RAC V

RESPONSE ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region V

ANNUAL GROUNDWATER QUALITY AND
CAPTURE REPORT FOR 2000

ONALASKA MUNICIPAL LANDFILL
Onalaska, Wisconsin

Remedial Action

WA No. 103-RALR-05L5 / Contract No. 68-W6-0025

January 2001

PREPARED FOR

U.S. Environmental Protection Agency

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Introduction

Purpose

The primary objectives of the semiannual groundwater monitoring program at the Onalaska Municipal Landfill are to:

- Provide data to determine if groundwater contaminant concentrations in the aquifer between the landfill and the Black River are being reduced by the extraction system
- Provide data to determine if groundwater contaminant concentrations in the aquifer have been reduced to below the cleanup criteria
- Provide data to verify that a hydraulic gradient is being maintained by the extraction system in order to contain and collect contaminated groundwater
- Monitor the impact on water levels in the wetlands adjacent to the site to make sure that the extraction system is not lowering water levels to such a level as to affect the wetlands adversely

The groundwater monitoring program is also used to provide information on background water quality and identify any seasonal fluctuations in groundwater quality.

Cleanup Criteria

Under the remedy selected in the ROD, the following cleanup standards were adopted:

- Groundwater contaminant plume located at any point beyond the property boundary or design management zone (DMZ):
  - Preventive Action Limits (PALs) from Wisconsin Administrative Code Chapter NR 140
- Groundwater contaminant plume located at landfill waste boundary:
  - Maximum Contaminant Level (MCLs) from the Safe Drinking Water Act, 40 CFR 141.61 and 40 CFR 143
  - Non-zero Maximum Contaminant Level Goals (MCLGs) from the Safe Drinking Water Act, 40 CFR 141.50

Specific cleanup standards (i.e., specific concentrations) were established in the ROD for eleven indicator chemicals. The indicator chemicals represent a pared down list of the chemicals of concern identified during the Remedial Investigation. The ROD was amended by the USEPA on October 10, 2000 by an "explanation of significant differences" to bring the cleanup standards for these chemicals up-to-date with the latest NR 140 PALs and ESs.

If, after the groundwater operable unit has been operating for a minimum of 5 years, it becomes apparent that it is not technically or economically feasible to achieve a PAL, then a (Wisconsin) alternative concentration limit (WACL) may be established. Except where the background concentration of a compound exceeds the enforcement standard (ES), the WACL established may not exceed the ES for that compound. A WACL is calculated using procedures defined by the Wisconsin Department of Natural Resources (WDNR).

If it becomes apparent that it is technically impracticable to achieve the Groundwater Cleanup Standards, including any established WACL, then the USEPA, in consultation with the state, may then consider the use of alternate methods of controlling the groundwater contaminant plume or source to achieve the standards. If those alternate methods are found not to attain Groundwater Cleanup Standards (including any WACL established), then a CERCLA waiver may be considered.

Groundwater Monitoring Locations and Frequency

Groundwater samples are collected from the monitoring wells, extraction wells, and two residential wells. The residential wells are located at the Hubley and Ackerman homes. Groundwater elevation is measured in the monitoring wells and piezometers. Figure 1 shows the monitoring point locations. Table 1 summarizes the rationale for selection of each well and piezometer.

Baseline sampling was conducted in November 1993 before startup of the groundwater extraction and treatment system in the spring of 1994. Quarterly sampling was begun in March 1995. Sampling frequency was reduced from quarterly to semiannually because quarterly data collected from March 1995 through March 1997 demonstrated that semiannual sampling would be sufficient to achieve the objectives of the groundwater monitoring program.

Existing monitoring well MW-4S was added to the groundwater sampling program in March 1996. This well was replaced in the summer of 1997 because something was obstructing the passage of a bailer. Existing monitoring well MW-5S was added to the groundwater sampling program in July 1996. Existing monitoring wells MW-2S, MW-2M, and MW-2D (located in the landfill) were added to the groundwater sampling program in June 1997. MW-4S, MW-5S, MW-2S, MW-2M, and MW-2D were added to assess volatile organic compound (VOC) contamination in and close to the landfill since the concentration of VOCs in the outer wells has generally decreased to below preventive action limits (PALs). Metals analyses were also conducted on the wells for comparison to outer wells, which continue to show metals contamination above PALs. Sampling was discontinued at MW-2D and MW-12S after the April 1999 sampling event as recommended in the 1998 report and approved by the USEPA.

