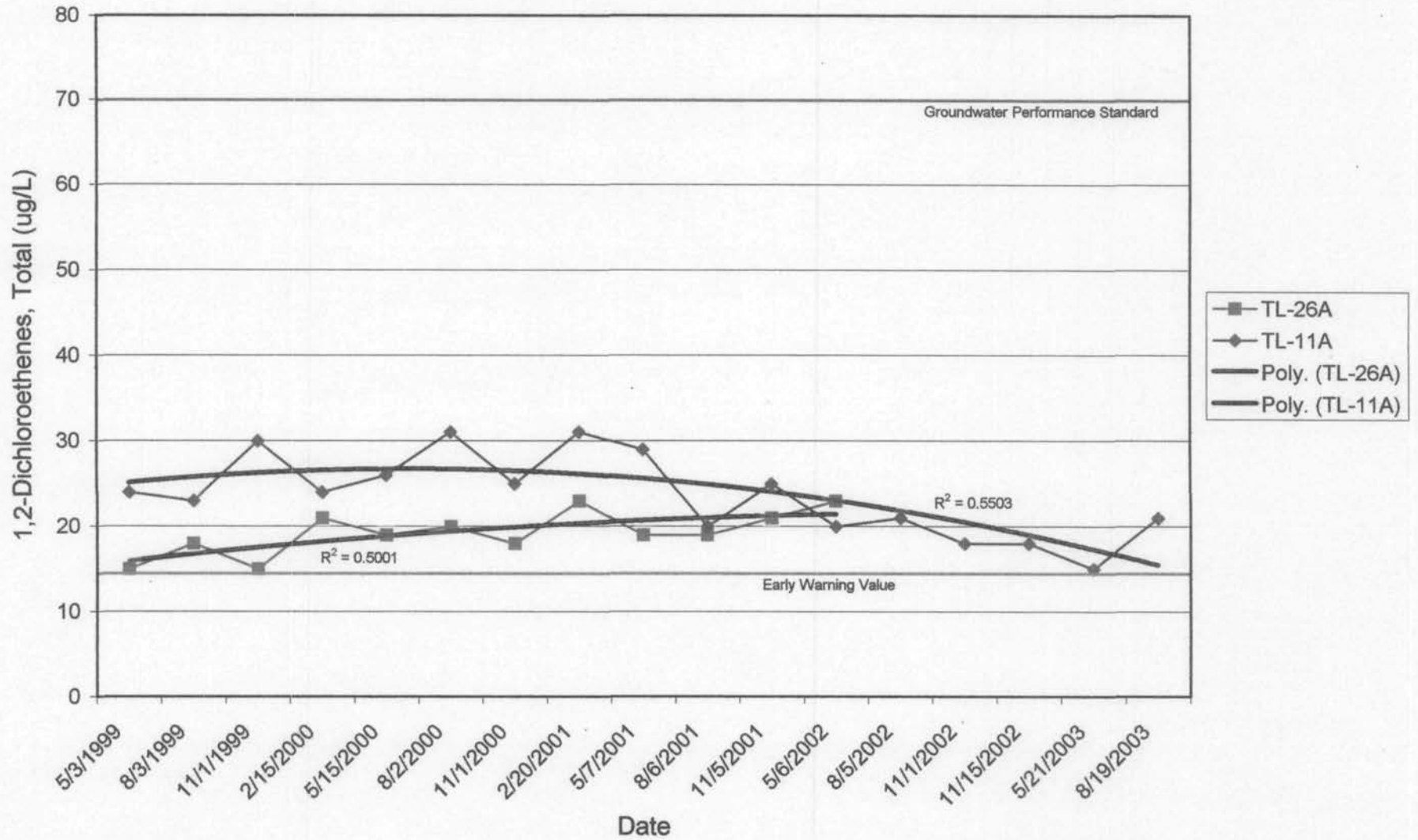


Figure 5 - 1,2-Dichloroethenes, Total



During the past five years, tetrachloroethene and trichloroethene exceeded the groundwater performance standards in wells W-01 and TL-11A (Figures 1 and 2). Tetrachloroethene has not exceeded the performance standard in W-01 since 1999. Regression analysis indicated concentrations continue to decrease in both wells over time (Figures 1 and 2).

During the past five years, 1,1-dichloroethane exceeded the groundwater performance standard once in well TL-26A. 1,1-dichloroethane has not exceeded the groundwater performance standard in any well since March 1999 (Figure 3). Regression analysis indicated a continued decreasing concentration trend in TL-26A.

During the past five years, 1,2-dichloroethane exceeded the groundwater performance standard in wells W-05 and TL-26A, and P-3/4 (Figure 4). 1,2-dichloroethane has not exceeded the groundwater performance standard in W-05 or P-3/4 since November 2001 and February 2000 respectively. 1,2-dichloroethane continues to exceed the groundwater performance standard in TL-26A. The highest detected value occurred during second quarter 2000. Regression analysis indicated a decreasing concentration trend since then (Figure 4).

During the past five years, 1,2-dichloroethenes totals were not detected above the groundwater performance standard in any well (Figure 5).

During the past five years vinyl chloride exceeded the groundwater performance standard in 12 wells (Figures 6A and 6B). Since February 2002 vinyl chloride only exceeded the groundwater performance standard in northern plume area wells W-15, W-36, and TL-7A. Regression analyses for W-36 and TL-7A indicated concentrations continue to decrease over time (Figure 6A). Since February 2002 vinyl chloride did not exceed the groundwater performance standard in any southern plume area wells (Figure 6B).

Vinyl chloride concentrations exceeded groundwater performance standards in 12 wells (Section 4.4, *Tacoma Landfill Beyond 2000 Request, 1997*) during fourth quarter 1997. Vinyl chloride concentrations were at or exceeded groundwater performance standards in two wells during fourth quarter 2003. Statistical analyses show vinyl chloride concentrations continue to decrease over time.

4.3.1 Groundwater Plume Contaminant Decrease - 1999 to 2003

As discussed in the *Tacoma Landfill Beyond 2000 Request, 1997*, the groundwater plume was determined to have two areas, a north area and a south area as demarcated by the yellow line in Figure 7. Contamination has not been detected in monitoring wells TL-25a, TL-25b, P-5, P-6, P-7, and extraction wells W-34 and W-35 since installation. The analytical results from these wells document the area of uncontaminated groundwater between the north and south plume areas.

Vinyl chloride was again chosen as representative of the groundwater plume based on strictest performance criteria and persistence through time. Concentration data were presented symbolically, with colored dots, rather than contours to best depict the discontinuous residual groundwater plume distribution.

The northern groundwater plume area has two distinct sub-areas defined by extraction wells W-20 and W-21, and monitoring wells TL-4 and TL-5a in the north. And extraction wells W-15, W-36, W-37, W-38, and W-43, and monitoring wells TL-7a and P-08 in the south. Note

Figure 6A - Vinyl Chloride vs Time - Northern Plume Area

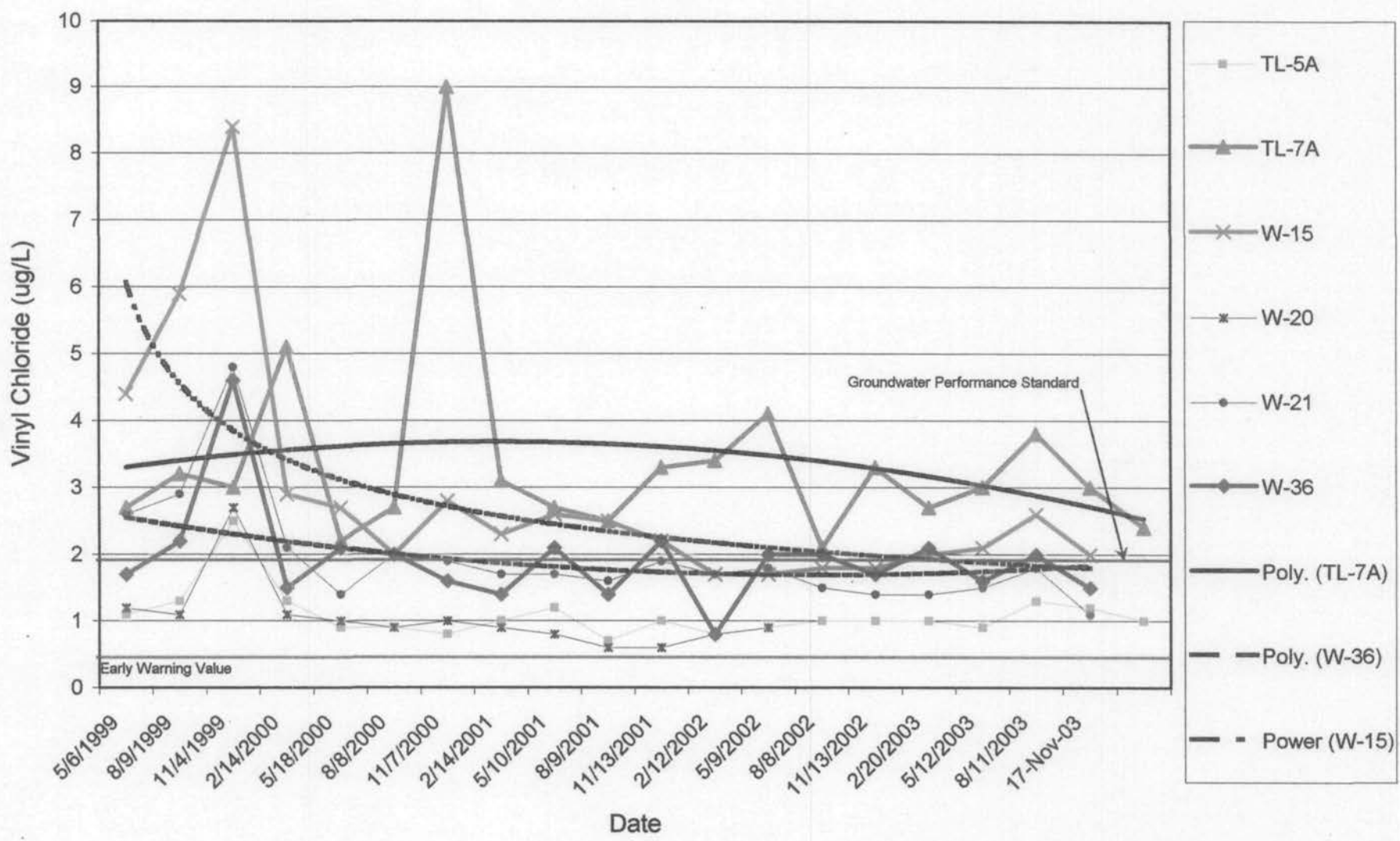
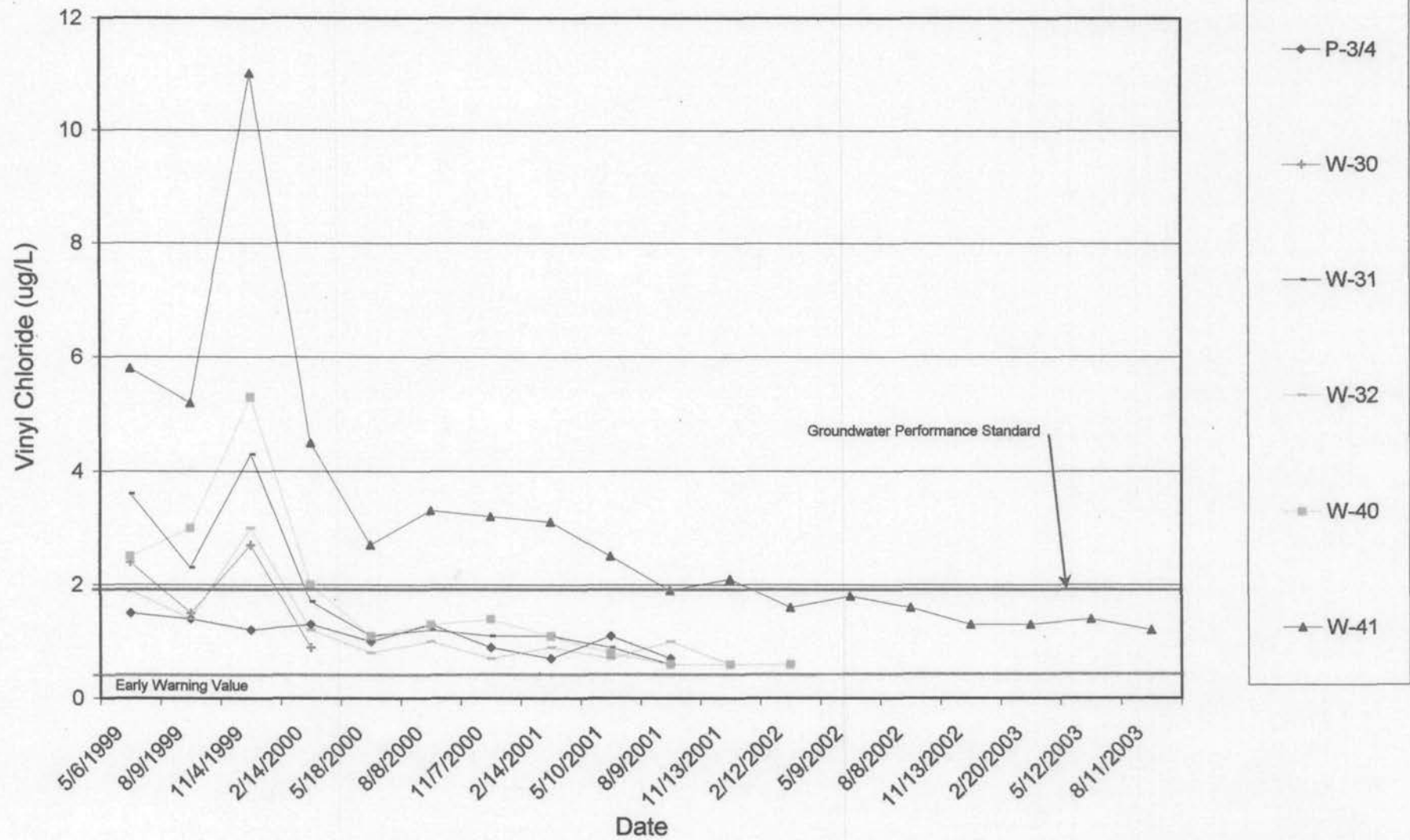


Figure 6B - Vinyl Chloride vs Time - Southern Plume Area



North End

South End

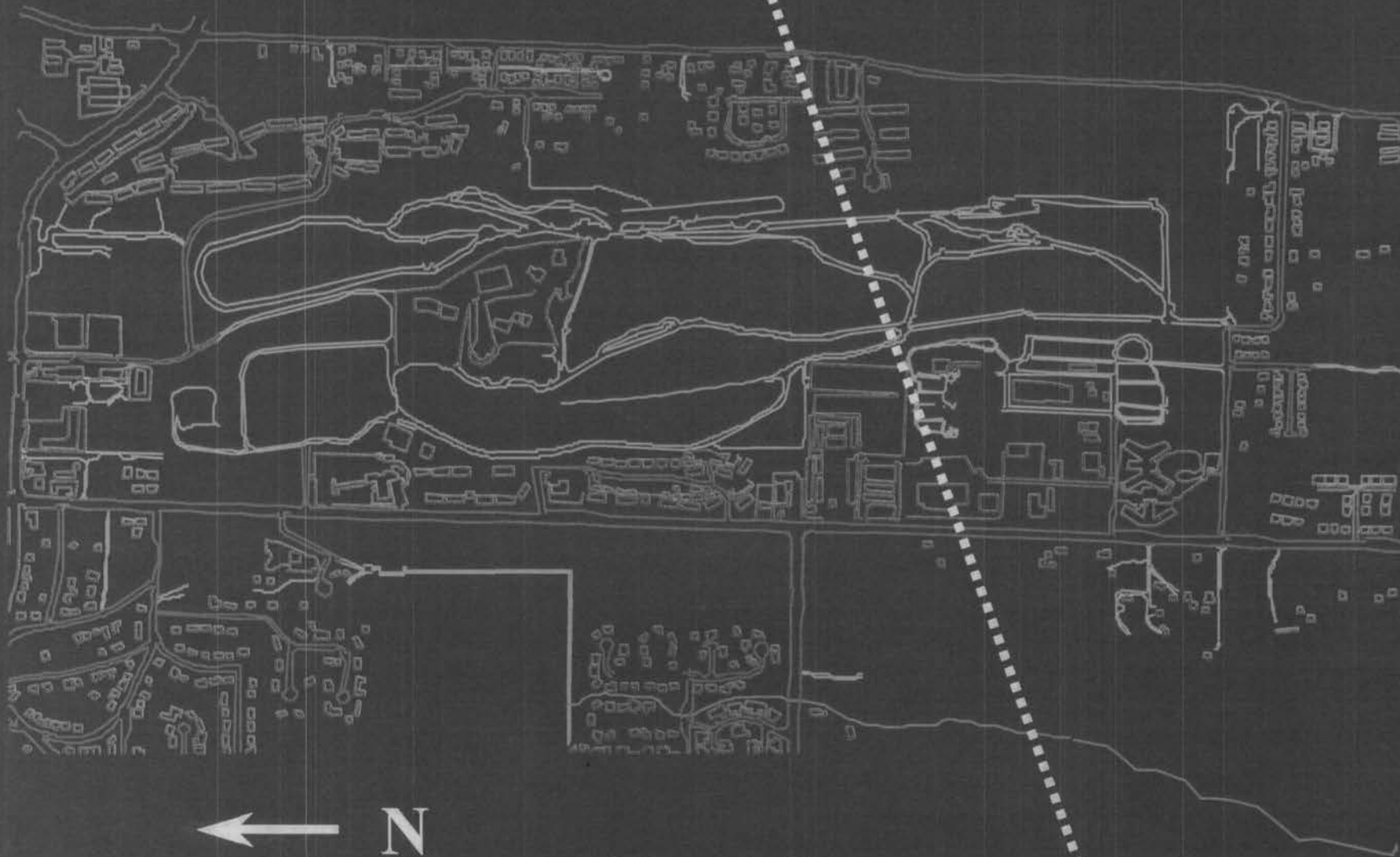


Figure 7

that well TL-17AR is an off site upgradient monitoring well contaminated by the former New Frontier Lanes bowling alley site plume.

Vinyl chloride concentrations decreased for all wells in the north area during 1999 to 2003 (Figures 8, 9 and 10) except performance monitoring well P-08. Vinyl chloride was detected at 1.2 µg/L in P-08 during fourth quarter 2003. There was no statistically significant trend for P-08 during 2003. Vinyl chloride in wells W-15, TL-7A, and W-36 exceeded the groundwater performance criteria during the past five years, but regression trends for these wells show concentrations continue to decrease over time (Figure 6A). Based on the analytical data the north plume area continues to shrink over time.

The southern plume area is defined by extraction wells W-01, W-05, W-30, W-31, W-32, W-33, W-40, and W-41. And also by monitoring wells P-02, P-3/4, TL-9B, TL-11A, TL-19C, TL-20C, TL-26A, and TL-27B. Note that monitoring well 89.5 is not in the Tacoma Landfill groundwater plume. The well was contaminated by a source in the Nalley Valley.

Vinyl chloride concentrations decreased for all wells in the southern area during the first five-year extension period 1999 to 2003 (Figures 11, 12, and 13). None of the southern plume area wells exceeded the vinyl chloride groundwater performance criteria since 2001. Based on the analytical data the southern plume area continues to shrink over time.

Vinyl chloride concentrations have decreased in the north and south groundwater plume areas by an order of magnitude from greater than 20 µ/L to less than 3 µg/L since the first five-year extension request was submitted in 1997, and continue to decrease. The groundwater analytical results indicate the GETS and cap system continue to shrink the groundwater plume in a timely manner.

4.3.2 Groundwater Plume Capture Zone Evaluation

The groundwater plume capture zone was analyzed to determine whether capture was being maintained. Fourth quarter 2003 POC and EOP extraction well production rates and aquifer hydrogeologic parameters were used to determine well capture zones.

4.3.2.1 Horizontal Capture





The horizontal capture zone and stagnation point and width were obtained using equations based on Javendal and Tsang (1986). The equations from Javendal and Tsang require the input of several parameters. These parameters include the pumping rate for each well, aquifer transmissivity, and regional hydraulic gradient. The equations used were for a single pumping well. The calculated capture zones do not reflect the influence of other wells.

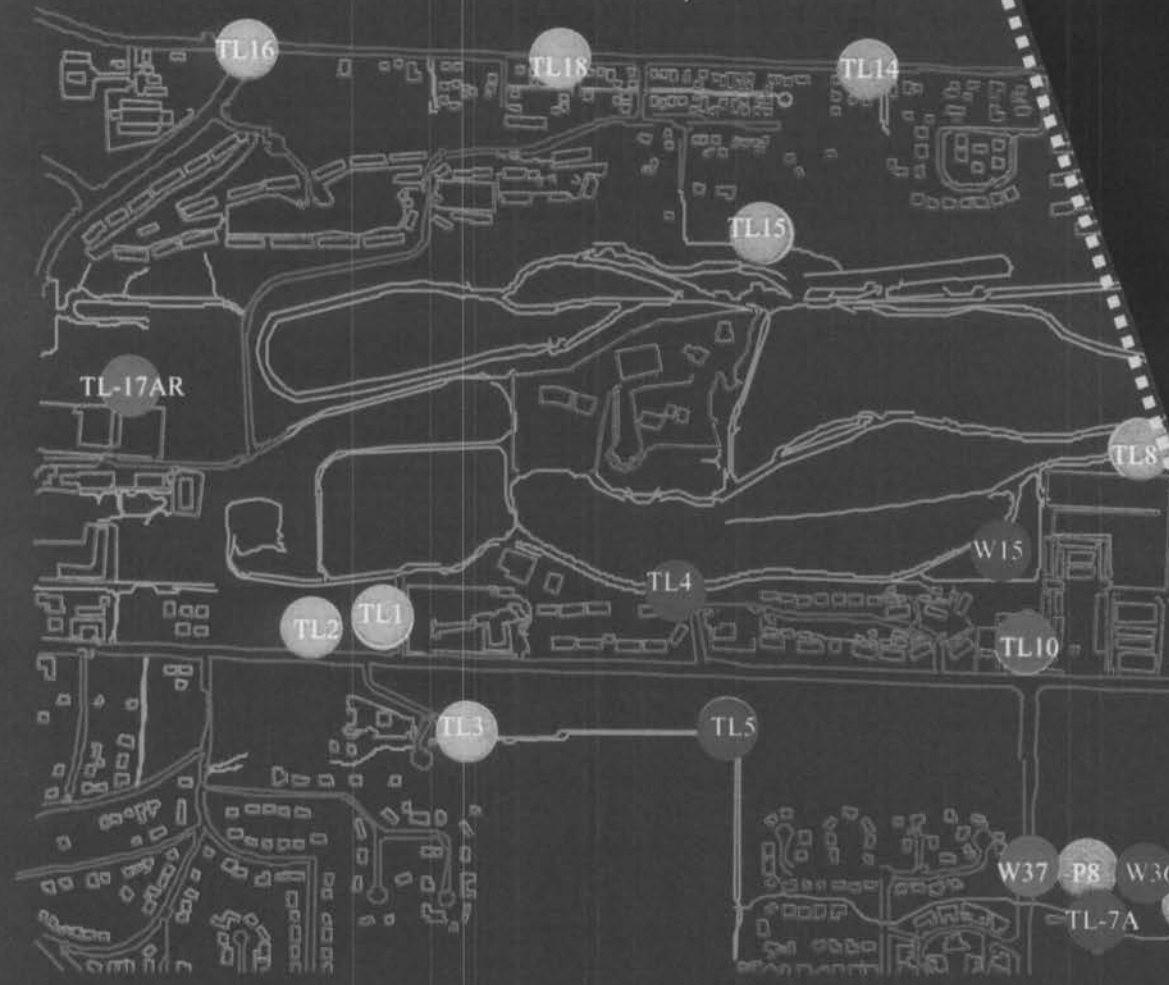
Capture zones overlap between other wells (W-1 to W-20) is evident from the influence of pumping rate changes on adjacent POC wells. A pumping rate increase in, for example W-1, rapidly decreases the available drawdown in W-2 which results in on-off well cycling. The reduced available drawdown can no longer sustain the W-2 pumping rate which causes the well to shutoff when pumped down to a preset groundwater elevation.

The POC wells do not fully penetrate the aquifer. The Weight and Sonderegger (2001) equation for estimating saturated aquifer thickness in a partially penetrating well was used to estimate a saturated aquifer thickness for each well.

1999



-  $\geq 2.0 \mu\text{g} / \text{L}$
-  $\geq 1.0 \mu\text{g} / \text{L}$
-  $\geq 0.5 \mu\text{g} / \text{L}$
-  *Not Detected*



North End

Figure 8

2001



- $\geq 2.0 \text{ ug / L}$
- $\geq 1.0 \text{ ug / L}$
- $> 0.5 \text{ ug / L}$
- Not Detect*



North End

Figure 9

2003

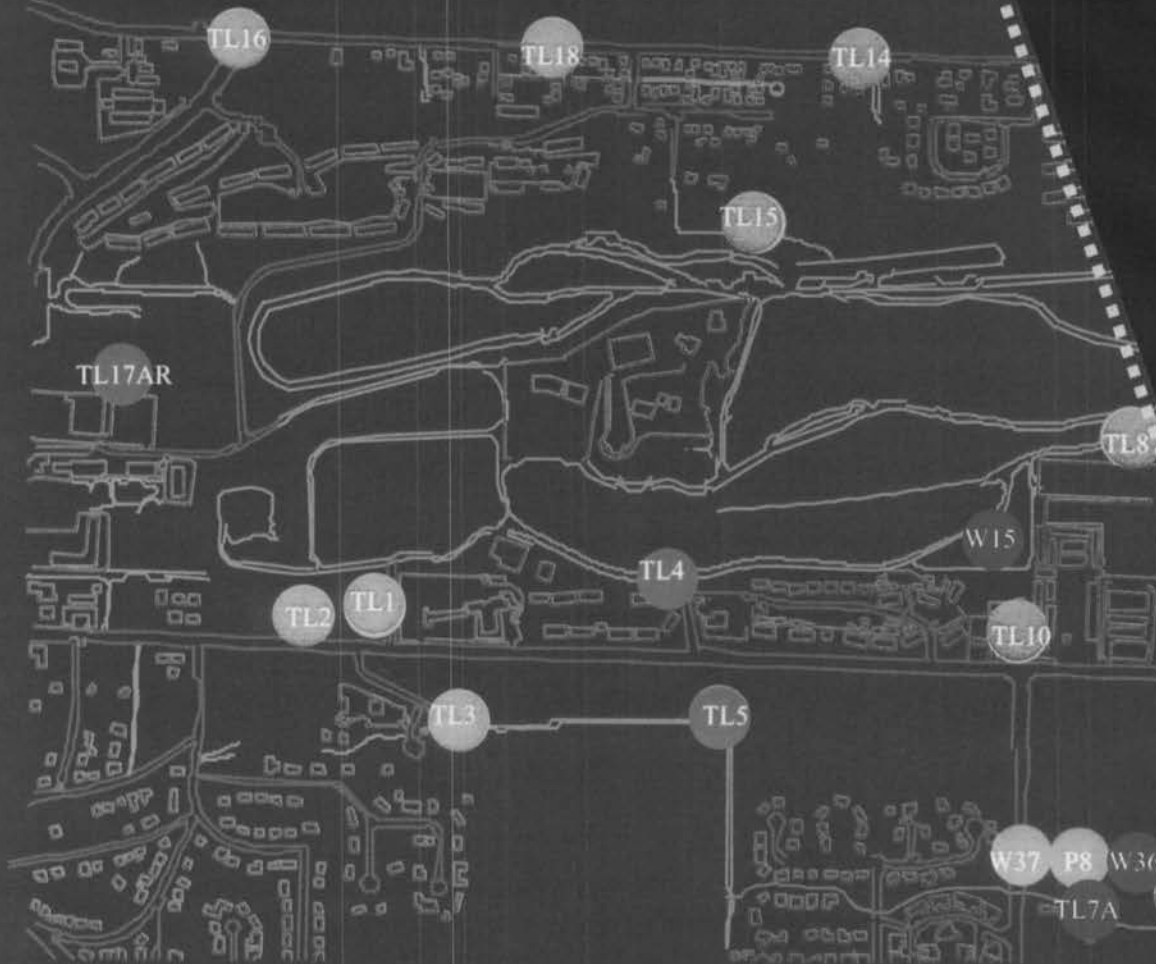


○ $\geq 2.0 \text{ ug / L}$

○ $\geq 1.0 \text{ ug / L}$

○ $> 0.5 \text{ ug / L}$

○ *Not Detect*



North End

Figure 10

*South
End*

1999





-  $\geq 2.0 \mu\text{g} / \text{L}$
-  $\geq 1.0 \mu\text{g} / \text{L}$
-  $\geq 0.5 \mu\text{g} / \text{L}$
-  *Not Detect*