W159908.CV.05.02.02 Fig 1 MW, EX, Piez NW 1-12-01 tll

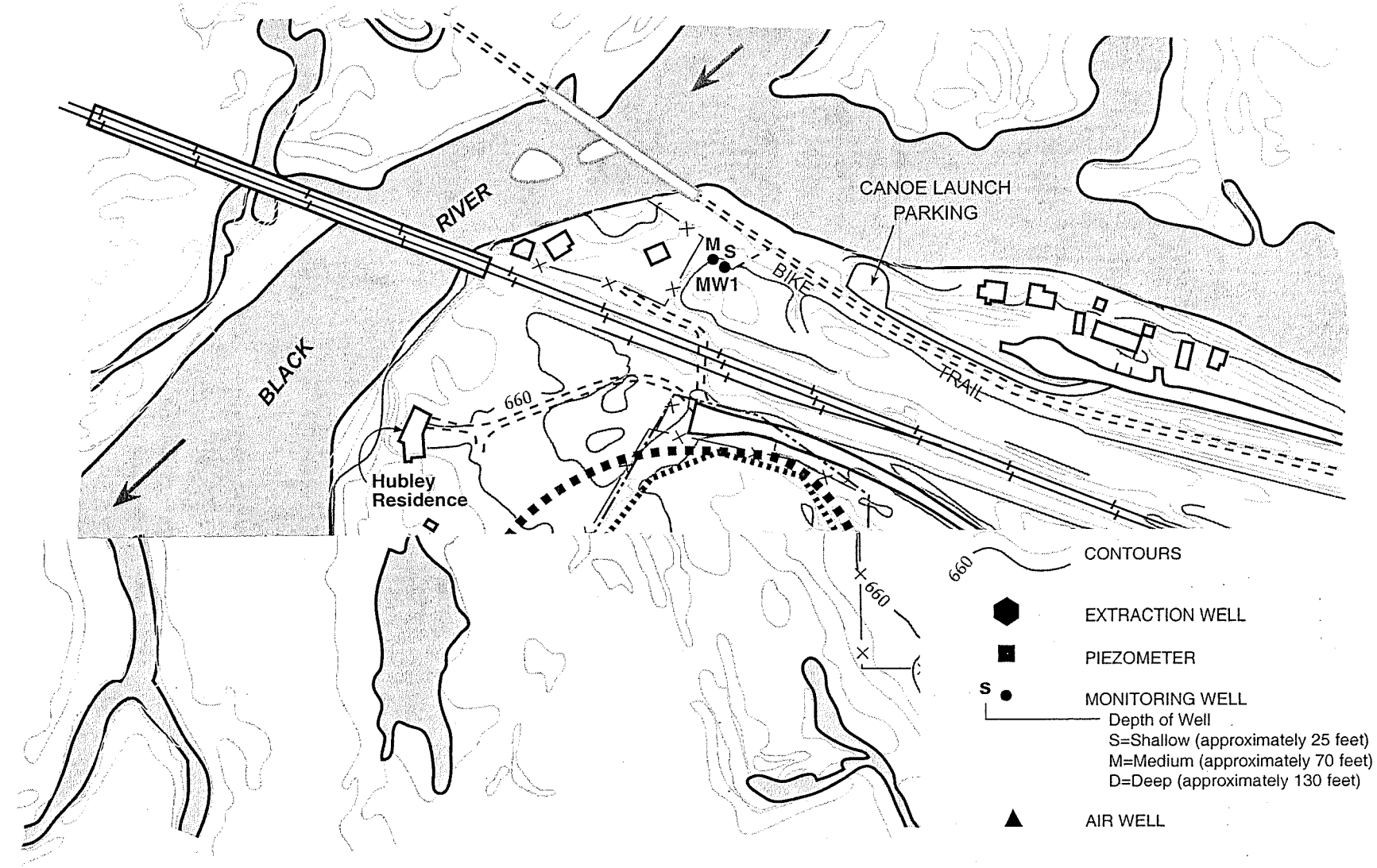


FIGURE 1
MONITORING WELL, EXTRACTION WELL, AND PIEZOMETER NETWORK
ONALASKA LANDFILL

TABLE 1
Monitoring Well Network Rationale
Onalaska Municipal Landfill

Well Designation	Rationale
PZ-01	Monitor groundwater level northwest of Extraction Well 5 to determine if the necessary capture zone is being attained
PZ-02	Monitor groundwater level between wetlands and extraction system to determine if wetlands water levels are being lowered
PZ-03	Monitor groundwater level between wetlands and extraction system to determine if wetlands water levels are being lowered
PZ-04	Monitor groundwater level between wetlands and extraction system to determine if wetlands water levels are being lowered
PZ-05	Monitor groundwater level east of easternmost extraction well to determine if necessary capture zone is being attained
PZ-06	Monitor groundwater level east of easternmost extraction well to determine if necessary capture zone is being attained
MW-1S	Monitor shallow background groundwater quality upgradient of the landfill and the extraction system to allow statistical evaluation of background groundwater characteristics
MW-1M	Monitor intermediate depth background groundwater quality upgradient of the landfill and the extraction system to allow statistical evaluation of background groundwater characteristics
MW-2S	Monitor shallow groundwater quality in the center of the landfill to determine if a reduction in groundwater contaminants occurs over time
MW-2M	Monitor intermediate depth groundwater quality in the center of the landfill to determine if a reduction in groundwater contaminants occurs over time
MW-2D	Monitor deep groundwater quality in the center of the landfill to determine whether contamination has occurred and if a reduction in groundwater contaminants occurs over time
MW-4S	Monitor shallow groundwater quality immediately downgradient of landfill to determine if a reduction in groundwater contaminants occurs over time (compliance point for Wisconsin PALs)
MW-5S	Monitor shallow groundwater quality immediately downgradient of landfill to determine if a reduction in groundwater contaminants occurs over time (compliance point for MCLs)
MW-6S	Monitor shallow groundwater quality downgradient of the landfill and extraction system to determine if a reduction in groundwater contaminants occurs over time (compliance point for Wisconsin PALs)
MW-6M	Monitor intermediate depth groundwater quality downgradient of landfill and extraction system to determine if a reduction in groundwater contaminants occurs over time (compliance point for Wisconsin PALs)
MW-8S	Monitor shallow groundwater quality downgradient of the landfill and extraction system to determine if contaminated groundwater has been captured (compliance point for Wisconsin PALs)
MW-8M	Monitor intermediate depth groundwater quality downgradient of landfill and extraction system to determine if contaminated groundwater has been captured (compliance point for Wisconsin PALs)
MW-12S	Monitor shallow groundwater quality east of easternmost extraction well to determine if necessary capture zone is being attained and whether contaminated groundwater has been captured (compliance point for Wisconsin PALs)

TABLE 1
Monitoring Well Network Rationale
Onalaska Municipal Landfill

Well Designation	Rationale
MW-14S	Monitor shallow groundwater quality west of westernmost extraction well to determine if necessary capture zone is being attained and whether contaminated groundwater has been captured (compliance point for Wisconsin PALs). However, the RI report states that contamination at MW-14S may be related to the former Bly Rendering Works, which was located near this well, rather than the landfill.
EW-1	Groundwater extraction well—water quality monitored to determine if reduction in groundwater contaminants occurs over time (compliance point for Wisconsin PALs)
EW-2	Groundwater extraction well—water quality monitored to determine if reduction in groundwater contaminants occurs over time (compliance point for MCLs)
EW-3	Groundwater extraction well—water quality monitored to determine if reduction in groundwater contaminants occurs over time (compliance point for MCLs)
EW-4	Groundwater extraction well—water quality monitored to determine if reduction in groundwater contaminants occurs over time (compliance point for MCLs)
EW-5	Groundwater extraction well—water quality monitored to determine if reduction in groundwater contaminants occurs over time (compliance point for Wisconsin PALs)

Sampling Event Information

Semiannual groundwater samples and groundwater elevation measurements were collected May 10 through 12 and September 18 through 20, 2000. All samples except residential well VOC samples were sent by overnight courier to Test America's Specialized Assays Environmental laboratory in Nashville, Tennessee, for testing of select VOCs, metals, and wet chemistry parameters. The VOC samples from the residential wells were sent by overnight courier to Northern Lake Service laboratory in Crandon, Wisconsin. Northern Lake Service laboratory is a subcontract laboratory to Specialized Assays Environmental. The monitoring wells were sampled in accordance with the procedures described in the Field Sampling Plan. The following observations were made and actions taken during the sampling events:

Spring

- An organic odor was noted in MW-4S and MW-14S.
- Mini-Rae photoionization detector (PID) readings >1999 ppm (i.e., off scale) were measured in MW-4S and PZ-05 during the spring sampling event.
- Mini-Rae readings of over 10 ppm were also measured in MW-8S, PZ-01, and PZ-02.
- Mini-Rae readings initially were 420 in AW-25 and 265 in AW-14 when the cap was first removed but dropped to 0 to 10 ppm after the cap was off for a minute or two, indicating only a small volume of VOCs had concentrated near the top of the wells.

Fall

- An organic odor was noted in MW-4S.
- Mini-Rae readings of 200 initial, dropping to 30 to 60 ppm after a couple minutes, were measured in MW-4S.
- Mini-Rae readings of over 10 ppm were also measured in MW-5S, AW-14, and AW-25.

Groundwater Quality Results

Organization

Data validation results for the two rounds of sampling are presented followed by preliminary calculations of alternative concentration limits. This is followed by discussion of the analytical results. Discussion of the analytical results is grouped by organic contaminants, metal contaminants, and wet chemistry. Comparisons are made to the NR 140 PAL and ES and Federal MCL cleanup standards adopted in the amended ROD. Comparisons are also made to preliminary alternative concentration limits (ACLs) for parameters where background concentrations may prevent compliance with cleanup standards.

The analytical results are presented in tabular form in Appendix A and graphically in Appendix B. The graphs in Appendix B include results from each sampling event to date, including the baseline sampling event in 1993 before the groundwater extraction and treatment system was started. The horizontal lines in the graphs represent the latest NR 140 PALs and ESs adopted per the amended Record of Decision (ROD). Results qualified as rejected (R) during validation were not plotted. In past annual reports, parameters that were not detected were plotted at the detection limit. This resulted in the appearance of concentration variations for undetected parameters due to detection limit variations between sampling events. Graphs showing the October 1999 priority pollutant scan results gave the appearance of a significant spike for many organic contaminants that were not detected. The apparent spike was a result of a higher detection limit of 10 $\mu g/L$ for organic contaminants in the priority pollutant scan versus a detection limit of 1 $\mu g/L$ or less in previous sampling events. Therefore, 1993 through 2000 nondetect results were not plotted in Appendix B of this annual report. If this resulted in a graph with no plotted results since baseline sampling in 1993 then the entire graph was eliminated.

Data Validation

Laboratory results for the May and September sampling events were validated by CH2M HILL with the exception of the May 2000 monitoring well VOC results, which the USEPA validated. The validation included a comparison of the data packages and QA/QC results to the requirements described in the Special Analytical Service (SAS) and the *USEPA National Functional Guidelines for Data Review*. QA/QC qualifiers resulting from the validation have been added to the data presented in this report. Table 2 summarizes the results from the validation.

TABLE 2
Summary of 2000 Groundwater Monitoring Analyses Validation
Onalaska Municipal Landfill

Parameter	Well	Spring or Fall	SAS No.	Project Qualifier	CH2M HILL Validation Comments
Iron	MW-1S, MW-1S FR, MW-6S, MW-6M, MW-8S, MW-8M, Ackerman, Hubley, MW-2M, MW-4S, MW-5S, MW-14S, MW-14S FR	S	00CF13-08, 20, 14, 15, 16, 17, 01, 02, 11, 12, 13, 19, 21	J	Estimated in quantity due to a percent recovery of iron in the matrix spike above the QC limit of 125%
Manganese	MW-1S	S	OOCF13-08	J	Estimated in quantity due to field duplicate imprecision.
Mercury	EW-1, EW-2, EW-3, EW-4, EW-5, MW-1M	S	00CF13-03, 04, 05, 06, 07, 09	UJ	Undetected and estimated in quantity due to low percent recovery of the CRDL standard.
Toluene	EW-1, MW-5S	F	00CF13-39, 29	J	Biased high and estimated in quantity due to MS/MSD duplicate imprecision and LCS concentration above QC limits
Iron	MW-2M, MW-4S, MW-5S, MW-1S, MW-1SFR, MW-1M, Ackerman, MW-6S, MW6-M, MW-8S, MW-8M	F	00CF13-37, 38, 39, 34, 45, 35, 27, 40, 41, 42, 43	J	Biased high and estimated in quantity due to MS/MSD duplicate imprecision
Iron	Hubley, MW-14S, EW-3FR, EW-1, EW-2, EW-3, EW-4, EW-5	F	00CF13-28, 44, 46, 29, 30, 31, 32, 33	J	Biased low and estimated in quantity due to MS/MSD duplicate imprecision
Lead	Hubley, MW-14S, EW-3FR,EW-1, EW-2, EW-3, EW-4, EW-5	F	00CF13 - 28, 44, 46, 29, 30, 31, 32, 33	UJ	Undetected and estimated in quantity due to a low %R for the CRDL standard for ICP and the percent difference and ICP serial dilution was above the recommended limits of 10%
Manganese	MW-2M, MW-4S, MW-5S, MW-1S, MW-1S FR, MW-1M, Ackerman, MW-6S, MW-6M, MW-8S, MW-8M, Hubley, MW-14S, EW-3FR, EW-1, EW-2, EW-3, EW-4, EW-5,	F	OOCF13-37, 38, 39, 34, 45, 35, 40, 41, 42, 43, 28, 44, 46, 29, 30, 31, 33	J	Biased low and estimated in quantity due to MS/MSD duplicate imprecision.

MS/MSD = Matrix Spike/Matrix Spike Duplicate
LCS = Laboratory Control Sample
CRDL = Contract Required Detection Limits
ICP = Inductively Coupled Plasma
%R = Percent Recovery

Preliminary Alternative Concentration Limits

ACLs were calculated using the procedures to establish a Wisconsin ACL (WACL) for contaminants with background concentrations that may prevent compliance with groundwater cleanup standards (e.g., PALs). It is recommended that ACLs be requested of

WDNR for contaminants with concentrations above groundwater cleanup standards due to background. This request should be made when parameters exceeding groundwater cleanup standards due to background concentrations are prolonging the remedial action. Statistical evaluation was also performed on wet chemistry parameters without established PALs using the procedures to establish PALs. This was done to allow comparison of wet chemistry results in each well to background results. The preliminary ACL and PAL calculations are shown in Table 3. The statistical evaluation for ACLs and PALs would be similar to that provided in Table 3, but it would include the additional sampling results that will be accumulated up to the time the ACLs request is made to WDNR.

Organic Contaminants

Benzene

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	None

The NR 140 PAL is 0.5 μg/L and the NR 140 ES and Federal MCL are 5 μg/L. The detection limit was below the PAL except for MW-4S in the spring sampling event when it was 4 μg/L. The benzene concentrations have been below the PAL and the detection limit at most wells since the start of the sampling program. However, the benzene concentration has been above the PAL adopted per the amended ROD at times in EW-03 (all four quarterly rounds in 1995), EW-04 (October 1998), MW-2S (April 1999), MW-2M (June 1998 and October 1999), MW-4S (June 1996), and MW-5S (December 1996).

Ethylbenzene

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	EW-1, EW-2, EW-3, EW-4, MW-4S, MW-5S, MW-14S

The NR 140 PAL is 140 μg/L and the NR 140 ES and Federal MCL are 700 μg/L. The detection limit was below the PAL. The highest concentration detected in 2000 was 34 μg/L in MW-4S in the May sampling event. Ethylbenzene has consistently been below the PAL adopted per the amended ROD in all the wells since startup of groundwater remediation.

Toluene

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	EW-1, MW-4S, MW-5S

The NR 140 PAL is 200 μg/L and the NR 140 ES and Federal MCL are 1000 μg/L. The detection limit was below the PAL. The highest concentration detected in 2000 was 19.4 μg/L in MW-5S in the May sampling event. The toluene concentration has been below the PAL at most wells since the start of the sampling program. However, the toluene concentration has been above the PAL adopted per the amended ROD at times in EW-03 (June 1995), EW-04 (June 1995), and MW-5S (October 1996, December 1996, March 1997, and April 1999). It appears that the toluene concentration at MW-5S may be continuing to decrease.

TABLE 3

Statistical Evaluation of Select Parameters from Background Monitoring Wells MW-1S and MW-1M (Using Data To Date)

Preliminary Shallow Well (MW-1S) Background Based ACLs For Select Parameters

Parameter (µg/L)	Average	Standard Deviation	No. of Results	Avg. + 2 Std. Dev.	Original PAL	Preliminary ACL
Arsenic	5.2	1.4	16	8	5	8
Barium (Note 1)	126	88	16	301	400	310
Cobalt (Note 2)	6.1	1.8	3	10	8	-
Iron	640	1257	16	3155	150	3200
Manganese	1052	917	16	2886	25	2900
Vanadium (Note 2)	5.8	1.4	3	9	6	-
Color C.U.	38	49	15	136.3	7.5	140

Notes:

1. ACL not appropriate because ACL would be less than PAL.
2. Need 8 results before calculating a preliminary ACL.

Preliminary Medium Depth Well (MW-1M) Background Based ACLs For Select Parameters

Parameter	Average	Standard Deviation	No. of Results	Avg. + 2 Std. Dev.	Original PAL	Preliminary ACL
Arsenic (Note 2)	9.2	4.0	3	17	5	-
Barium (Note 1,2)	220	5	3	229	400	-
Cobalt (Note 2)	Not Detected		3	-	8	-
Iron (Note 2)	4280	1269	3	6819	150	-
Manganese (Note 2)	1495	346	2	2188	25	-
Vanadium (Note 2)	Not Detected		3	-	6	-

Notes:

1. ACL not appropriate because ACL would be less than PAL.
2. Need 8 results before calculating a preliminary ACL.

Preliminary Shallow Well (MW-1S) Background Based PALs For Parameters Where PALs Have Not Been Set

Parameter	Average	Standard Deviation	No. of Results	Avg. + 3 Std. Dev.[1]	Avg. + NR140.20 Table 3 Incr.	Greater of Two Prev. Col.
Indicator Parameters						
Alkalinity, Total as $CaCO_3$ (mg/L)	122	24	8	192	222	222
Chemical Oxygen Demand (mg/L)	9	4	8	22	34	34
Hardness (As $CaCO_3$) mg/L	206	88	9	471	306	471
pH	6.83	N.A.	16	N.A.	N.A.	N.A.
Total Dissolved Solids (mg/L)	256	389	16	1,422	456	1,422
Total Organic Carbon (mg/L)	5	1	9	9	6	9
Other Parameters Requiring Monitoring						
Oil & Grease, Total Rec (mg/L)	0.7	1.2	13	4.3	N.A.	4.3
Turbidity (NTU)	73	73	15	292	N.A.	292

Total Xylenes

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	EW-1, EW-2, EW-3, EW-4, EW-5, MW-4S, MW-5S, MW-14S

The NR 140 PAL is 1,000 µg/L and the NR 140 ES and federal MCL are 10,000 µg/L. The detection limit was below the PAL. The highest concentration detected in 2000 was 155 µg/L in MW-5S in the September sampling event. Total xylenes have consistently been below the PAL adopted per the amended ROD in all the wells since startup of groundwater remediation. It appears that the total xylenes concentration at MW-4S may be continuing to decrease.

1349 600 ↗ 236 451 ↗ 480/96

Trimethylbenzenes (1,2,4- and 1,3,5- combined)

Wells exceeding PAL in 2000	MW-4S, MW-5S
Wells exceeding ES in 2000	MW-4S
Wells above detection limit in 2000	EW-1, EW-2, EW-3, EW-4, EW-5, MW-4S, MW-5S, MW-14S

1,2,4- and 1,3,5-Trimethylbenzenes were not on the list of contaminants of concern presented in the ROD. The NR 140 PAL is 96 µg/L and the ES is 480 µg/L for the combined concentration of 1,2,4- and 1,3,5-trimethylbezenes. The highest combined concentrations detected in 2000 were 1,349.9 µg/L in MW-4S and 236.7 µg/L in MW-5S. 1,2,4- and 1,3,5-Trimethylbenzenes were also identified in the 1999 Priority Pollutant Scan as "tentatively identified compounds" (TICs). MW-4S and MW-5S were the only two wells with the estimated concentration of 1,2,4- and 1,3,5-trimethylbenzenes exceeding the PAL during that sampling event as well.

Naphthalene

Wells exceeding PAL in 2000	MW-4S, MW-5S, MW-14S
Wells above detection limit in 2000	EW-1, EW-2, EW-3, EW-4, MW-4S, MW-5S, MW-14S

Naphthalene was not on the reduced list of contaminants of concern presented in the ROD. The NR 140 PAL is 8 µg/L and the ES is 40 µg/L. The highest concentrations detected in 2000 were 39.1 µg/L in MW-4S, 28.21 µg/L in MW-14S, and 23.95 µg/L in MW-5S.

Methylene Chloride

Wells exceeding PAL in 2000	MW-4S
Wells exceeding ES in 2000	MW-4S
Wells above detection limit in 2000	MW-4S

Methylene chloride was not on the reduced list of contaminants of concern presented in the ROD. The NR 140 PAL is 0.5 μg/L and the ES is 5 μg/L. The only concentration detected in 2000 was 9 μg/L in MW-4S.

Other Chlorinated Organic Contaminants For Which An NR 140 PAL Exists

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	EW-3, MW-2M, MW-6M, and MW-8M

Four chlorinated VOCs with NR 140 PALs were detected below PALs in one or more of the wells noted above: 1,1-dichloroethane, trichloroethene, chloroethane, and chlorobenzene. Trichloroethene, which was detected at 0.43 μg/L in MW-8M, was the closest to the PAL (NR 140 PAL of 0.5 μg/L).

Other Chlorinated Organic Contaminants for Which No NR 140 PALs Exist

Compounds that were detected above the level of quantitation for which no NR 140 PAL or federal MCL exists are listed in Table 4. USEPA Region IX preliminary remediation goals (PRGs) and Region III risk based concentrations (RBCs) are provided. The PRGs or RBCs provide an indication of the potential health concerns for a parameter but they are not currently applicable cleanup standards. Parameters that exceeded one or both criteria and the values exceeding the standard are underlined and noted in bold.

Propylbenzene in MW-4S was the only contaminant detected above one of the criteria. The concentration was just above the PRG but well below the RBC. This compound was also identified in the 1999 Priority Pollutant Scan as a TIC. MW-4S was the only well with the estimated concentration of propylbenzene exceeding the PRG during that sampling event as well although the estimated concentration was near the PRG criteria in MW-5S as well. Discussion of whether to monitor for parameters exceeding a criteria in future sampling events is included under "Recommended Adjustments to the Monitoring Program."

Organic Contaminants Discussion of Results Summary

Year 2000 concentrations of organic contaminants that have specific cleanup concentrations established in the ROD were below the latest NR 140 criteria adopted per the amended ROD. However, the laboratory results indicate three organic contaminants were above NR 140 PALs in one or more of the following wells: MW-4S, MW-5S, and MW-14S.The contaminants were naphthalene, methylene chloride, and trimethylbenzenes (1,2,4- and 1,3,5- combined). Methylene chloride and trimethylbenzenes (1,2,4- and 1,3,5- combined) were both present above the ESs in MW-4S. Discussion of whether to monitor for parameters exceeding a criteria in future sampling events is included under "Recommended Adjustments to the Monitoring Program."