Figure 11

*South
End*

2001

- $\geq 2.0 \mu\text{g} / \text{L}$
- $\geq 1.0 \mu\text{g} / \text{L}$
- $\geq 0.5 \mu\text{g} / \text{L}$
- *Not Detect*

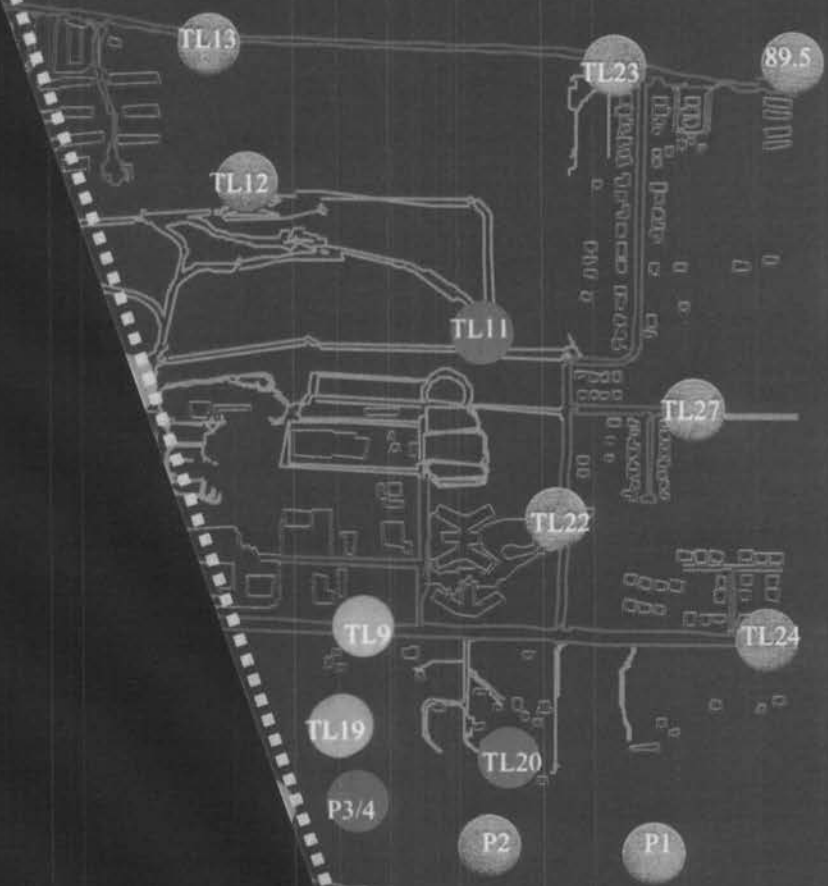


Figure 12

*South
End*

2003





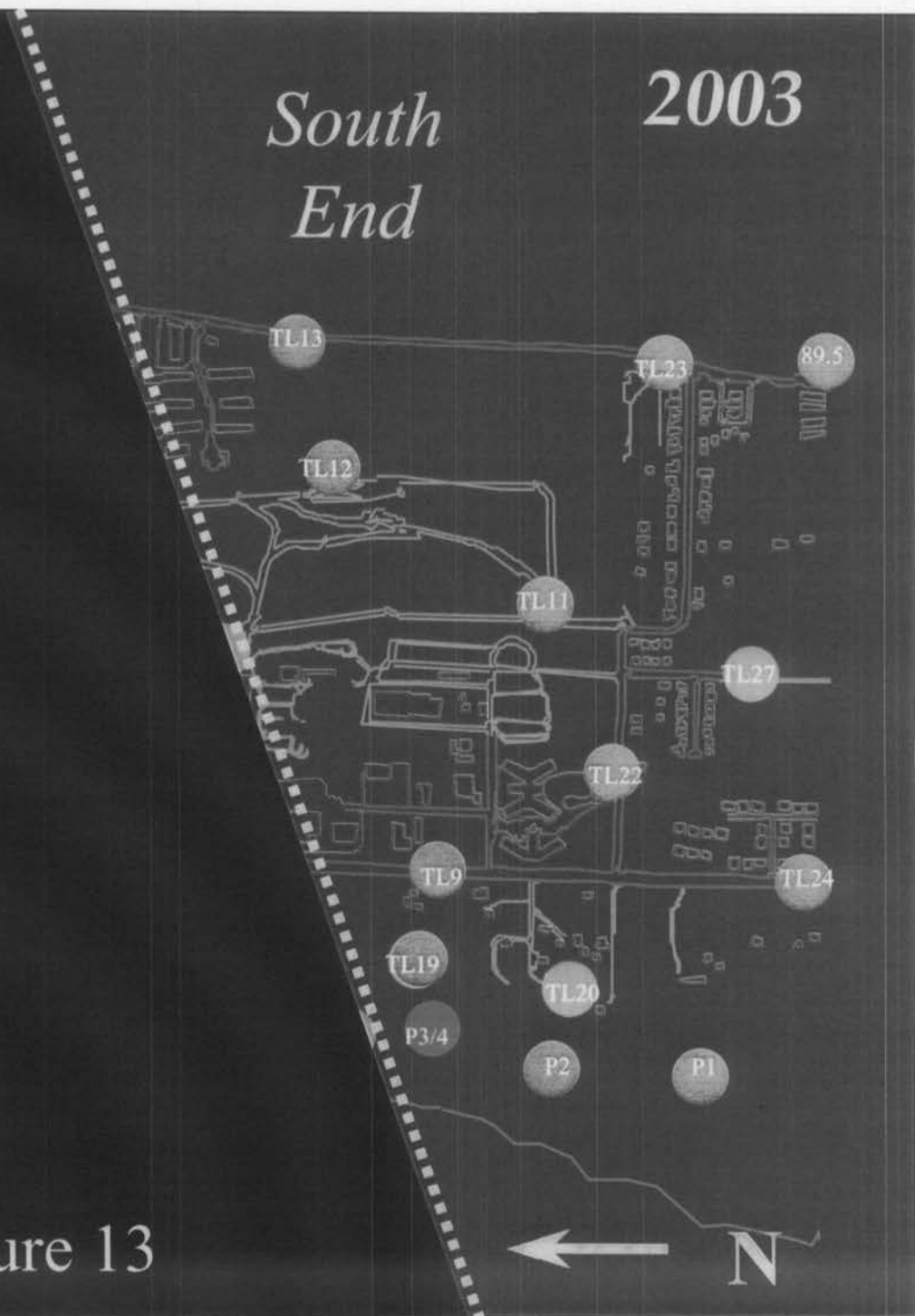
-  $\geq 2.0 \mu\text{g} / \text{L}$
-  $\geq 1.0 \mu\text{g} / \text{L}$
-  $\geq 0.5 \mu\text{g} / \text{L}$
-  *Not Detect*

Figure 13



The hydraulic conductivity value for each well was based on saturated aquifer sediment (e.g. sand, gravel) thicknesses in each well. The sediment hydraulic conductivity values reported in the Remedial Investigation Report (1987) were used.

Transmissivity was calculated with the saturated aquifer thickness and hydraulic conductivity. Extraction well production rates were recorded daily. An average 0.002 hydraulic gradient was determined using multiple year observations.

The equations, production rates, and hydrogeologic parameters were entered into an EXCEL spreadsheet to calculate five coordinate points for each well. These points represent the downstream distance to stagnation point at center point of capture zone, distance between dividing streamlines at well line, and distance between dividing streamlines far upstream from the wells. A capture zone curve for each well was generated with these points using AUTOCAD 2002. The capture zone curve axis is parallel to the regional flow gradient so the capture zone curves were overlain onto the fourth quarter 2003 groundwater flow contour map (Figure 14).

The overlapping capture zones indicated the POC wells continue to maintain effective plume capture.

4.3.2.2 Vertical Capture

The downgradient B and C Completion monitoring wells were installed in the upper and lower Older Gravel (Qog) respectively. These wells are below the A Completion wells in the hydraulically connected Colvos Sand and so monitor vertical plume capture.

The B and C Completion monitoring well analytical results reported since the first five-year closure extension were graphed to determine whether effective vertical capture was being maintained. Graphs were constructed for monitoring wells that reported values greater than the analytical quantification limit (0.5µg/L). The graphs show contaminant concentration trends over time (Figure 15 to 23).

B Completion Monitoring Wells





Groundwater performance criteria were not exceeded for any compound in any B Completion monitoring well during the past five-year monitoring period.

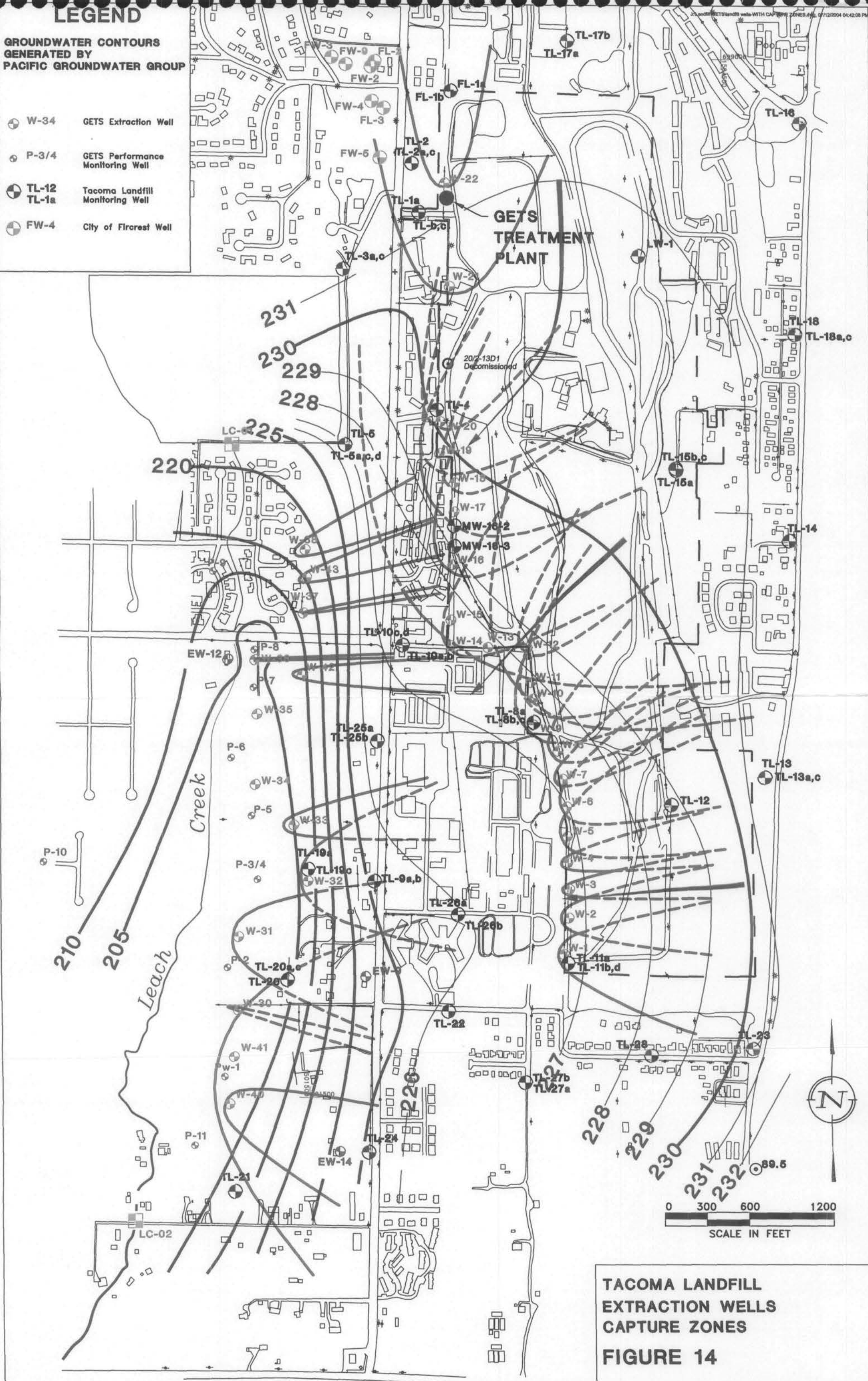
Early Warning Value Exceedances (EWV) follows:

- 1,1-dichloroethane has not exceeded the early warning value in any B Completion well since third quarter 2001 (Figure 15).
- 1,2-Dichloroethane exceeded the early warning value in TL-09B and TL-26B. Regression analysis indicated concentrations continued to decrease in both wells (Figure 16).
- No EWV exceedances were reported for 1,2-dichloroethenes, total (Figure 17).
- Trichloroethene slightly exceeded the EWV in TL-11B during third and fourth quarters 2003. Current and long-term trends indicated continued concentration decrease (Figure 18).

LEGEND

GROUNDWATER CONTOURS
GENERATED BY
PACIFIC GROUNDWATER GROUP

-  W-34 GETS Extraction Well
-  P-3/4 GETS Performance Monitoring Well
-  TL-12 TL-1a Tacoma Landfill Monitoring Well
-  FW-4 City of Fircrest Well



TACOMA LANDFILL
EXTRACTION WELLS
CAPTURE ZONES
FIGURE 14

Figure 15 - Tacoma Landfill Monitoring Wells
B Completions

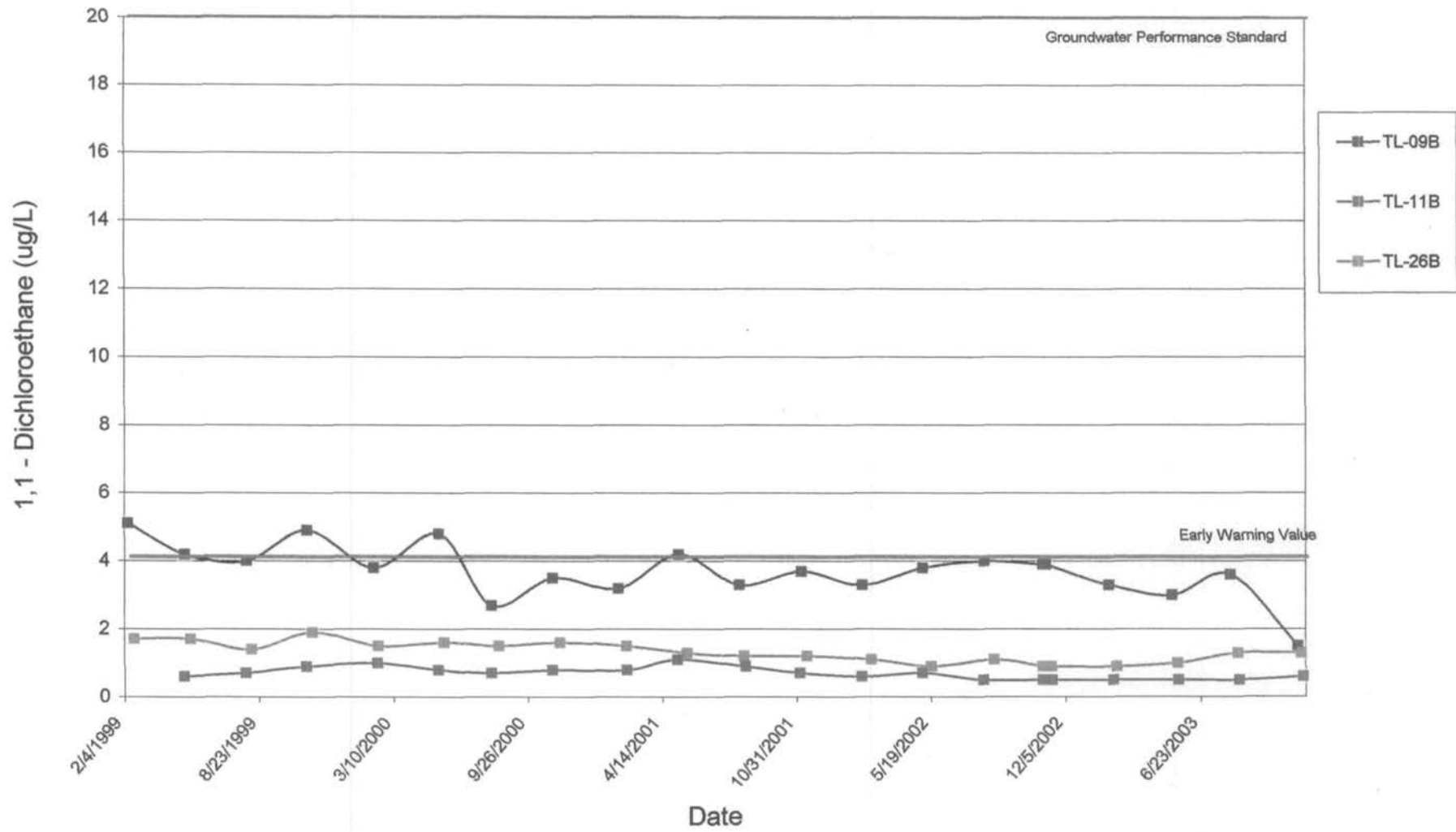


Figure 16 - Tacoma Landfill Monitoring Wells
B Completion

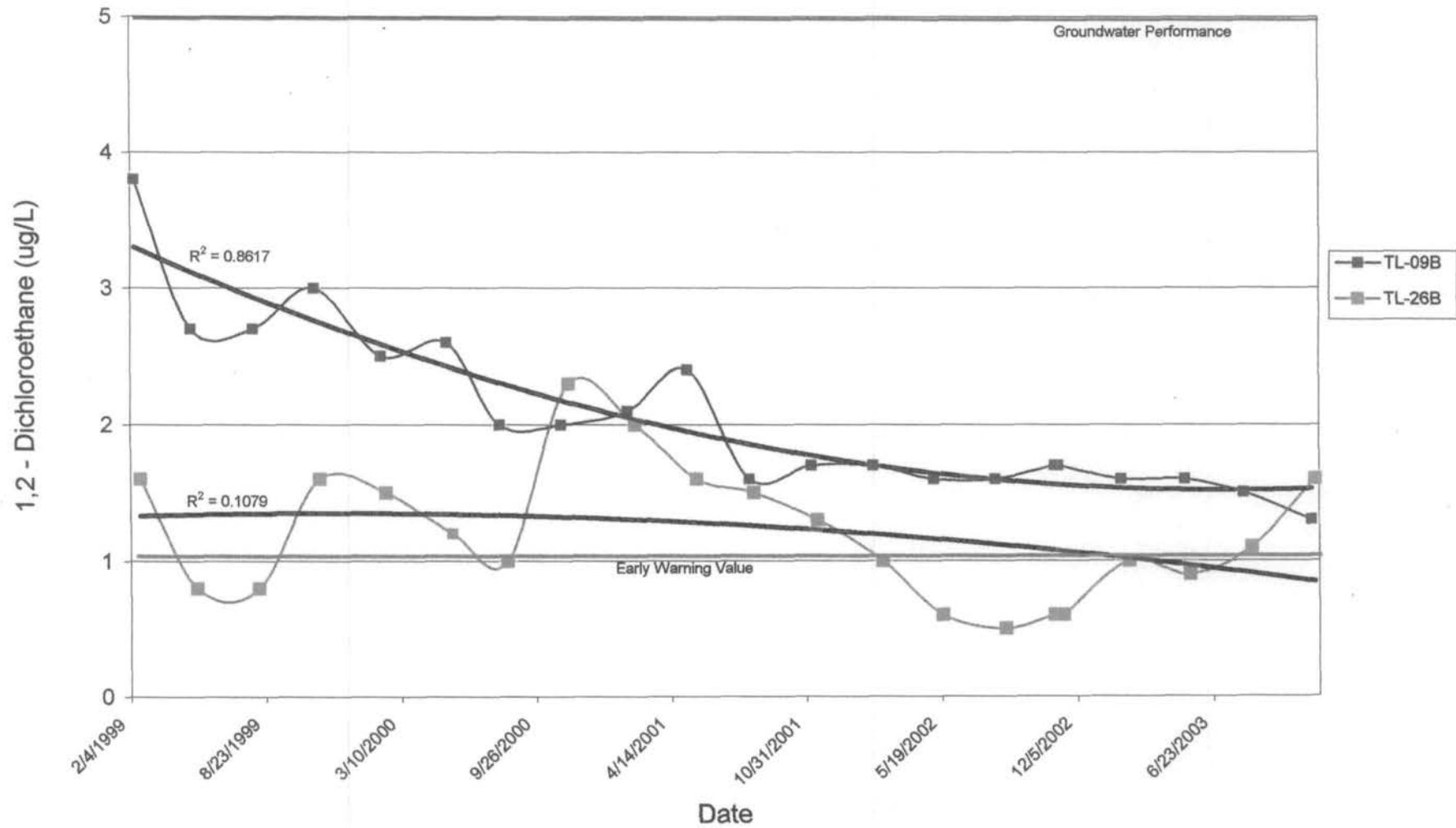


Figure 17 - Tacoma Landfill Monitoring Wells
B Completion

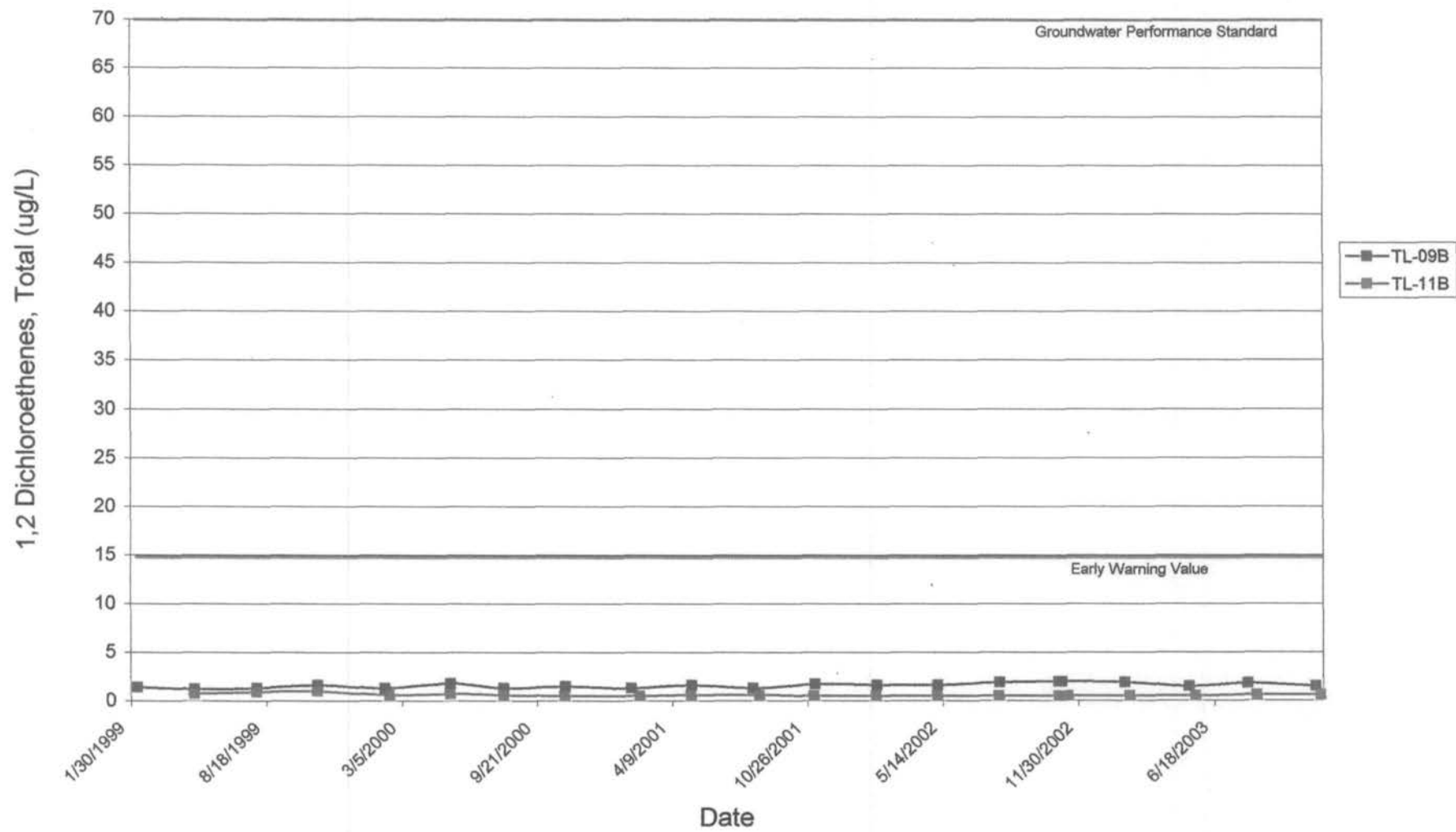


Figure 18 - Tacoma Landfill Monitoring Well
B Completion

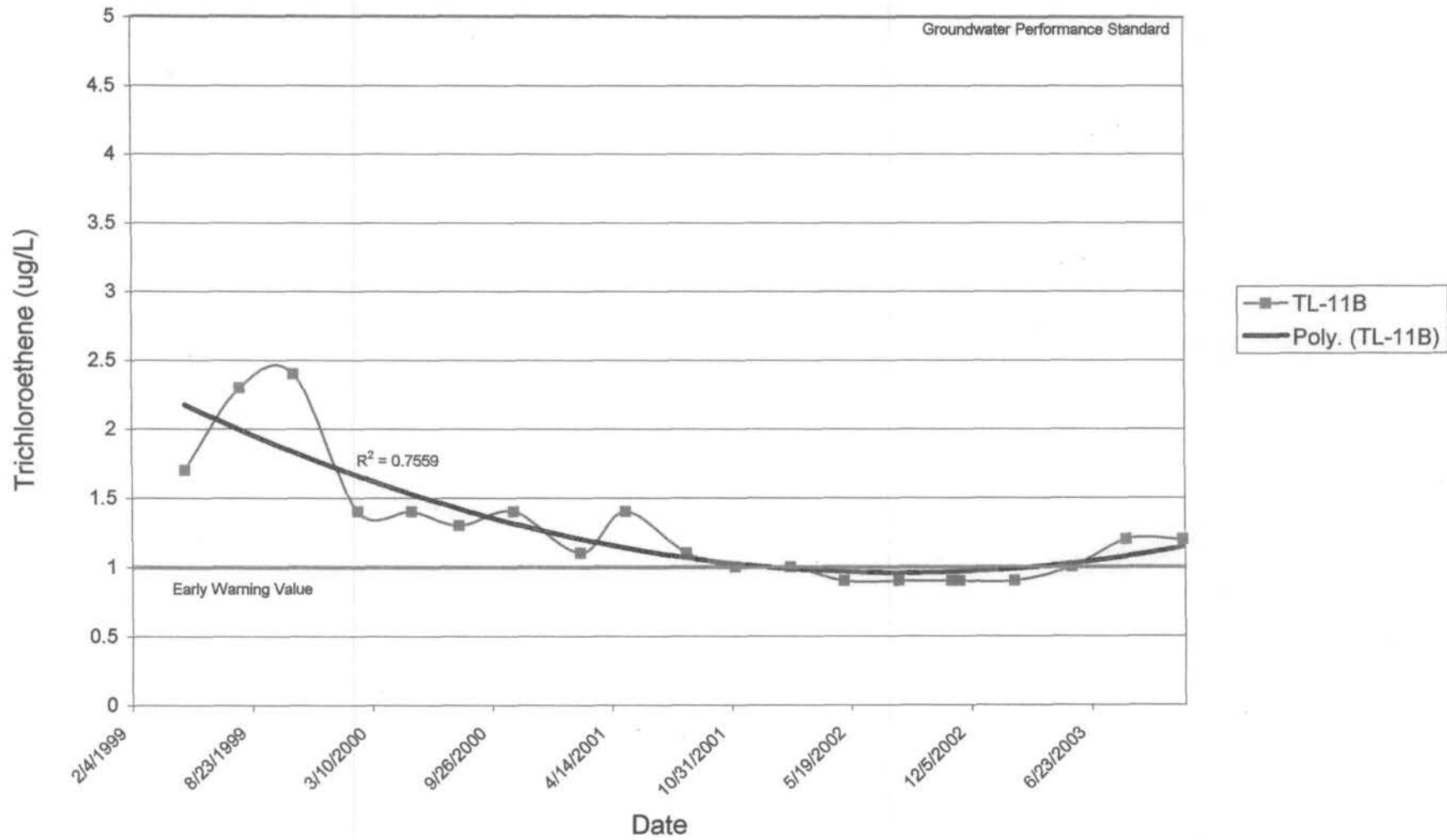


Figure 19 - Tacoma Landfill Monitoring Wells
B Completion

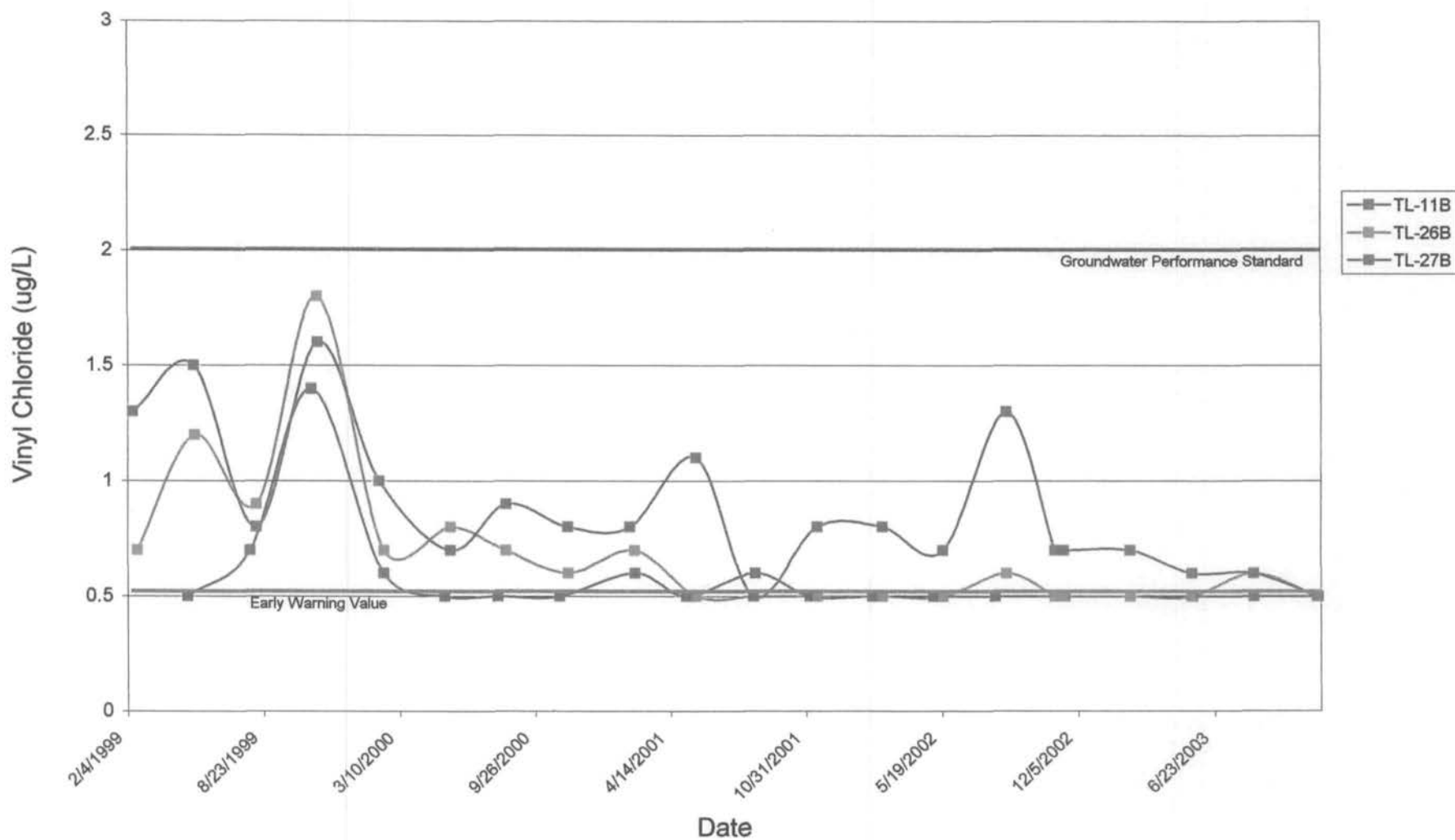
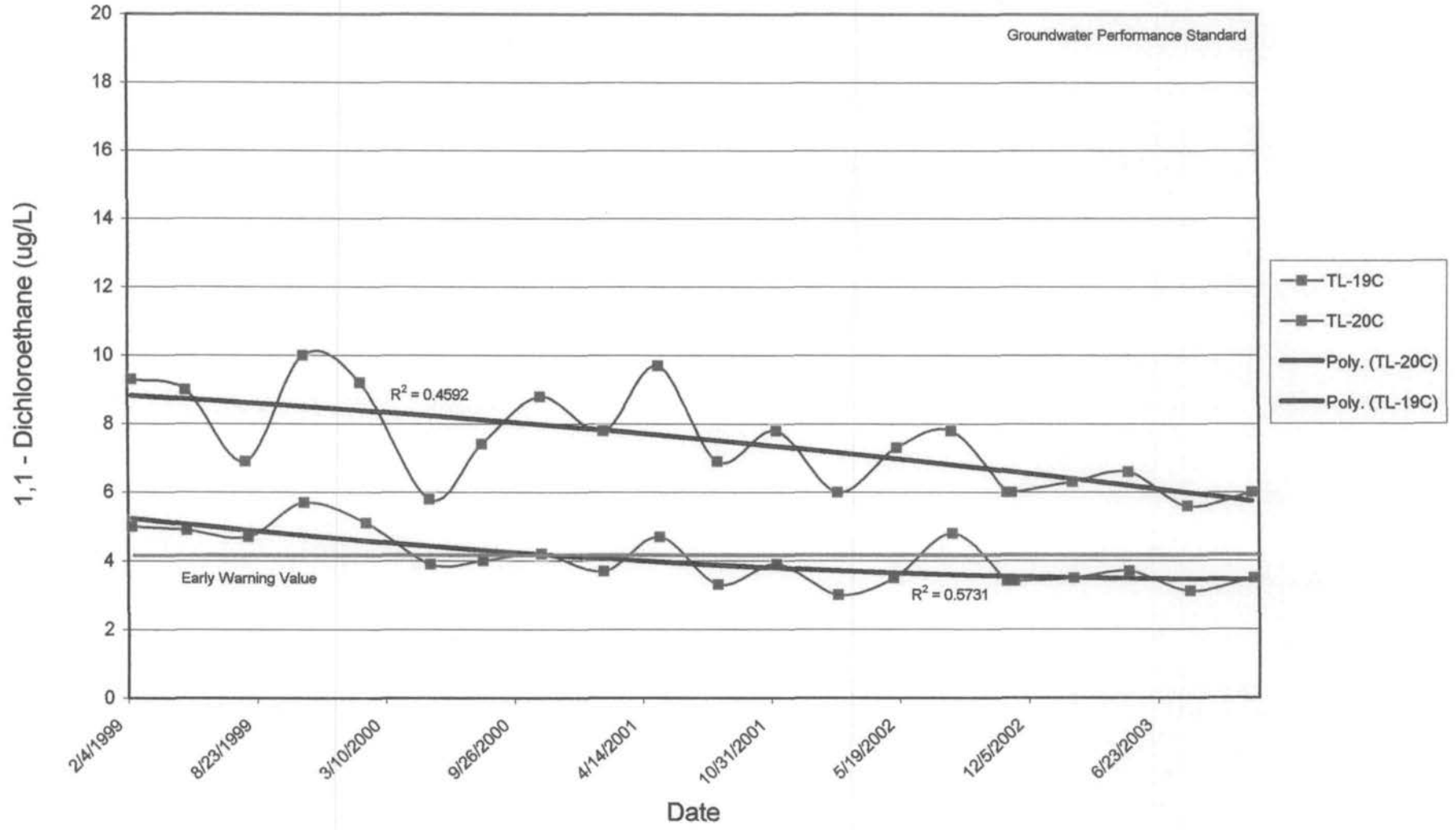


Figure 20 - Tacoma Landfill Monitoring Wells
C Completions



- No vinyl chloride EWV exceedances reported during fourth quarter 2003. Concentrations continue to decrease over time (Figure 19).

C Completion Monitoring Wells

Groundwater performance criteria were not exceeded for any compound in any C Completion monitoring well during the past two and one half years of the monitoring period.

Early Warning Value Exceedances (EWV) follows:

- 1,1-dichloroethane exceeded the EWV in monitoring wells TL-19 and TL-20C (Figure 20). TL-19C has not exceeded the EWV since fourth quarter 2001. Regression analyses indicated concentrations continue to decrease in both wells over time.