MW-4S and MW-14S are outside the property boundary and DMZ; therefore PALs are applicable at both wells. As noted above, the RI report states that contamination at MW-14S may be related to the Bly Rendering Works facility rather than the landfill. MW-5S is within the property boundary and DMZ. Therefore, PALs are not directly applicable at MW-5S. However, given the proximity of MW-5S to the property boundary, this well may be indicative of contaminant concentrations just outside the property boundary where PALs apply. There is also the possibility that without the capture provided by the extraction

wells, contaminants at MW-5S and other locations along the perimeter of the landfill could migrate beyond the property boundary at concentrations similar to those found at MW-5S in the future. Evaluation of contaminant movement or an additional monitoring well west of MW-5S and outside the property boundary would be required to determine concentrations where PALs apply unless concentrations drop below PALs in MW-5S.

TABLE 4
Other Contaminants with No PAL or MCL Detected Above Level of Quantitation Detection Limits
Onalaska Municipal Landfill

Parameter	Well	Concentration (µg/L)	PRG (µg/L)	RBC (µg/L)
Butylbenzene	EW-1, EW-2, EW-4	0.72–0.9	61	240
	MW-4S	54.2	61	240
	MW-5S	10.4	61	240
	MW-14S	4.11–5.06	61	240
Sec-Butylbenzene	EW-1, EW-2, EW-4, EW-5	0.42–1.35	61	240
	MW-4S	50.6	61	240
	MW-5S	8.88	61	240
	MW-14S	2.06–2.45	61	240
Tert-Butylbenzene	EW-3, EW-4	0.57–0.61	61	240
	MW-4S	6.3	61	240
	MW-5S	8.16	61	240
Propylbenzene	EW-1 – EW-5	0.69–3.07	61	240
	MW-4S	65.5	61	240
	MW-5S	41.85	61	240
	MW-14S	3.38–3.61	61	240
Isopropylbenzene	EW-1, EW-2, EW-3, EW-4	0.9–1.96	660	660
	MW-4S	26.1	660	660
	MW-5S	25.33	660	660
	MW-14S	2.3–2.34	660	660
Diethylether	EW-3	0.73	1,200[a]	1,200[a]
	MW-2M	1.09	1,200[a]	1,200[a]
p-Isopropyltoluene	EW-1, EW-2, EW-3, EW-4	0.59–1.35	Note b	Note b
	MW-4S	62.7	Note b	Note b
	MW-5S	7.52	Note b	Note b
	MW-14S	1.35–1.66	Note b	Note b

a. Criteria for ethyl ether
b. No criteria found

Metal Contaminants

Arsenic

Wells exceeding PAL (and proposed MCL) in 2000	EW-01, EW-02, EW-03, EW-04, EW-05, MW-1S, MW-1M, MW-2M, MW-4S, MW-5S
Wells exceeding PAL (and proposed MCL) in 2000 outside property boundary	EW-01, EW-05, MW-1S, MW-1M, MW-4S
Wells exceeding ES and existing MCL in 2000	None
Wells exceeding proposed MCL in 2000 inside property boundary	EW-02, EW-03, EW-04, MW-2M, MW-5S
Wells exceeding preliminary ACL in 2000	EW-02, EW-03, EW-04, EW-05, MW-1S, MW-1M, MW-2M, MW-4S, MW-5S
Wells exceeding preliminary ACL in 2000 outside property boundary	EW-05, MW-1S, MW-1M, MW-4S

The NR 140 PAL is 5 μg/L, and the NR 140 ES and federal MCL are 50 μg/L. However, the USEPA has proposed reducing the MCL to 5 μg/L. The detection limit was equal to the PAL. Based on MW-1S background data to date, the average background arsenic concentration in shallow well MW-1S has been 5.2 μg/L (see Table 3). Evaluation of MW-1S background data to date using the procedures to establish an ACL yields a value of 8 μg/L (see Table 3). Insufficient data exist for background arsenic concentrations in medium depth groundwater, but the first 3 rounds of data in MW-1M would yield a higher ACL (see Table 3). An ACL based on both MW-1S and MW-1M may be appropriate for the extraction wells that draw groundwater from both the shallow and medium aquifers. The highest concentration detected in 2000 was 21 μg/L in EW-03 in the May sampling event. As in the past, a decreasing arsenic concentration gradient was apparent to either side (i.e., in EW-02 and EW-04) of EW-03, indicating EW-03 is near the center of the metals contamination plume. Arsenic was detected in both the shallow (9 and 10 μg/L) and medium depth (13 μg/L) background wells in May but not in September. Although, the background concentration of arsenic may prevent compliance with the PAL at times, the landfill has contributed to arsenic concentrations greater than background. Arsenic concentration appears to vary between sampling events but there is no noticeable trend to indicate arsenic concentrations are decreasing with time.

Barium

Wells exceeding PAL in 2000	EW-01, EW-02, EW-03, EW-04, MW-6M, MW-8M
Wells exceeding PAL in 2000 outside property boundary	EW-01, MW-6M, MW-8M
Wells exceeding ES and MCL in 2000	None

The NR 140 PAL is 400 μg/L, and the NR 140 ES and federal MCL are 2,000 μg/L. The detection limit was below the PAL. Based on MW-1S background data to date, the average background barium has been 126 μg/L (see Table 3). Evaluation of background MW-1S data to date using the procedures to establish an ACL yields a value of 310 μg/L (see Table 3). Given that this is less than the current NR 140 PAL, an ACL based on background barium in shallow groundwater will not be appropriate unless future background results deviate significantly from results to date. The minimum of 8 background values required to calculate an ACL for background barium in medium depth groundwater (i.e., MW-1M) will not be available until the spring of 2003. However, the MW-1M results to date indicate that that an ACL based on background barium in medium groundwater would also be less than the PAL and therefore not appropriate. The highest concentration detected in 2000 was 754 μg/L in EW-03 in the September sampling event. As in the past, a decreasing barium concentration gradient was apparent in 2000 to either side (i.e., in EW-02 and EW-04) of EW-03, indicating EW-03 is near the center of the metals contamination plume. Although, the background concentration of barium may prevent compliance with the PAL at times, the landfill has contributed to barium concentrations greater than background.

As seen on the graphs, the concentration of barium appears to have decreased somewhat since initial sampling events in the wells with some of the highest concentrations (e.g., MW-6M, EW-03, EW-02, and EW-01). However, the concentration of barium does not appear to have decreased significantly in any wells over the last 3 years although it may still be decreasing in MW-6M.

Cadmium

Wells exceeding PAL in 2000	EW-02, EW-03, EW-04, EW-05, MW-1M, MW-2M, MW-4S, MW-5S
Wells exceeding PAL in 2000 outside property boundary	EW-05, MW-1M, MW-4S
Wells exceeding ES and MCL in 2000	None

The NR 140 PAL is 0.5 μg/L, and the NR 140 ES and federal MCL are 5 μg/L. The detection limit was 1 μg/L, which is above the PAL. The concentration in 2000 was 1 to 2 μg/L in the wells where it was detected. Cadmium was added to the monitoring program in EW-01 through EW-05, MW-2S, MW-2M, MW-4S, MW-5S, and background wells MW-1S and MW-1M after detection at roughly 3 μg/L in EW-1 and EW-3 in the 1999 priority pollutant scan. Cadmium was not detected in the upstream shallow groundwater monitoring well MW-1S but it was detected in the upstream medium groundwater monitoring well MW-1M at 1 μg/L in the May sampling event.

Cobalt

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	EW-04 (at detection limit)

Note: Cobalt was only requested to be analyzed for in background wells MW-1S and MW-1M. However, the lab analyzed for cobalt in May in the extraction wells as well.

The NR 140 PAL is 8 μg/L, and the NR 140 ES is 40 μg/L. There is no MCL drinking water standard for cobalt. The detection limit of 5 μg/L was below the PAL. Cobalt was not detected in either background monitoring well in 2000. Cobalt was added to the monitoring program in background wells MW-1S and MW-1M after detection at 6.8 to 11 μg/L in MW-2M, MW-1S, MW-5S, and MW-14S in the 1999 priority pollutant scan. The concentration was 8.2 μg/L in background monitoring well MW-1S in the 1999 priority pollutant scan. Only the background monitoring wells were added to the monitoring program because the concentrations in the other wells were only slightly above the concentration in MW-1S and the PAL . This will allow determination of an ACL for comparison to other wells when sampled for cobalt in future priority pollutant scans.

Iron

Wells exceeding PAL in 2000	All wells sampled
Wells exceeding PAL in 2000 outside property boundary	EW-01, EW-05, Ackerman residential, Hubley residential, MW-1S, MW-1M, MW-4S, MW-6S, MW-6M, MW-8S, MW-8M, MW-14S
Wells exceeding ES in 2000	All wells sampled except Hubley residential and MW-6S
Wells exceeding preliminary ACL in 2000	EW-02, EW-03, EW-04, Ackerman residential, MW-1S, MW-1M, MW-2M, MW-4S, MW-5S, MW-14S
Wells exceeding preliminary ACL in 2000 outside property boundary	Ackerman residential, MW-1S, MW-1M, MW-4S, MW-14S

The PAL for iron is 150 μg/L, and the NR 140 ES is 300 μg/L. There is no MCL drinking water standard for iron. Iron in background well MW-1S has varied significantly between sampling events. Based on background data to date, the average background iron has been 640 μg/L (see Table 3). Evaluation of background data to date using the procedures to establish an ACL yields a value of 3,200 μg/L (see Table 3). Insufficient data exist for background iron concentrations in medium depth groundwater, but the first three rounds of data in MW-1M would yield a higher ACL (see Table 3). An ACL based on both MW-1S and MW-1M may be appropriate for the extraction wells, which draw groundwater from both the shallow and medium aquifers. The highest concentration detected in 2000 was 22,300 μg/L in MW-2M in the September sampling event. As in the past, a decreasing iron concentration gradient was apparent in 2000 to either side (i.e., in EW-02 and EW-04) of EW-03, indicating EW-03 is near the center of the metals contamination plume. The iron concentrations in the Hubley and Ackerman residential wells appear to be completely attributable to background concentration. The iron concentration in some of the other wells may also be completely attributable to background iron. Although, the background concentration of iron may prevent compliance with the PAL and ES in many wells, the landfill has contributed to iron concentrations greater than background.