- 1,2-Dichloroethane exceeded the early warning value in TL-19 and TL-20C. TL-19 has not exceeded the EWV since third quarter 2000. Concentrations continued to decrease in TL-19 (Figure 21). And regression analysis indicated concentrations stopped increasing in TL-20C during second quarter 2003.
- No EWV exceedances were reported for 1,2-dichloroethenes, total (Figure 22).
- Vinyl chloride concentrations in TL-05 and TL-20 exceeded the EWV during 2003 (Figure 22). Vinyl chloride concentrations in TL-10 exceeded the EWV. TL-10C has not exceeded the EWV since third quarter 2001. Regression analyses indicated continued concentration decrease over time.

Groundwater Performance Standard Exceedances for vinyl chloride follow:

- Vinyl chloride concentrations rapidly decreased in TL-05C and TL-20C since fourth quarter 1999. Vinyl chloride concentrations have not exceeded the GPS since third quarter 2001, and continue to decrease (Figure 23).

4.4 Second Consent Decree Requirement Satisfied

The groundwater monitoring analytical data indicated an order of magnitude decrease in vinyl chloride concentrations since the first five-year closure extension request. Low contaminant concentrations detected in downgradient wells indicated leakage within design parameters that did not significantly slow timely plume shrinkage. The results indicated groundwater performance standards are being achieved.

The POC system effectively prevents downgradient contamination movement. The EOP wells have effectively remediated the offsite plume. And we anticipate the EOP wells will achieve off site cleanup before 2010.

The City is committed to operating the groundwater extraction treatment system until the drinking water standards for the COCs are restored.

Figure 21 - Tacoma Landfill Monitoring Wells
C Completions

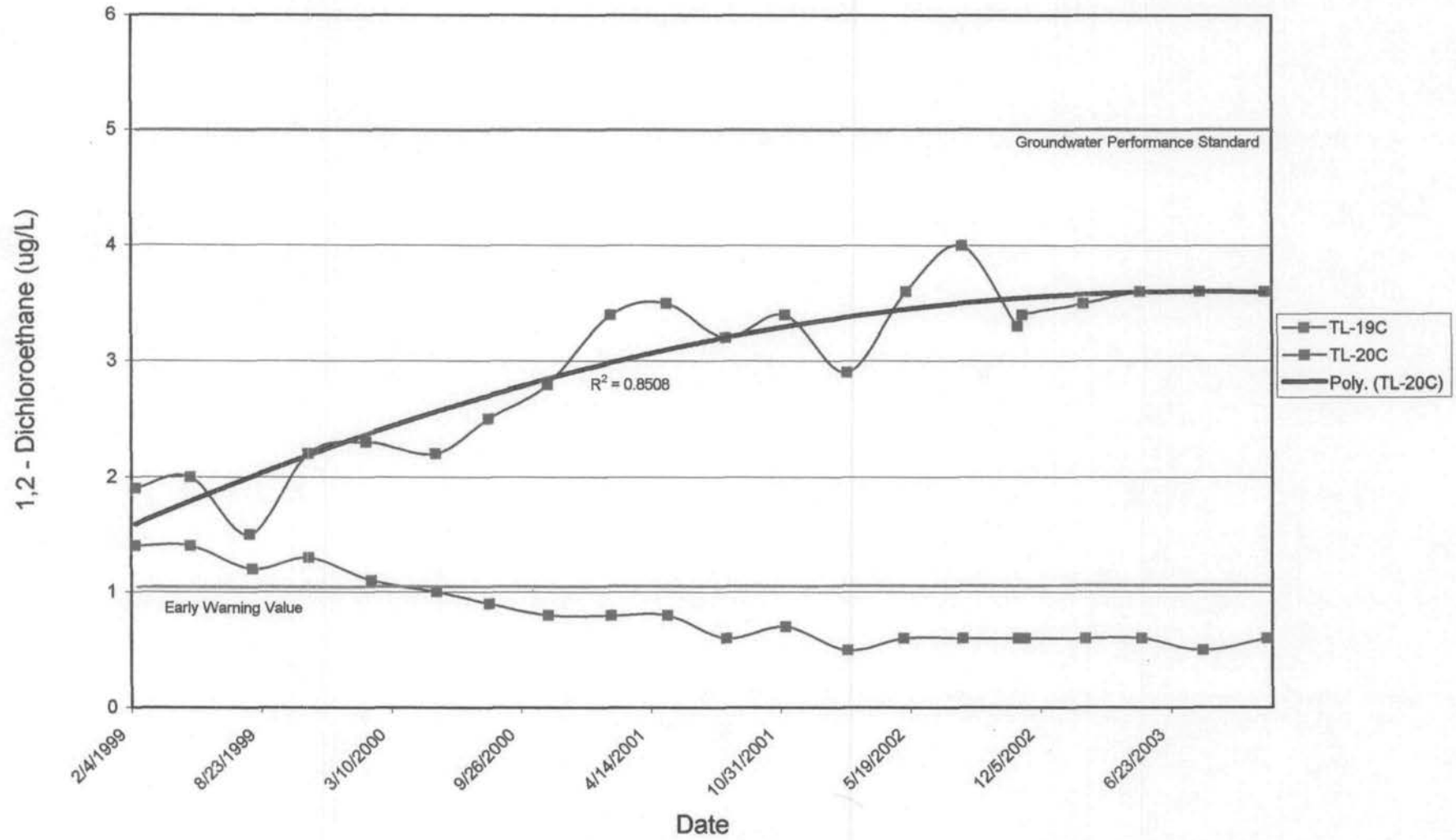


Figure 22 - Tacoma Landfill Monitoring Wells
C Completions

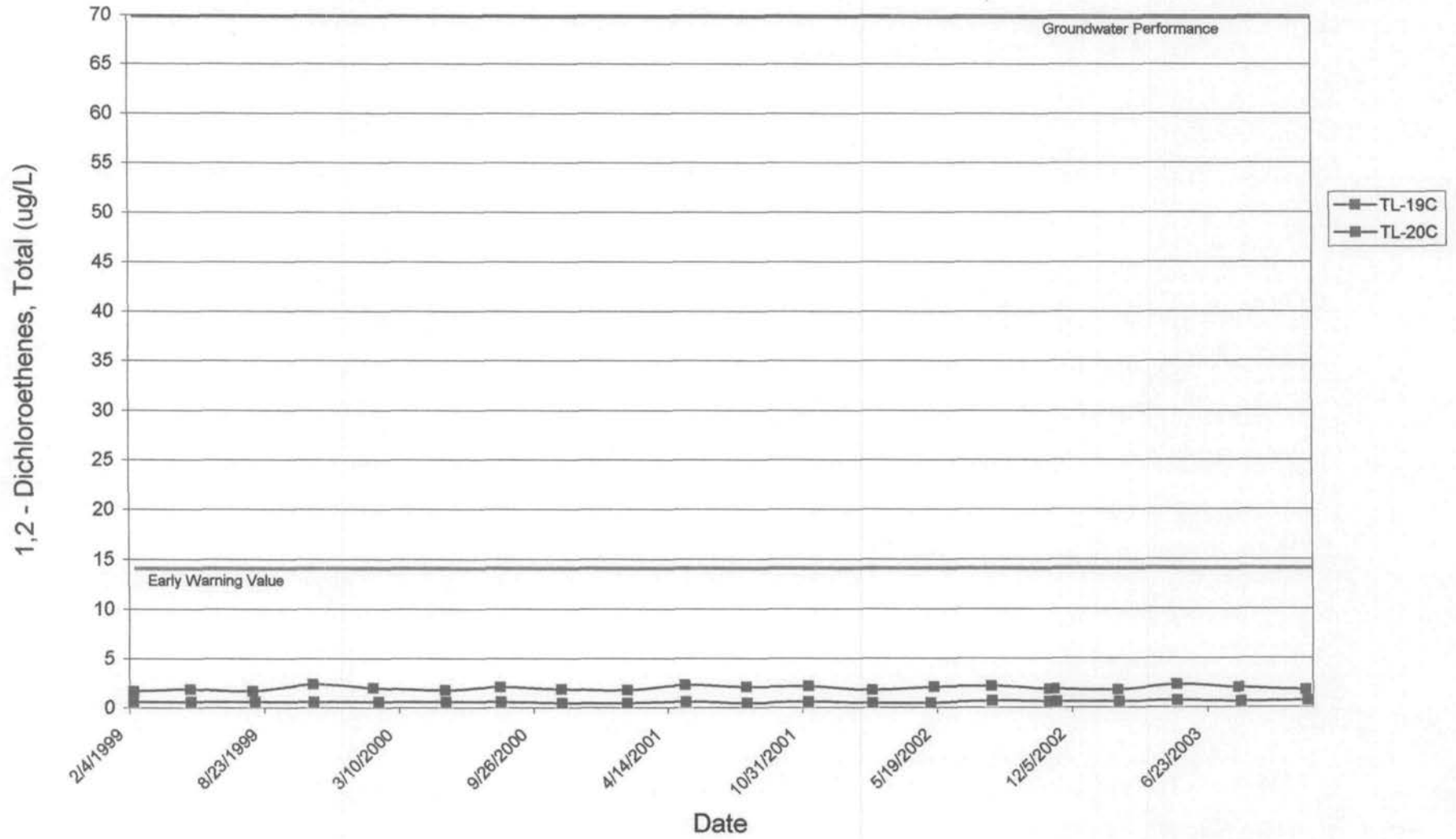
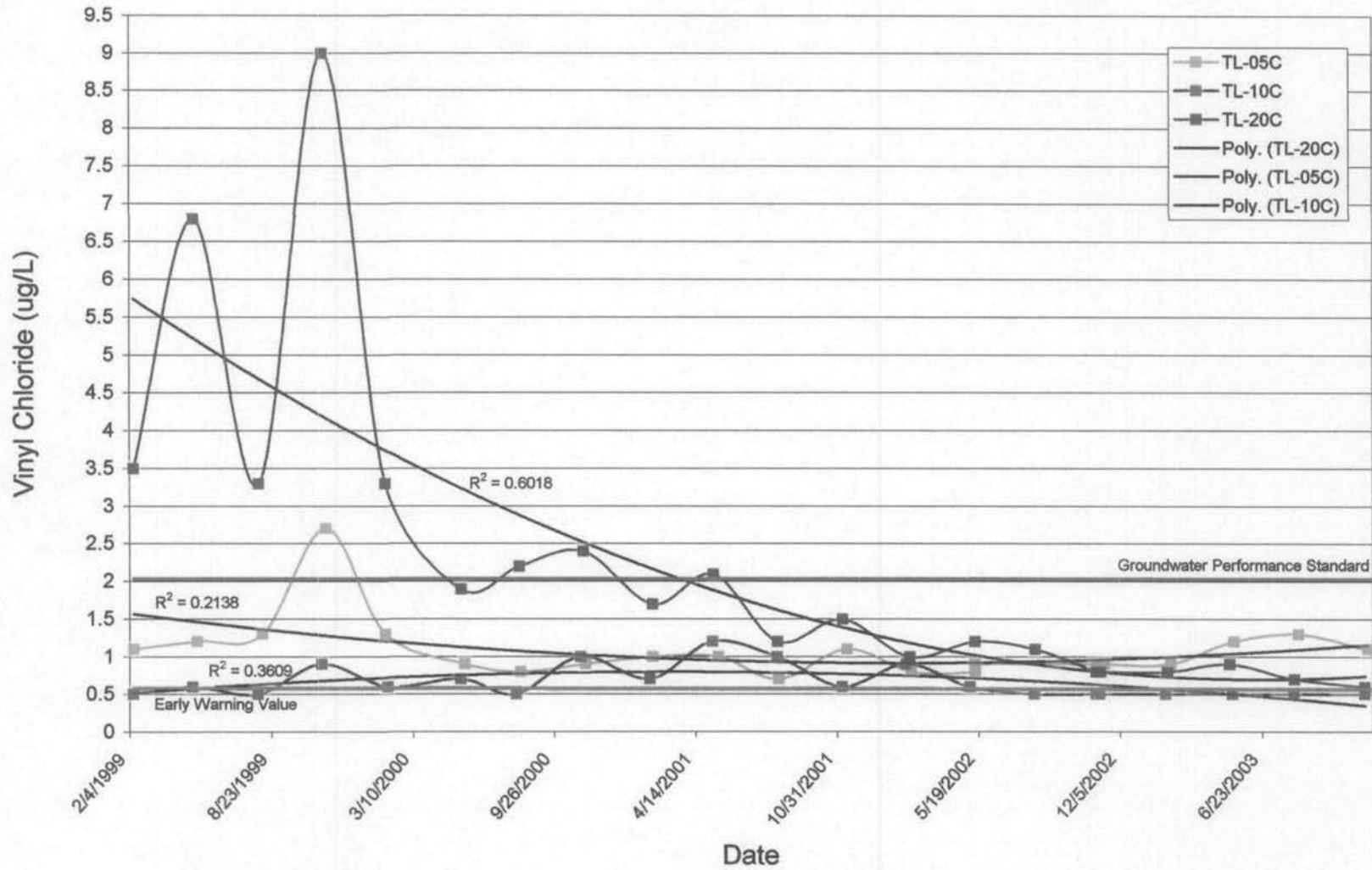


Figure 23 - Tacoma Landfill Monitoring Wells
C Completions



Regression analyses indicated concentrations continue to decrease in both wells over time.

- 1,2-Dichloroethane exceeded the early warning value in TL-19 and TL-20C. TL-19 has not exceeded the EWW since third quarter 2000. Concentrations continued to decrease in TL-19 (Figure 21). And regression analysis indicated concentrations stopped increasing in TL-20C during second quarter 2003.
- No EWW exceedances were reported for 1,2-dichloroethenes, total (Figure 22).
- Vinyl chloride concentrations in TL-05 and TL-20 exceeded the EWW during 2003 (Figure 22). Vinyl chloride concentrations in TL-10 exceeded the EWW. TL-10C has not exceeded the EWW since third quarter 2001. Regression analyses indicated continued concentration decrease over time.

Groundwater Performance Standard Exceedances for vinyl chloride follow:

- Vinyl chloride concentrations rapidly decreased in TL-05C and TL-20C since fourth quarter 1999. Vinyl chloride concentrations have not exceeded the GPS since third quarter 2001, and continue to decrease (Figure 23).

4.4 Second Consent Decree Requirement Satisfied

The groundwater monitoring analytical data indicated an order of magnitude decrease in vinyl chloride concentrations since the first five-year closure extension request. Low contaminant concentrations detected in downgradient wells indicated leakage within design parameters that did not significantly slow timely plume shrinkage. The results indicated groundwater performance standards are being achieved.

The POC system effectively prevents downgradient contamination movement. The EOP wells have effectively remediated the offsite plume. And we anticipate the EOP wells will achieve off site cleanup before 2010.

The City is committed to operating the groundwater extraction treatment system until the drinking water standards for the COCs are restored.

5.0 Third Consent Decree Requirement

" that since the effective date of the Consent Decree, the Settling Defendant has instituted and is operating an aggressive solid waste recycling and hazardous materials collection program "

This section will discuss the programs Tacoma implemented to ensure compliance with the third consent decree requirement. This document will also provide a brief narrative on the rationale Tacoma used to reach the conclusion that the third Consent Decree has been met.

The third Consent Decree requirement does not provide set numerical goals that have to be met or specific programmatic requirements. This makes determination of compliance with this goal subjective. Some specifics can be gained from the goal as stated. First, the third Consent Decree requirement focuses on collection programs. Second, the condition requires implementation and operation of the programs, and not the attainment of numerical goals.

5.1 Tacoma Recycling Programs

Since 1988, Solid Waste Management has been implementing innovative and aggressive programs to collect and process recyclable material. The following table summarizes Tacoma Recycling Programs, listed with the year of implementation and the materials currently being collected or banned from disposal. Further descriptions of the service provided and quantities of materials collected are included in this section.

Program	Material Type	Year Implemented
New Materials Collected at Landfill Recycling Center	Used Furniture	2004
New Materials Diverted at Landfill Recycling Center	Packing Peanuts	2003
New Material banned from disposal by Commercial Generators		2003
New Materials Diverted at Landfill Recycling Center	Computer CPU's	2003
New Materials added to Landfill Recycling Center	Used Household Goods, Clothing and Used Building Materials	2002
Commingled Residential/Multifamily/School and Small Business Curbside Collection Implemented City-wide	Aluminum & Tin Cans Container Glass Magazines Newspaper/Phone Books Empty Aerosol Cans Household Batteries Mixed Waste Paper #1, #2 Plastic Bottles Corrugated Cardboard	1997
Commingled Residential Curbside Collection -	Aluminum & Tin Cans Container Glass	1996

Pilot Program	Magazines Newspaper/Phone Books Empty Aerosol Cans Household Batteries Mixed Waste Paper #1, #2 Plastic Bottles Corrugated Cardboard	
Produce Waste Collection/Recycling	Produce Waste	1991
Waste Watchers (Schools)	Cardboard File Stock Grade Paper	1991
Source Separated Residential Curbside Collection	Aluminum & Tin Cans Container Glass Magazines Newspaper/Phone Books Empty Aerosol Cans Household Batteries	1990
Curbside Yard waste Collection	Non Commercial Yard Waste	1990
Source Separated Multi-Family Curbside Collection	Same as residential Curbside Collection, except Batteries and Magazines are not part of this service	1990
School Recycling (TRASH) - Community Drop-Off Program	Aluminum Newspaper	1988
Waste Oil Collection	Waste Oil from Do-it-yours	1988
Landfill Recycling Center	Aluminum & Steel Cans Empty Aerosol Cans ferrous scrap metal Container Glass #1 & # 2 Plastic Magazines & Catalogs Newspaper Telephone Books Mixed Waste Paper Waste Oil	1988
Landfill Receiving Area	Ferrous Scrap Metal Non Ferrous Scrap Metal Appliances Polyurethane Foam Tires Yard Waste (self haul)	1986

5.1.1 Residential Curbside Collection of Recyclables

The City of Tacoma Solid Waste Utility collects recyclable materials from its residential customers at the curb. Participation in the curbside recycling program is voluntary. Tacoma's residential curbside recycling program collects recyclable material from households ranging from single family to four-plexes, and is based on a commingled collection system for all materials with the exception of glass and household batteries which

are placed in a separate container. In 2003, 40,220 customers were signed on to Tacoma's curbside program, 77% of Tacoma's 52,000 single-family customers. Residents recycled 16,288 tons of material in 2003 through the curbside recycling program, a 433% increase over the last report in 1995.

For each participating customer, the City provides every other-week pickup of plastic containers and film, polycoated paperboard, mixed papers, cardboard, aluminum, steel (tin) and aerosol cans, glass containers, magazines and catalogs, newspaper, phone books and household batteries. Participants commingle everything but the glass and batteries into one large container. Recyclable materials collected at the curb are taken to a private business where they are manually sorted into individual components and marketed.