Iron concentration decreased significantly in MW-8S in the first few years of groundwater extraction. However, the concentration of iron does not appear to have significantly decreased in any wells over the last several years.

Lead

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	None

The NR 140 PAL is 1.5 µg/L, the NR 140 ES is 15 µg/L, and the Federal Action Limit MCL (AMCL) is 90 percent of residences served in a public water supply must be below 15 µg/L. The detection limit was equal to the PAL. Lead was not detected in any wells in 2000. The reported lead result in background well MW-1S from December 1995 is not included on the graphs because the 81.6 µg/L reported by the lab compresses the scale on all the lead graphs and because the reported value appears to be an anomaly that is highly suspect.

Manganese

Wells exceeding PAL in 2000	All wells sampled
Wells exceeding PAL in 2000 outside property boundary	EW-01, EW-05, Ackerman and Hubley residential, MW-1S, MW-1M, MW-4S, MW-6S, MW-6M, MW-8S, MW-8M, MW-14S
Wells exceeding preliminary ACL in 2000	MW-1S
Wells exceeding preliminary ACL in 2000 outside property boundary	MW-1S

The PAL for manganese is 25 µg/L, and the NR 140 ES is 50 µg/L. There is no MCL drinking water standard for manganese. Manganese in background well MW-1S has varied significantly between sampling events. Based on background data to date, the average background manganese has been 1,052 µg/L (see Table 3). Evaluation of background data to date using the procedures to establish an ACL yields a value of 2,900 µg/L (see Table 3). The highest concentration detected in 2000 was 3,140 µg/L in MW-1S in the May sampling event. As in the past, a decreasing manganese concentration gradient was apparent in 2000 to either side of EW-03 (i.e., in EW-02 and EW-04), indicating EW-03 is near the center of the metals contamination plume. The manganese concentrations in the Hubley and Ackerman residential wells appear to be attributable completely to background concentration. The manganese concentration in some of the other wells may also be completely attributable to background manganese. However, based on the decreasing concentration gradient to either side of EW-03 and concentrations significantly higher than background in several wells for multiple sampling events, it appears that the landfill has contributed to manganese concentrations greater than background.

Mercury

Wells exceeding PAL in 2000	None
Wells exceeding PAL in 2000 outside property boundary	None
Wells exceeding ES and MCL in 2000	None

The NR 140 PAL is 0.2 μg/L, and the NR 140 ES and federal MCL are 2 μg/L. The detection limit was equal to the PAL. Mercury was not detected in any well in 2000. Mercury was added to the monitoring program in EW-01 through EW-05, MW-2S, MW-2M, MW-4S, MW-5S, and background wells MW-1S and MW-1M after detection at 0.21 μg/L in MW-4S, 0.88 μg/L in MW-5S, and 2.2 μg/L in MW-2M in the 1999 priority pollutant scan.

Vanadium

Wells exceeding PAL in 2000	None
Wells above detection limit in 2000	None

Note: Vanadium was analyzed for only in background wells MW-1S and MW-1M.

The NR 140 PAL is 6 μg/L, and the NR 140 ES is 30 μg/L. There is no MCL drinking water standard for vanadium. The detection limit of 5 μg/L was below the PAL. Vanadium was not detected in either background monitoring well in 2000. It was added to the monitoring program in background wells MW-1S and MW-1M after detection at 7.5 to 16 μg/L in MW-1S, MW-5S, MW-6S, MW-6M, and EW-05 in the 1999 priority pollutant scan. The concentration was 7.5 μg/L in background monitoring well MW-1S in the 1999 priority pollutant scan. Only the background monitoring wells were added to the monitoring program because the concentrations in the other wells were only marginally above the concentration in MW-1S and the PAL . This will allow determination of an ACL for comparison to other wells when sampled for vanadium in future priority pollutant scans.

Metal Contaminants Discussion of Results Summary

In 2000, metals were detected at concentrations above PALs in all monitoring wells, residential wells, and extraction wells. The concentration of metals generally decreases from EW-3 to EW-2 to EW-1 and similarly decreases from EW-3 to EW-4 to EW-5. Therefore, EW-3 appears to be near the middle of the metals contamination plume from the landfill. Based on the decreasing metals concentration gradient to either side of EW-03 and metals concentrations significantly higher than background for most of the sampling events in several wells downstream of the landfill, there is strong evidence that the landfill has contributed to metals concentrations greater than background in many of the wells. However, the metals concentrations in some other wells appear to be due to background concentrations.

Barium concentration decreased significantly in MW-6M in the first few years of groundwater extraction. Similarly, iron concentration decreased significantly in MW-8S in the first few years of groundwater extraction. However, the concentration of metals does not appear to have significantly decreased over the last few years.

Metals concentrations will continue to be compared to preliminary calculated ACLs (if greater than PALs) because background concentrations for some metals exceed PALs. However, the metals concentrations in some of the wells with elevated concentrations from the landfill will likely remain above calculated preliminary ACLs for years. It is recommended that ACLs be requested of WDNR at some future date when it appears that the only parameters exceeding PALs at the site are exceeding the PALs due to background concentrations. The statistical evaluation would be similar to that provided in Table 3, but it would include the additional results that will be accumulated up to the time of the request.

Wet Chemistry

pH

pH measurements are taken in the field at the time of sampling. Values for pH generally ranged from 6.7 to 7.8 except MW-14S which ranged from 6.1 to 6.3. There is no PAL for pH but the measured values are relatively neutral and do not indicate any significant pH concerns related to the landfill.

Color

Wells exceeding PAL in 2000	EW-01, EW-02, EW-03, EW-04, EW-05, MW-1S, MW-1M, MW-06S, MW-06M, MW-8M, MW-14S, Hubley residential
Wells exceeding PAL in 2000 outside property boundary	EW-01, EW-05, MW-1S, MW-1M, MW-06S, MW-06M, MW-8M, MW-14S, Hubley residential
Wells exceeding preliminary ACL	None

The NR 140 PAL for color is 7.5 color units (CU), and the NR 140 ES is 15 CU. Based on background data to date, the average background color is 38 CU (see Table 3). Evaluation of background data to date using the procedures to establish an ACL yields a value of 140 CU (see Table 3). None of the wells monitored exceeded this criterion. Therefore, background color is more significant than color resulting from landfill contaminants. The highest color detected in 2000 was 90 CU in MW-1S in the May sampling event. The tests for color are highly dependent on the analyst's judgment; therefore, the results of these tests are not precise and will vary. The imprecision is apparent even between duplicate samples from the May and September 2000 monitoring events which were as follows: 29 CU for MW-1S versus 90 CU for MW-1S Dup.; 6 CU for MW-14S versus 12 CU for MW-14S Dup.; 32 CU for EW-03 versus 1 CU for EW-03 Dup.; 13 CU for MW-1S versus 20 CU for MW-1S Dup. Color has been lower at all wells since December 1996. However, the imprecision of the analysis may be the cause of some of the variation in results between sampling rounds.

Odor

Wells exceeding PAL in 2000	EW-01, EW-02, EW-03, EW-04, EW-05, Ackerman residential, MW-1M, MW-14S
Wells exceeding PAL in 2000 outside property boundary	EW-01, EW-05, Ackerman residential, MW-1M, MW-14S

The NR 140 PAL for odor is 1.5 t.o.n. and the NR 140 ES is 3 t.o.n. The highest concentration detected in 2000 was 256 t.o.n. in EW-03 in the September sampling event. MW-4S, which is not analyzed for odor in the laboratory, consistently has the strongest field observable hydrocarbon odor. Some odor in the extraction wells may be partially explainable from natural background odors in the medium depth aquifer based on MW-1M exceeding the PAL in the September sampling event. The water in MW-14S often contains a field observable hydrocarbon odor and sheen, thereby explaining the odor results in the lab. As stated in the RI report, the odor and sheen at MW-14S may be attributed to a diesel fuel spill at the former Bly Rendering Works rather than the landfill. The test for odor is highly dependent on the analyst's judgment. The results of these tests are not precise and will vary between analysts.

Oil and Grease

There are no groundwater or drinking water standards for oil and grease. Oil and grease was not detected in background wells MW-01S and MW-1M in 2000. Based on background data to date, the average background oil and grease is 0.7 mg/L (see Table 3). Evaluation of background data to date using the procedures to establish a PAL yields a value of 4.3 mg/L (see Table 3). None of the wells monitored exceeded this criterion. The highest concentration detected in 2000 was 4 mg/L in MW-14S in the May sampling event. The concentration of oil and grease appears to be lower in many wells since 1996.