5.1.2 Curbside Collection of Yard Waste

Tacoma provides curbside yard waste service collection for residential customers. City yard waste collection trucks collect yard waste from participating customers at the curb every other week. Participation is voluntary. Pickups are made on the same day as curbside recycling collection, which also coincides with normal garbage collection. In 2003, Tacoma collected 17,696 tons of yard waste through the curbside collection program more than double the amount reported in the last report. In 2001-02, the City purchased and distributed over 30,000, 96-gallon yard waste containers that allowed customers to recycle more yard waste with less effort. The yard waste brought in by Tacoma curbside collection vehicles or self-haul customers is consolidated into transfer trailers and trucked to an area composting company where it is ground, composted with other organic waste and marketed as a soil amendment.

5.1.3 Multi-Family Curbside Recycling

Curbside collection of recyclable material is also provided for multi-family residential complexes in Tacoma. Duplexes, tri-plexes and four-plexes in Tacoma have received residential curbside recycling service since the inception of the program in 1990 and were transitioned to the commingled program when it went Citywide in 1997. Approximately 162 larger complexes recycle via a source-separated system that utilizes three, 60-gallon containers and two, 90-gallon containers. The 60-gallon containers collect three colors of glass-clear, brown and green and the 90-gallon containers collect newspaper and tin cans. In 2002-03, the City piloted a commingled recycling program for larger complexes. The pilot showed that commingled recycling would work for larger complexes if the management and maintenance staff were willing to follow up with tenants who don't cooperate. The program will require a large investment in equipment and labor to make recycling available to all Tacoma apartment residents. Tonnages collected from multi-family buildings are included in one of two areas, commingled recycling or commercial recycling.

5.1.4 Commercial Customer Curbside Recycling

Tacoma collects recyclable materials from commercial customers at the curb. Small businesses and schools participate in the same commingled program as our residential customers. Businesses that generate large quantities of glass and containers, such as restaurants and taverns, are served by our source separated five-bin system described in the section above. Businesses that generate large amounts of cardboard are served by our cardboard recycling program. This service is provided to customers on a voluntary basis. In 2003, 1,006 tons of material were collected in our commercial curbside programs; a 126

percent increase from the 445 tons collected in 1994. These results do not include the small commercial accounts collected by residential curbside collection vehicles nor do they include the businesses that receive recycling services provided by several private recycling companies in the Tacoma area.

5.1.5 City of Tacoma in-house Desk Recycling

The City of Tacoma collects commingled recyclables from containers placed at City employees' desks at most City facilities. Solid Waste is planning a comprehensive in-house recycling program to be implemented Citywide by the end of 2005. The volume of these materials is mixed in with the residential commingled tonnages. We estimate that over 90% of City facilities are able to recycle and that a large majority of City employees participate in the recycling program.

5.1.6 Produce Waste Recycling

The City of Tacoma began collecting produce waste from commercial customers in 1991. Produce waste was selected because the yard waste-composting program was already in operation and produce waste was identified as a compostable portion of the waste stream that can be diverted from the landfill. This program is currently offered to grocery stores, florists and certain restaurants that agree to separate plant waste from animal/seafood waste. Collection of produce waste is made twice per week in the cold months and three times per week in the warm months using semi automated collection equipment. In 1995, 398 tons of commercial produce waste was recycled as a result of this program, while 486 tons of produce waste were recycled in 1996. In 2003, 810 tons of produce waste was recycled from 32 businesses.

5.1.7 School Recycling Program

Currently the majority of Tacoma Public Schools recycle the same mix of materials as the single-family residents with the same commingled containers. Schools also recycle cardboard in separate containers. In 2004, the City and the schools will partner to test a milk carton recycling program and to implement a green schools program. The volume of commingled recycling collected at the schools is included in the residential tonnage.

In addition to the commingled recycling, 14 schools have separate community cardboard collection containers and eight have separate newspaper collection containers. These containers collected 176 tons of cardboard and 71 tons of newspaper in 2003.

In 1996, 214 tons of recyclable material was collected as a result of this program.

The EnviroChallenger Program was started in the summer of 2000 to teach Tacoma's children how they can help keep the Puget Sound environment healthy. The EnviroChallenger goes to Tacoma's public and private schools and teaches hands-on, environmental science lessons to kindergarten through fifth grade students. Students learn how their actions can affect the environment, how to identify healthy habitats, how to recognize the factors that harm the Puget Sound environment and what actions they can take to maintain the health of our local waterways. This project helps prevent future stormwater problems, reduces toxic discharges into Puget Sound, increases recycling and reduces the amount and toxicity of waste generated in Tacoma. The City of Tacoma's Public Works/Environmental Services Department sponsors the program.

Tacoma's EnviroChallenger Program targets a culturally diverse student population. Tacoma's minority population within the Tacoma Public Schools is 41%, with African American—20%, Asian—12%, Native American—2%, and Hispanic—7%. The EnviroChallenger project is expected to travel to two classrooms per day, teaching two lessons to kindergarten through fifth grade classes, within seven topic areas. All of Tacoma's 36 elementary schools, up to 12 private schools as well as home school organizations are targeted for EnviroChallenger visits.

A secondary audience is the general community, particularly parents, guardians and grandparents of public and private school elementary children that will join their children in environmental learning.

Since its inception in 2000, the EnviroChallenger educators have booked or delivered programs to 45 schools in Tacoma, logging 2,244 in class lessons, which represents 51,612 opportunities to get waste reduction and conservation messages to K-5 students and their parents.

Due to program popularity, the City of Tacoma added a second educator and van in May of 2003. The program has a goal of delivering 900 lessons during the 2003 – 2004 school year.

5.1.8 Waste Oil Recycling Program

Tacoma collects and recycles used motor oil at convenient locations throughout the City. Waste oil has been collected at the landfill since 1988. The Solid Waste Management Division is now promoting used oil recycling at collection tanks established at four Schuck's Auto Supply stores within the City. Residents are urged to bring waste oil from automobiles, motorcycles, boats and lawn movers to the tanks, as long as the oil is not mixed with other substances. (Used oil from Tacoma Maintenance operations is also collected at various City of Tacoma Fleet Maintenance Shops, Tacoma Belt Line, the Police garage and Public Utility maintenance shops.) The oil from this collection program is reprocessed for use as a fuel.

In 1994, Tacoma recycled over 100,000 gallons of waste oil as result of this program. Since 1994, Tacoma has collected an average of 88,582 gallons per year with a decreasing trend over the years. In 2003, the waste oil collected decreased to 75,450 gallons. The decrease in waste oil collected is likely due to the increased number of private collections sites available and a decrease in do-it-yourself oil changers. Used motor oil was targeted because of its potential to contaminate groundwater and the Puget Sound ecosystem, and because of the high volume of this waste.

5.1.9 Miscellaneous Recycling and Waste Reduction Programs

Tacoma also sponsors or participates in other programs that stress waste reduction, recycling or environmental stewardship. A brief summary of those programs is provided here.

- Since its inception, the City of Tacoma has participated in the region wide grass cycling and green gardening program. This program provides low cost electric mulching mowers at a reduced price, with the City providing additional rebates as an incentive to purchase. The electric mulching mowers reduce the amount of solid

- waste and air pollution generated when compared to normal grass cutting with gasoline mowers. As part of the promotion, the City recycles gasoline mowers to remove the mowers from use.
- Participated with a regional effort and the Department of Ecology to sponsor 2Good2Toss, which is an online exchange that encourages the reuse of usable materials. This popular program has helped facilitate the transfer of usable materials region wide.
 - Green building promotion - The City of Tacoma has actively participated in the various green building programs. The Solid Waste Division has sponsored a workshop on the topic for local government employees and contractors. The Solid Waste Division has also worked with the Master Builders Association to foster a program for implementation through that group.
 - The City of Tacoma has been an active participant in the electronics product stewardship issues, and is now a participant in the Northwest Product Stewardship Council steering committee.

5.2 Tacoma Landfill and Recycling Center Programs

Several recyclable materials are identified at the Tacoma Landfill scale-house by landfill workers. These materials are separated for recycling at the landfill receiving area. Self-haul customers are directed to specific bays to unload the following recyclable material: Computer cpu's, scrap metal, white goods (appliances), tires, and yard waste. Nurseries and landscaping businesses are the primary customers self-hauling yard waste to the landfill. All yard waste self-haul customers are directed to dump their loads into transfer trailers bound for local composting companies. In 2003, 39,000 tons of yard waste was diverted at the landfill. In 1995, 989 tons of scrap metal and appliances and 4,750 tons of yard waste were collected for recycling at the landfill receiving area. Scrap metal and self haul yard waste tonnages increased to 1,250 and 6,729 tons respectively in 1996.

The Recycling Center, also located at the Tacoma Landfill, collects aluminum cans, steel (tin) cans, aerosol cans, scrap metal, tin foil, glass containers, #1 PET plastic, #2 HDPE natural and colored, glossy magazines/catalogs, newspaper, cardboard, phone books and mixed waste paper. In 2001, at the same time that we expanded the curbside recycling program, we added 3-7 plastics, polycoated paperboard and plastic film to the items collected at the Center. In 2003, we partnered with the local Goodwill to collect used household goods and clothing and used building materials. The building materials go to a company called ReHarvest which trains disadvantaged workers in deconstruction and warehouse/retail skills. In 2004, we added packing peanuts and clothes hangers to the list of materials collected at the center. The Recycling Center is open to the general public and commercial businesses seven days a week from 8 AM - 6 PM. In 2003, 2,135 tons of material were diverted at the center. In 1995, 1,723 tons of material was collected for recycling at Tacoma's Recycling Center. Tonnages decreased in 1996 to 1,627 tons, possibly due to the implementation of the curbside recycling pilot program.

5.3 Promotion of Recycling Services

The City of Tacoma utilizes many different avenues to promote its programs, with a heavy reliance on direct mail advertising.

Some of the specific efforts include the following.

- A yearly mailing of a recycling brochure to each single-family household in Tacoma.
- Quarterly newsletters called "EnviroTalk" with information on recycling and household hazardous waste disposal and overall solid waste issues.
- Information in utility bill inserts.
- Periodic education pieces on the local municipal television station, which is aired on local cable access stations.
- An education display at the Tacoma Landfill.
- Presentations to community groups, business groups, and other organizations, as well as presentations to all levels of students, from elementary school to college level classes.
- Landfill tours for different community and school groups.
- Miscellaneous brochures and pamphlets promoting waste reduction and recycling are produced and distributed.
- Staff is available to answer a phone line dedicated to recycling and waste reduction, and is staffed during business hours.
- Tacoma participates in fairs, shows and other events where staff can communicate with significant amounts of people in a target audience.

The City implemented the EnviroChallenger Program to educate elementary school students on the basics of recycling and waste reduction. Since its inception, the program has visited and presented to over 50,000 students.

5.3.1 Commercial Education Programs:

Technical assistance regarding recycling and hazardous waste disposal is available to businesses. Upon request, a resource conservation specialist from Tacoma Solid Waste Management visits a business and helps determine which waste materials currently produced can be recycled, which of the recycling methods would be the most cost effective, and ways to prevent excess waste being generated. The expert can also help the business get set up for recycling. In addition, routine audits are performed to reduce the amounts of hazardous wastes disposed in the solid waste stream. During these audits performed by Solid Waste staff, recycling information and assistance is also delivered to businesses that can benefit from this assistance.

5.3.2 Recycling Program Awards

Tacoma's Recycling Programs have been recognized by many groups as an innovative and effective program. Some of the awards and recognition Tacoma has received for its recycling programs are listed below.

- 2000 Association of Washington Cities Livability Award for recycling operations and PR campaign.
- 1999 AWC Municipal Achievement Award for the "Talkin Trash" campaign.

- 1999 Washington State Department of Ecology Solid Waste Reduction and Recycling Award for Best Large Government program.
- 1995 National Recycling Coalition *Outstanding Urban Program*, City of Tacoma Recycling Program.
- 1994 *James C Howland Award for Urban Enrichment, Honorable Mention*, City of Tacoma Community Waste Oil Recycling Program (sponsored by National League of Cities CH2MHill).
- 1994 Washington State Department of Ecology Solid Waste Reduction and Recycling Award, *Best Government Program in Western Washington*, City of Tacoma Solid Waste Utility.
- 1994 *Weyerhaeuser Company Foundation for Recycling*, Tacoma Public Schools/Solid Waste Utility Waste Watchers paper recycling program.
- 1993 *Washington Ecological Commission Environmental Excellence Award, Best Public Agency*, City of Tacoma Solid Waste Utility Community waste oil recycling program.
- 1992 National Environmental Achievement Award (sponsored by City and State Magazine) *Best Mid-sized City Recycling Program in the Nation*, City of Tacoma Solid Waste Utility.

In addition, the program's public relations staff won numerous awards from agencies recognizing their quality public relations work.

5.4 Recycling Program Improvements

While Tacoma's recycling programs have received state and national recognition, the programs continue to be evaluated in hopes of further refining the recycling efforts in the City. The City has evaluated potential improvements to the Solid Waste collection and recycling programs, which would increase the amount of recyclables diverted from the waste stream. In 2004, we will analyze our participation and target those collection routes that have low set out rates. We will also work with our citizens advisory panel to establish rates for commercial and multi-family recycling that will allow us to expand these programs to all businesses and apartments in the City.

5.5 Tacoma Hazardous Materials Diversion Programs

Tacoma has undertaken numerous efforts to divert hazardous materials from entering the landfill. Since 1987, Tacoma has been providing Household Hazardous Waste (HHW) Collection services for Tacoma residents in one form or another. Commercial or industrial hazardous waste is prevented from entering the landfill using extensive source control efforts and an existing hazardous waste management infrastructure.

In the latter part of 2002, Tacoma implemented two campaigns to aid in the diversion of hazardous materials from the solid waste stream. The first campaign targeted mercury reduction within households and business in Tacoma. This campaign involved a thermometer exchange at local drug stores and Home and Garden Show, a mercury awareness program to educate residents on the hazards associated with mercury, a

collection program to divert mercury containing waste from MSW, a thermostat exchange program, a technical assistance program to advise local businesses on how to properly handle and dispose of mercury and a dental amalgam diversion program.

The second campaign involved reducing the amount of cooking oil and grease waste entering the environment through the solid waste stream, surface water and our waterways. Although cooking oil and grease is not considered a hazardous waste, it is abundant in households and can cause problems when introduced to waste streams and waterways. This program involved setting up a collection program to divert cooking oil and grease waste and an awareness program to educate residents on how to properly dispose of these wastes.