TDS

The TDS concentrations have been below the aesthetic- and taste-based recommended concentration limit of 500 mg/L since 1996. Total dissolved solids (TDS) results are used to indicate if the landfill leachate is affecting the monitoring wells. Based on background data to date, the average background TDS is 256 mg/L (see Table 3). Evaluation of background data to date using the procedures to establish a PAL yields a value of 1,422 mg/L (see Table 3). None of the wells monitored exceeded this criterion. The highest concentration detected in 2000 was 460 mg/L in EW-01 in the September sampling event. The average TDS concentrations have not changed noticeably; however, there have been fewer excursions since 1995.

Turbidity

There is no turbidity limit applicable to groundwater because of the lower risk of microorganisms in groundwater. For comparison, the USEPA's MCL for turbidity applicable to water systems using surface water is 1 TU, or 5 TU if disinfection and microbiological determinations are not an issue. Based on background data to date, the average background turbidity is 73. Evaluation of background data to date using the procedures to establish a PAL yields a value of 292 NTU (see Table 3). None of the wells monitored exceeded this criterion.

The highest concentration detected in 2000 was 122 NTU in the Ackerman residential well in the September sampling event. The turbidity in the Ackerman residential well during the May sampling event was 6 NTU. The reason for the increase in September is unknown.

Wet Chemistry Discussion of Results Summary

PALs exist for color and odor. Color was present at values above the PAL in all wells monitored except the Ackerman residential well and MW-8S. However, none of the wells monitored exceed the preliminary ACL calculated using background groundwater data from MW-1S. Odor was above the PAL in monitoring wells MW-1M and MW-14S, the Ackerman residential well, and all five extraction wells. The odor in the five extraction wells and the Ackerman residential well may have resulted from background odor in medium depth and deep groundwater aquifers based on the MW-1M result. MW-14S typically has a field observable organic odor, which may have a correlation to the VOC contaminants detected in that well and may be a result of the former Bly Rendering Works.

Results for 2001 will allow determination of whether the Ackerman residential well turbidity and odor results in September 2000 were an anomaly or whether turbidity and odor in the well should be investigated further. Based on organic and metals results in the

Ackerman residential well, there does not appear to be a health concern. The remaining wet chemistry results do not appear to indicate a problem from the landfill.

Wet chemistry parameters are not monitored in wells in or near the landfill (MW-2S, MW-2M, MW-4S, and MW-5S). Monitoring of wet chemistry parameters in these wells is being deferred because there is no significant value in monitoring these parameters at this time. However, wet chemistry results from these wells may be indicative of landfill contamination.

Groundwater Elevation and Capture Analysis

Objectives

The objectives of the groundwater elevation and capture analysis were to:

- Evaluate the effectiveness of the groundwater extraction system's hydraulic gradient control and collection of contaminated groundwater within the aquifer for the year
- Monitor the impact on water levels in wetlands adjacent to the site to ensure the extraction system is not lowering water levels to such a level as to adversely affect the wetlands

Groundwater Extraction

The groundwater extraction system at the Onalaska site consists of five extraction wells located south of the landfill in a line that extends roughly from the northwest to the southeast (Figure 1). The objective of the groundwater extraction system is to capture groundwater flowing south and southwest of the landfill in the area defined by the groundwater remediation target area, shown as a dashed line in Figure 1.

The groundwater pumping rates are summarized by year in Table 5. During the feasibility study, the amount of groundwater flowing through the sand and gravel aquifer beneath the site was estimated at 350,000 gallons per day. The groundwater extraction and treatment system removed and treated a total of 365,955,490 gallons in 2000. This is an average removal of 1,002,618 gallons per day. The high extraction rates were designed to ensure a hydraulic gradient toward the extraction wells in order to capture and contain the plume of contaminated groundwater. This results in a high rate of flushing and dilution.

Available Water Level Data

Available data consist of water elevation data for two semiannual monitoring events in 2000. Water level data were collected at 22 monitoring locations:

- River level at bike bridge near MW-1S
- Shallow wells: MW-1S, MW-2S, MW-4S, MW-5S, MW-6S, MW-8S, MW-12S, and MW-14S
- Intermediate wells: MW-1M, MW-2M, MW-6M, and MW-8M
- Piezometers: PZ-01 through PZ-06
- Air sparging wells: AW-14, AW-25, and AW-29

Water elevation data are summarized in Table 6.

TABLE 5
Groundwater Pumping Rates
Onalaska Municipal Landfill

Year	Total Volume Extracted and Treated (gal)	Average Daily Extraction Rate (gal/day)	Average Pumping Rate (gpm)
1994	176,247,120	855,568	594
1995	261,374,480	716,094	497
1996	247,556,080	678,236	471
1997	279,514,300	765,793	532
1998	257,877,450	706,514	491
1999	344,720,570	944,440	656
2000	365,955,490	1,002,618	696
Totals & Averages	1,933,245,490	806,864	560

Groundwater Capture Evaluation

Approach

Data evaluated during the RI indicate that groundwater at the site flowed from the north toward the south-southwest, except during high river stages when it flowed to the south-southeast. The groundwater extraction system results in a more defined flow toward the extraction wells and reverses flow in the area south and west of the extraction wells to the north and east.

Groundwater elevations were calculated by subtracting the depth to water measurements from the well casing elevation. Depth to water is measured from the top of each well casing. Similarly, river elevation is measured based on the depth to water from a surveyed elevation on the bicycle bridge. Groundwater and river water elevations for the spring and fall monitoring events are plotted in Figures 2 and 3, respectively. The plotted elevations were used to evaluate whether a hydraulic gradient is being maintained to contain and collect contaminated groundwater and to evaluate effects on the wetlands. Estimated groundwater elevation contours and flow directions were plotted based on groundwater elevations at the monitored locations. Groundwater flow toward the extraction system at the monitoring locations indicates that the extraction system is effectively capturing groundwater in the groundwater remediation target area.

Monitoring wells MW-2S was dry during both sampling events and AW-14 was dry in May. The groundwater elevations for these wells represent the well bottom and are shown with a less-than symbol on Figures 2 and 3.

Medium-depth wells (MW-1M, MW-2M, MW-6M, and MW-8M) were used to determine the vertical groundwater flow; they were not used during the horizontal flow direction assessment.

TABLE 6
Groundwater Elevation Results For Capture Analysis
Onalaska Municipal Landfill

Well	Well Rim Elevation (ft)	May-00		Sep-00	
		Depth to Water (ft)	Water Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)
Black River[a]	655.77	13.73	642.04	11.90	643.87
MW-1S	663.22	21.12	642.10	19.48	643.74
MW-1M	663.47	21.38	642.09	19.75	643.72
MW-2S[2]	672.39	29.5 (bot. of well)	< 642.89	29.5 (bot. of well)	< 642.89
MW-2M	671.34	30.21	641.13	28.74	642.60
MW-4S	664.11	23.70	640.41	22.59	641.52
MW-5S	655.56	14.77	640.79	13.22	642.34
MW-6S	646.25	5.49	640.76	4.30	641.95
MW-6M	648.20	7.32	640.88	6.13	642.07
MW-8S	659.11	18.31	640.80	17.24	641.87
MW-8M	659.07	18.21	640.86	17.35	641.72
MW-12S	662.95	21.58	641.37	20.67	642.28
MW-14S	654.32	13.48	640.84	11.97	642.35
AW-14[b]	655.90	14.53 (bot. of well)	< 641.37	14.03	641.87
AW-25	655.57	15.08	640.49	13.83	641.74
AW-29	661.20	20.03	641.17	19.50	641.70
PZ-01	654.73	14.06	640.67	12.54	642.19
PZ-02	649.76	8.42	641.34	7.60	642.16
PZ-03	647.10	6.32	640.78	5.07	642.03
PZ-04	647.43	6.60	640.83	5.49	641.94
PZ-05	660.23	19.47	640.76	18.49	641.74
PZ-06	659.08	18.21	640.87	17.23	641.85

a. The depth to water for the Black River is measured from a surveyed point on the bicycle trail bridge near MW-1S (top of 3rd I-beam from SE end of bridge on the downstream side).
b. Well MW-2S was dry during both events and AW-14 was dry during the May sampling event. Therefore, depth to water was recorded as the depth to the bottom of the well and the water elevation is reported as less than the elevation of the bottom of the well.

Conclusions

Groundwater flow was toward the extraction system, as illustrated by Figures 2 and 3. Higher groundwater elevations occurred in the monitoring wells and piezometers located along the remediation area perimeter (MW-14S, PZ-02, PZ-03, PZ-04, MW-12S, PZ-06, and MW-01S) versus the monitoring wells and piezometers located within the interior of the remediation area. The groundwater flow patterns indicate that groundwater flow is toward the extraction wells in the remediation area and groundwater capture is occurring. There are not enough wells to determine where the zone of influence extends to at any given time. However, it is apparent that contaminated groundwater originating from under the landfill is captured.

Comparison of groundwater elevations at MW-6S and MW-6M indicates a small upward flow potential from the medium depth aquifer to the shallow depth aquifer. This has been the case for all monitoring events. Comparison of groundwater elevations at MW-8S and MW-8M indicates a small upward flow potential from the medium depth aquifer to the shallow depth aquifer for the May sampling event and the reverse for the September sampling event. This is consistent with past sampling events where flow direction has varied between sampling events. No conclusions can be made regarding vertical gradient between MW-2S and MW-2M because MW-2S was dry during both sampling events.