Also in 2002, the City added the collection and recycling of fluorescent light bulbs to the collection capability at the HHW Facility. This service is offered to both residents and small generators, making this one of the more comprehensive diversion programs around.

In the latter part of 2003, a new program to collect cell phones was initiated as a pilot. This program has two very positive goals. First, cell phones and their batteries have toxic components such as cadmium, nickel and mercury. This program helps remove these waste phones from the disposal stream and gets them to recycling facilities. Second, phones that are still usable are given to domestic violence shelters for distribution to clients. Federal law requires that all cell phones, even those without service, be able to call emergency services by dialing 911. These phones are used by those clients who cannot afford cell phones or service.

5.5.1 Household Hazardous Waste

The centerpiece of Tacoma's efforts to reduce hazardous wastes from entering the landfill is the permanent HHW Collection Facility. This facility collects all types of HHW from Tacoma residents and disposes or recycles the wastes through properly permitted treatment, storage and disposal facilities. This service is available to all Tacoma and Pierce County residents and is very successful at diverting HHW. This ongoing opportunity to properly dispose of HHW was first implemented at a temporary facility on Tacoma's landfill property in 1990, and was then moved to the permanent facility located near the Recycling Center.

Tacoma's HHW diversion programs have been very successful. Over the last three years, approximately 26,463 City and County households have used the HHW collection services. Over 525 tons of HHW was diverted during that time. Collection event customers and HHW Facility participation prior to 1993 have diverted additional HHW from the waste stream.

5.5.2 Commercial Hazardous Waste

Commercial hazardous waste diversion uses a combination of Tacoma source control efforts and existing vendors that handle regulated hazardous waste. Tacoma's source control efforts utilize business assistance visits to audit businesses in the Tacoma service area and inspection of solid waste loads delivered to the landfill (Load Checking). Approximately 200 Tacoma businesses are visited each year. Assistance visits usually comprise of an audit of hazardous waste handling practices, generation rates, storage methods and disposal records. At some businesses, checks of waste containers before collection is performed as an additional source control effort.

Load checks are performed at the landfill on waste that has been transported to the landfill. Waste loads are selected both randomly and by segregating specific loads from targeted businesses. Loads are inspected for regulated wastes and free liquids. City personnel are also instructed to inspect or observe waste loads at the scale house and at the various tipping facilities at the landfill.

Businesses that dispose of hazardous wastes improperly are directed to the vendors that provide hazardous waste services. Because there is an existing private infrastructure for handling small quantity and large quantity generator hazardous wastes in Pierce County, the City determined it was not necessary to compete with the existing hazardous waste disposal companies.

5.6 Third Consent Decree Requirement Satisfied

Tacoma's aggressive efforts to implement, operate and improve diversion of hazardous materials, and recyclable materials has been well documented. Tacoma has satisfied the third consent decree requirement based on the following:

- Tacoma's existing recycling programs offer one of the widest ranges of materials that can be recycled.
- The many opportunities to recycle that Tacoma offers, both at the curb and at drop off stations, allows excellent access to Tacoma's recycling services.
- Tacoma's recycling programs have been recognized on both a national and state level, as proven by the numerous awards the program has received. The Hazardous Waste Program was featured in a national publication that focuses on effective and innovative collection programs.
- The Hazardous Waste diversion program achieves a very high participation rate for HHW Collection, and the historical efforts of Tacoma in HHW and commercial hazardous wastes is providing dividends in reduced Hazardous wastes found in waste loads at the landfill. The comprehensive nature of the small quantity generator program, which includes many different source control efforts, has been highly effective at reducing commercial hazardous waste disposal at the landfill.
- The willingness to pursue changes to improve an award winning Recycling Program indicates Tacoma's commitment to capturing the highest possible percentage of recyclable materials, and the commitment to aggressive, effective programs.

6.0 Fourth Consent Decree Requirement

"that other feasible solid waste management alternatives to disposal at the landfill do not exist"

The fourth requirement must be evaluated in the context of an integrated waste management system. "Integrated waste management is the systematic implementation of strategies and technologies which protect the environment while minimizing cost." (O'Leary, Walsh, Razvi, Waste Age, July 1989-March 1990).

Tacoma has taken an integrated waste management approach to manage its solid waste pursuant to the Tacoma-Pierce County Solid Waste Management Plan (TPC-SWMP). The TPC-SWMP was enacted to comply with the requirements of Chapter 70.95 RCW and the Washington State Solid Waste Management Plan (WS-SWMP). The WS-SWMP is produced under 40 CFR Part 256 and the Resource Recovery and Conservation Act (RCRA).

Solid waste management was prioritized in state and local plans as follows: (1) waste reduction; (2) waste recycling; (3) energy recovery or incineration and (4) land filling. These priorities were amended in 1989 to differentiate between separated and mixed wastes (separated being a higher priority than mixed). See TPC-SWMP p. 1-7, and RCW 70.95.010(8). Tacoma has adopted these solid waste management priorities.

To fulfill the priorities set forth in the integrated waste management system, Tacoma has enacted various ordinances. To encourage waste reduction, a rate incentive exists for customers. Customers that generate less waste receive a lower solid waste bill. To encourage recycling Tacoma implemented a city wide curbside commingled recycling program.

Costs to Tacoma and the environment must also be included in considering what is a feasible solid waste management alternative. Washington Chapter 70.95 RCW calls for disposal of remaining wastes in a manner that is environmentally safe and economically sound. Extended Central Area life provides a five to ten year bridge between current operations and planned future SWM developments that potentially include:

- Refuse Derived Fuel Plant Construction (3 to 10 years)
- Alternatively; Solid Waste Transfer Station Construction (3 to 10 years)

Both facility alternatives would require on-going solid waste transfer operations without the use of our current processing area. Without the Central Area, Tacoma would need to permit and build a temporary transfer facility to maintain operations during construction. This would result in considerable service disruption to landfill customers and unnecessary expense for Tacoma ratepayers.

Solid waste disposal in the Central Area during construction of either facility would result in considerable cost savings for Tacoma ratepayers and eliminate the inconvenience and environmental impact of a temporary transfer facility.

The remaining Central Area volume would offset approximately \$4,000,000 in tipping fees, based on a remaining volume equivalent to 178,734 tons at \$22.71/ton (2004 average at LRI). These savings would be applied toward Central Area closure costs.

In addition, during the past five years the Central Area has been operated in a backup capacity. The ability to operate the Central Area resulted in considerable tipping fee and transportation costs savings during the 2001 South Compactor upgrade.

Finally, continued Central Area operation will provide Tacoma with a feasible emergency disposal alternative in case of natural disasters, system failures, labor issues, adverse weather, regulatory prohibition, or other unforeseen circumstances that would prohibit disposal by long haul. And Central Area emergency use will result in considerable cost saving for Tacoma until we can construct auxiliary facilities.

The Consent Decree does not define the word feasible. Tacoma urges EPA to consider a broad definition of the word. According to American Heritage Dictionary, 2000 the definition of feasible includes: 2. Used or dealt with successfully; suitable; and 3. Logical; likely.

6.1 Fourth Consent Decree Requirement Satisfied

As we stated in section 2.0 we believe that "...*other feasible solid waste management alternatives...*" means "better solid waste management alternatives"

The suitable, logical, and best solid waste management alternative for Tacoma citizens is extended Central Area life. Based on our having satisfied the first and second consent decree requirements extended Central Area life will not damage the environment. But it will result in considerable cost savings over time for Tacoma ratepayers and avoid the need to permit and construct a temporary facility. For these reasons the fourth consent decree requirement is satisfied.



Appendix A

First Five-Year Closure Extension Terms & Conditions

The EPA and Ecology granted the first five year closure extension subject to the following terms and conditions in the EPA letter to Tacoma dated May 11, 1998:

1. Beginning May 30, 1998, the Central Area shall be filled and provided with interim covers in phases as outlined in Section 10.2 of the Operations and Closure Plan dated January 1998.

The Central Area southern one-third is filled to final elevation and covered with an interim cover in accordance with the Operations and Closure Plan.

2. The City shall install new gas extraction wells in the Central Area and those wells will be in operation by September 1, 1998.

The wells were installed in accordance with the May 11, 1998 letter from EPA and are in operation.

3. In addition to the activities addressed in #1 and #2 above, the City shall continue to seek ways to reduce odor problems at the landfill by developing and putting into effect an Odor Control Plan. This plan shall be submitted to the Tacoma-Pierce Count Health Department (TPCHD) for approval by July 16, 1998.

The Odor Control Plan was prepared submitted and approved in accordance with the May 11, 1998 EPA letter.

4. The City shall repair all known tears or leaks in the Landfill cap, including the cap separation from the Commercial Receiving Building, prior to October 30, 1998.

The repairs were completed in accordance with the Operations and Closure Plan.

5. The City shall submit a report regarding characterization of and response to perched leachate in the main landfill by May 15, 1998. The report will be contained in the 1997 annual Consent Decree report.

The report was submitted in the 1997 annual Consent Decree report.

6. The City shall comply with all terms and conditions of the Solid Waste Permit issued by the TPCHD.

The City complied with and continues to comply with the terms and conditions of the Solid Waste Permit issued by the TPCHD.



Appendix B

Second Five-Year Review Recommendations Status

The Second Five-Year Review EPA recommendations, provided in your August 6, 2003 letter, and their status follow:

1. Recommendation: Enhance landfill gas extraction adjacent to Home Depot and conduct additional investigations.

Status: Solid Waste Management (SWM) installed two multi-level gas extraction wells and one multi-level gas probe adjacent to the northern Landfill/Home Depot property boundary. Wells and probes were installed in accordance with Consent Decree specifications during September 2003.

2. Recommendation: Monitor flows of water collected in [the West 1 Area] leak detection system and report results. The agencies will determine the need for additional action based on these results.

Status: SWM monitored secondary containment discharge flow in the West 1 Area weekly from August 2001 through December 2003. An electric leak location survey was conducted in the West 1 Area by Leak Location Services, Inc. during May 2002. The survey located leaks in the primary cap and in the sewer manhole liner connections. The leaks were repaired in accordance with the Consent Decree during May and June 2002 (Leak Detection Survey Final Report, Parametrix, Inc., January 17, 2003).

Monitoring detected significant flow reduction to West 1 Area secondary containment catch basins 4 North, 4 South, and 4A South following cap repairs (see attached graphs). But secondary containment flow to the 4A North catch basin although reduced continued to occasionally exceed the modeled (Memorandum – Tacoma Landfill Closure Stage I Cap Review, Black & Veatch, November 1990) primary liner leakage rate for the double flexible membrane cap during the rainy season.

After discussions with the agencies SWM applied water to the ditch along the west side of West 1 Area on May 6 2003 to detect leaks in the primary cap. No leaks were found. In addition, on June 18, 2003 SWM conducted a smoke test along the west side of West 1 Area, using City sewer personnel and equipment, to detect leaks in the primary cap. Again no leaks were detected.

The 4A North flows that exceed the modeled primary liner leakage rate are infrequent and seasonal. SWM has conducted two electric location survey investigations and repaired detected leaks. And SWM has searched for additional potential leaks with the available practicable investigation methods. These flow events indicate an on-going but minor problem with a portion of the West 1 Area primary cap. SWM requested that no further investigations of the West 1 Area secondary flows be required. EPA, DOE, and TPCHD agreed all practicable investigation and repair methods had been applied and no further investigations and repairs were warranted. The West 1 Area secondary flows are monitored on a monthly basis.

3. Recommendation: a. Fill up to grade and place temporary cap in Central Area in compliance with Operations and Closure Plan. b. Revise & Implement Odor Control Plan.

Status: a. The Central Area southern one third has been filled to grade and a temporary cap is in place. b. The *City of Tacoma Landfill Odor Control Plan* was submitted to EPA, DOE, and TPCHD on June 30, 2003. The plan has been implemented.

4. Recommendation: Evaluate effectiveness of Bird Management Plan and adjust as necessary.

Status: SWM submitted an assessment of the *Tacoma Landfill Bird Management Plan* to TPCHD on May 15, 2003. Overall, TPCHD was very pleased with the effort and effectiveness that the City of Tacoma dedicated to prevent birds from feeding on exposed refuse throughout the landfill site. TPCHD will continue to monitor the implementation success of the *Tacoma Landfill Bird Management Plan*.

5. Recommendation: Remove visual obstructions from landfill cover.

Status: The garbage cans and vegetation were removed during spring 2003.

6. Recommendation: Identify all residences in the area potentially impacted by the landfill that are not hooked up to a City water supply. If any of the above have wells contaminated by the landfill, extend City water to them.

Status: All residences potentially impacted by the landfill were hooked up to City water.

The EPA arsenic maximum contaminant level reduction from 50 µg/L to 10 µg/L prompted review of the existing water wells (EW) status. Water samples collected from existing water wells EW-00, EW-12, and EW-30R during second quarter 2003 groundwater monitoring reported arsenic concentrations of 12.1 µg/L, 10.4 µg/L, and 10 µg/L respectively. These properties are reported as not hooked up to Tacoma water. Based on the following information we believe the landfill groundwater plume is not the arsenic source for these wells:

- EW-00 is located near the east side of Leach Creek. EW-12 and EW-30R are located near the west side of Leach Creek. These wells are outside the historical groundwater plume (Remedial Investigation Report Tacoma Landfill, December 1987) and so were not hooked up to City water.
- Performance monitoring wells P-09 and P-11 are located on the west side of Leach Creek. These wells were located on the west side to monitor potential groundwater plume movement beyond Leach Creek. Arsenic concentrations are consistently <2 µg/L for both wells.

- The initial concentrations, distribution, and rapid decrease in arsenic concentration in monitoring and extraction wells from point of compliance (7 µg/L to 42 µg/L) to end of plume (<2 µg/L to 10 µg/L) indicate the landfill groundwater plume is not the source of arsenic in EW-00, EW-12, and EW-30R.
- The Puget Sound region is one of five regions in the state with elevated (>10µg/L) arsenic groundwater concentrations (*A Geologic Source of Arsenic in Washington State Groundwater: A Literature Review*, Jennifer Parsons, Richelle M. Allen-King, 2003 Symposium on Hydrology of Washington State).