It was noted in last year's report that the groundwater elevation in AW-29 was 0.7 foot higher than the groundwater in the surrounding area in October 1999. Similarly, the groundwater was 1 foot higher than the surrounding area in October 1998. The groundwater was 0.7 foot higher in AW-29 than the surrounding area in May 2000 but within 0.04 foot of AW-25 and 0.18 foot of MW-4S in September 2000. It is not clear why the groundwater level is significantly higher at times in AW-29 versus AW-25 and MW-4S. This well and some additional air wells will be surveyed in to improve our understanding of groundwater levels in this area in the future.

Pumping Effects on Wetlands

Piezometers PZ-02, PZ-03, and PZ-04 are located near the wetlands to southwest of the Onalaska Landfill site. One objective of collecting water levels at these locations was to quantify the effects of groundwater extraction on water levels in the wetlands.

Based on the proximity of PZ-02 to the Dodge Chute of the Black River, it is likely that PZ-02 is influenced primarily by the water elevation in Dodge Chute and not by the extraction wells. Groundwater elevations at PZ-03 and PZ-04 were 6.1 to 6.7 inches less than at PZ-02 in May and 1.56 to 2.64 inches less than at PZ-02 in September. Assuming PZ-02 is representative of groundwater level beyond the influence of the extraction wells, the elevation differences provide an indication that PZ-03 and PZ-04 may be within the cone of depression caused by the extraction wells. However, if the river is controlling groundwater elevation in the vicinity of these three piezometers, it would be expected that the groundwater elevation at PZ-02 would be higher than at PZ-03 and PZ-04 because it is further upstream on Dodge Chute. Therefore, it is difficult to determine the actual influence of the extraction wells on the wetlands. Given the relatively small difference, it does not appear that the water level in the wetlands was being depressed significantly enough to create concern at the time of the two sampling events.

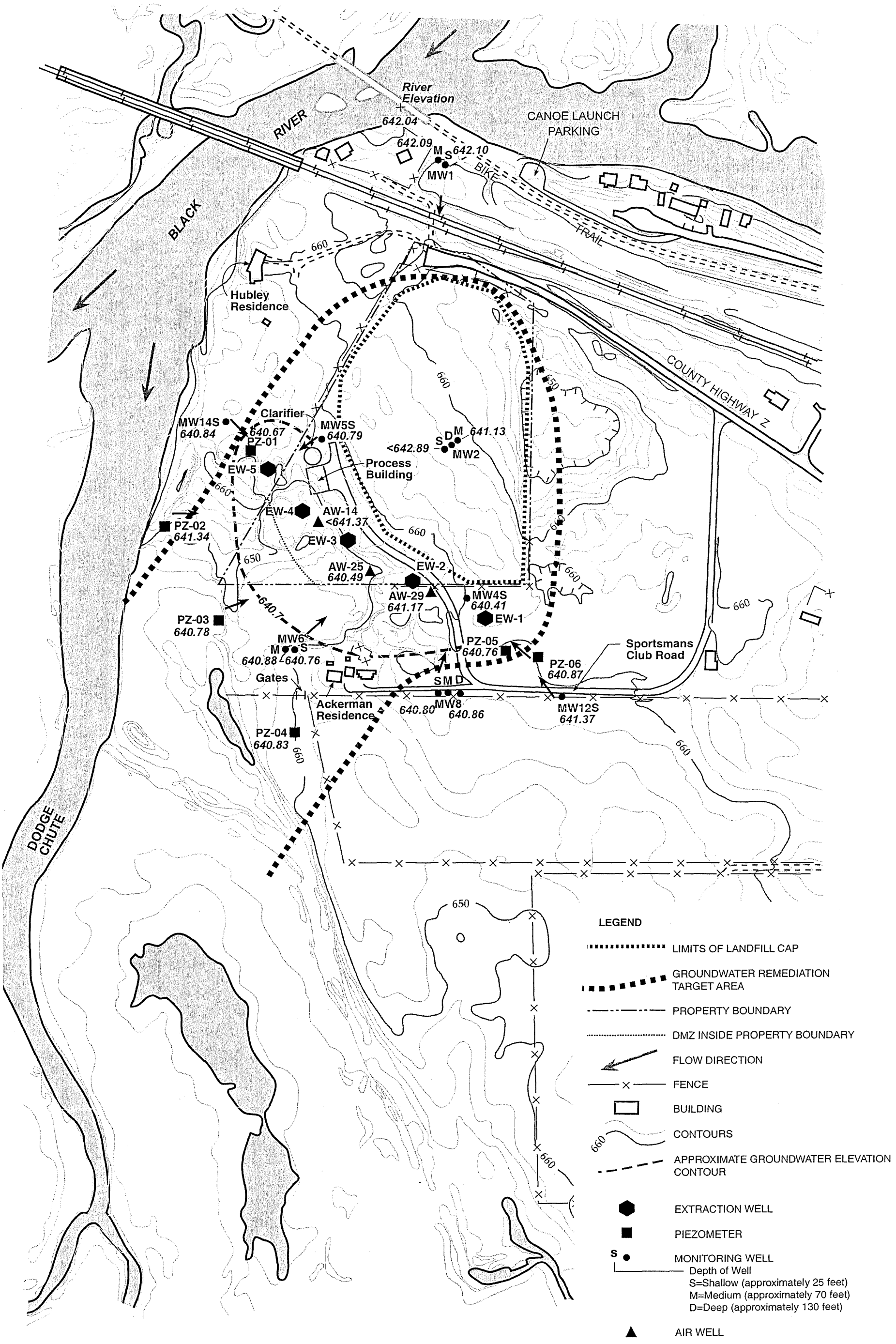


FIGURE 2
GROUNDWATER ELEVATIONS
MAY 2000
ONALASKA LANDFILL

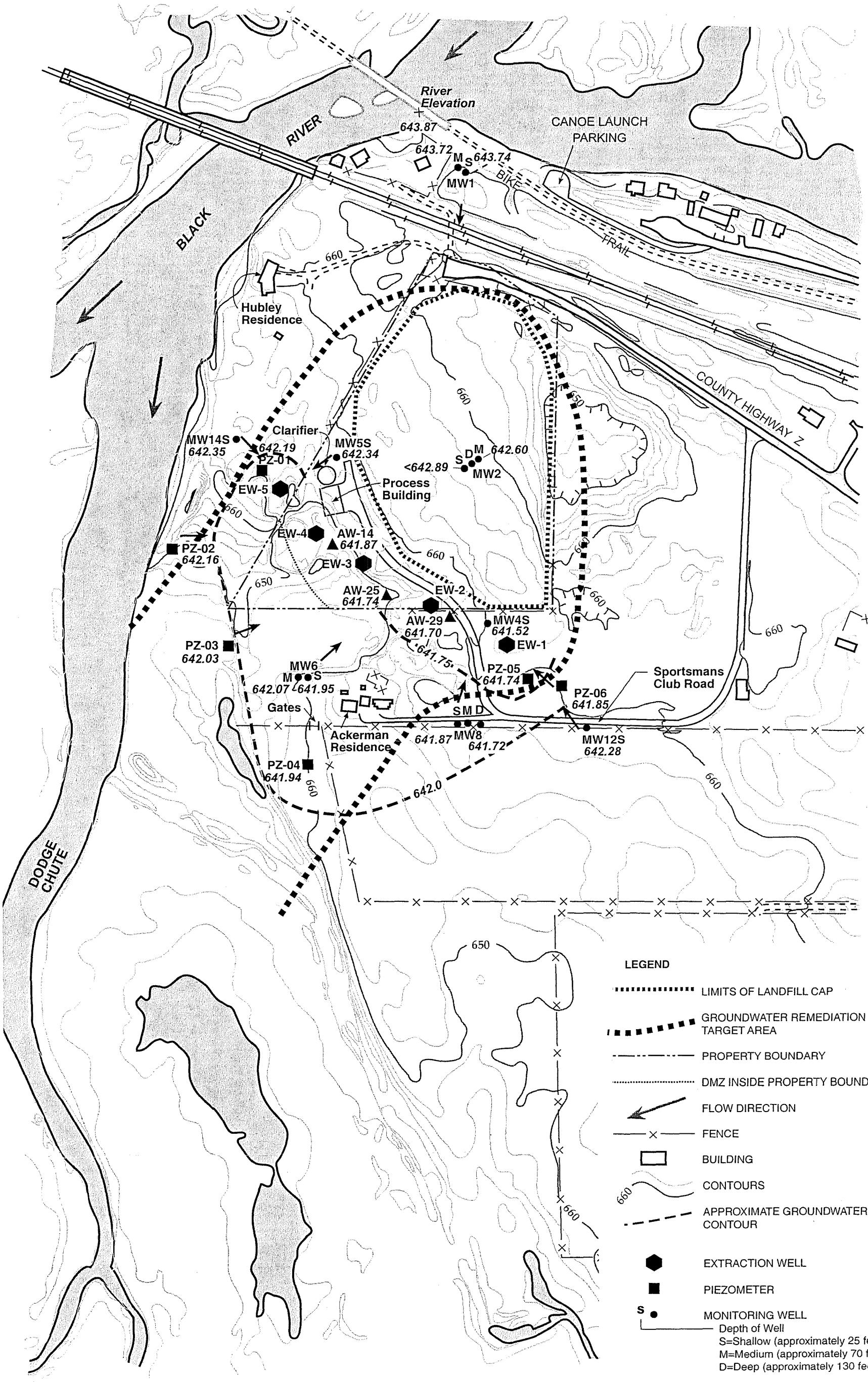


FIGURE 3
GROUNDWATER ELEVATIONS
SEPTEMBER 2000
ONALASKA LANDFILL

The gradient was nearly flat between PZ-03 and PZ-04 relative to MW-6S. MW-6S, which is closer to the extraction wells, was only 0.24 to 0.84 inch lower than PZ-03 and PZ-04 in May and 0.12 to 0.96 inch lower than PZ-03 and PZ-04 in September. This is a further indication that the wetlands are either beyond the zone of influence or at the outer edge of the zone of influence (i.e., there is not a steep cone of depression in the area of the wetlands). As discussed in the *Annual Groundwater Quality and Capture Report for 1996,* comparison of groundwater elevations in PZ-02, PZ-03, and PZ-04 with and without the extraction wells operating would be necessary to evaluate the exact effect of the extraction wells on groundwater elevation at these piezometers.

Recommended Adjustments to the Monitoring Program

Adjustments Incorporated in 2000 Based on 1999 Recommendations

All the recommended adjustments from the *Annual Groundwater Quality and Capture Report for 1999* (see section "Recommended Adjustments to the Monitoring Program") were discussed with Tim Prendiville/USEPA Work Assignment Manager in 2000 and approved. These changes were implemented as part of the 2000 monitoring program.

Recommendations for 2001

The laboratory analyzed VOC samples from the May sampling event for a more extensive list of contaminants than specified. The additional parameters were presented at the end of the subsection titled Organic Contaminants within the section titled Groundwater Quality Results. The following contaminants were detected above PALs (and ESs in two cases):

- Trimethylbenzenes (1,2,4- and 1,3,5- combined)
- Naphthalene
- Methylene chloride

Trimethylbenzenes (1,2,4- and 1,3,5- combined) is not a priority pollutant and therefore it was not specifically analyzed for during the 1999 priority pollutant scan. However, 1,2,4- and 1,3,5-trimethylbenzenes are noted as tentatively identified compounds (TICs) in the paper copy provided by the laboratory of the priority pollutant scan results. Based on the detection above a PAL (and ES in MW-4S) in May and the previous listing as a TIC on the 1999 priority pollutant scan, it is recommended that the contaminants be added to the VOC analyte list in MW-4S and MW-5S.

Naphthalene was analyzed for during the priority pollutant scan and detected above the PAL and just below the ES in MW-5S. However, the results were thrown out during validation due to detection in the equipment blank. This was discussed in last year's report, and it was not recommended that naphthalene be added to the monitoring program in 2000. Based on the detection of naphthalene above the PAL in MW-4S, MW-5S, and MW-14S in the May 2000 results, it is now recommended that naphthalene be added to the monitoring program for the three wells.

Methylene chloride was detected in MW-4S at 9 µg/L, which is above the 0.5 µg/L and 5 µg/L NR 140 PAL and ES. This is just below the 10 µg/L detection limit used for VOCs during the 1999 priority pollutant scan and may explain why the contaminant was not

found then. It is also possible that this single detection in May 2000 was an anomaly, especially given that methylene chloride detection is sometimes caused by laboratory contamination. It is recommended that methylene chloride be added to the monitoring program for MW-4S for the next two sampling events in 2001 and eliminated from subsequent events if not detected above the PAL.

In addition to these contaminants, there was one other non-routinely analyzed contaminant, propylbenzene, detected during the May 2000 sampling event above a potentially relevant criterion. The concentration was just above the PRG but well below the RBC. A review of the TIC list from the 1999 priority pollutant scan reveals that this contaminant was also detected then. The contaminant is not a priority pollutant, there is no NR 140 PAL or ES for it, and there are no data in IRIS or HEAST that indicate it poses a significant health concern at the concentration found. Therefore, it is not recommended that the contaminant be added to the monitoring program.

A further review of the TIC list from the 1999 priority pollutant scan reveals that 1,2,4- and 1,3,5-trimethylbenzenes are the only TICs with a NR 140 PAL and ES. Similarly, propylbenzene was the only other contaminant with an estimated concentration above a PRG or RBC. Therefore, no other additional contaminants from the TIC list are recommended for addition to the monitoring program.

Appendix A

Tabulated 2000 Groundwater Monitoring Results

Appendix A

Tabulated 2000 Groundwater Monitoring Results

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		ACKERMAN	EW-01	EW-02	EW-03	EW-04	EW-05	HUBLEY
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water	Water	Water
Sample Collection Date:		05/11/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/11/2000
Field Sample Identification:		00CF13-01	00CF13-03	00CF13-04	00CF13-05	00CF13-06	00CF13-07	00CF13-02
Laboratory Sample Identification:		230326	00-A67042	00-A67043	00-A67044	00-A67045	00-A67046	230327
Volatiles	**Units**							
1,1,1-Trichloroethane	ug/L	0.33 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.33 U
1,1-Dichloroethane	ug/L	0.36 U	0.4 U	0.4 U	0.9 =	0.4 U	0.4 U	0.36 U
1,1-Dichloroethene	ug/L	0.35 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.35 U
Benzene	ug/L	0.32 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.32 U
Ethylbenzene	ug/L	0.44 U	1.6 =	1 =	0.4 U	0.8 =	0.4 U	0.44 U
Tetrachloroethene	ug/L	0.11 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.11 U
Toluene	ug/L	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.37 U
Trichloroethene	ug/L	0.34 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.34 U
Xylenes, Total	ug/L	0.12 U	12.5 =	9.7 =	4.1 =	3.6 =	2.3 =	0.12 U

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		MW-01M	MW-01S	MW-01S	MW-02M	MW-04S	MW-05S	MW-06M
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water, Dup	Water	Water	Water	Water
Sample Collection Date:		05/12/2000	05/11/2000	05/11/2000	05/10/2000	05/10/2000	05/10/2000	05/11/2000
Field Sample Identification:		00CF13-09	00CF13-08	00CF13-20	00CF13-11	00CF13-12	00CF13-13	00CF13-15
Laboratory Sample Identification:		00-A67047	00-A65437	00-A65438	00-A64802	00-A64803	00-A64804	00-A65431
Volatiles	**Units**							
1,1,1-Trichloroethane	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.16 U
1,1-Dichloroethane	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.41 =
1,1-Dichloroethene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.16 U
Benzene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.16 U
Ethylbenzene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	34 =	12.8 =	0.16 U
Tetrachloroethene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.16 U
Toluene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	8 =	19.4 =	0.16 U
Trichloroethene	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	4 U	0.4 U	0.16 U
Xylenes, Total	ug/L	0.4 U	0.16 U	0.16 U	0.4 U	128 =	35.1 =	0.16 U

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML	OML	OML	OML
Field Sample Location:		MW-06S	MW-08M	MW-08S	MW-14S	MW-14S
Sample Interval:		N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water, Dup
Sample Collection Date:		05/11/2000	05/11/2000	05/11/2000	05/10/2000	05/10/2000
Field Sample Identification:		00CF13-14	00CF13-17	00CF13-16	00CF13-19	00CF13-21
Laboratory Sample Identification:		00-A65430	00-A65433	00-A65432	00-A64805	00-A64806
Volatiles	**Units**					
1,1,1-Trichloroethane	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
1,1-Dichloroethane	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
1,1-Dichloroethene	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
Benzene	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
Ethylbenzene	ug/L	0.16 U	0.16 U	0.16 U	1.1 =	10 =
Tetrachloroethene	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
Toluene	ug/L	0.16 U	0.16 U	0.16 U	0.4 U	0.4 U
Trichloroethene	ug/L	0.16 U	0.43 =	0.16 U	0.4 U	0.4 U
Xylenes, Total	ug/L	0.16 U	0.16 U	0.16 U	3.1 =	2.8 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

	Field Site Identifier:	OML	OML	OML	OML	OML	OML	OML
	Field Sample Location:	ACKERMAN	EW-01	EW-02	EW-03	EW-04	EW-05	HUBLEY
	Sample Interval:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Matrix:	Water	Water	Water	Water	Water	Water	Water
	Sample Collection Date:	05/11/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/11/2000
	Field Sample Identification:	00CF13-01	00CF13-03	00CF13-04	00CF13-05	00CF13-06	00CF13-07	00CF13-02
	Laboratory Sample Identification:	00-A65435	00-A67042	00-A67043	00-A67044	00-A67045	00-A67046	00-A65436
Metals	**Units**							
Arsenic	ug/L	5 U	7 =	10 =	21 =	16 =	11 =	5 U
Barium	ug/L	200 U	367 =	570 =	700 =	530 =	266 =	200 U
Cadmium	ug/L	NR	1 U	1 =	2 =	2 =	1 =	NR
Cobalt	ug/L	NR	5 U	5 U	5 U	5 =	5 U	NR
Iron	mg/L	0.695 J	2.17 =	6.01 =	7.62 =	4.08 =	1.75 =	0.205 J
Lead	ug/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Manganese	ug/L	73 =	NR	NR	NR	NR	NR	223 =
Mercury	ug/L	NR	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	0.2 UJ	NR
Vanadium	ug/L	NR	5 U	5 U	5 U	5 U	5 U	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

	Field Site Identifier:	OML	OML	OML	OML	OML	OML	OML
	Field Sample Location:	MW-01M	MW-01S	MW-01S	MW-02M	MW-04S	MW-05S	MW-06M
	Sample Interval:	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Matrix:	Water	Water	Water, Dup	Water	Water	Water	Water
	Sample Collection Date:	05/12/2000	05/11/2000	05/11/2000	05/10/2000	05/10/2000	05/10/2000	05/11/2000
	Field Sample Identification:	00CF13-09	00CF13-08	00CF13-20	00CF13-11	00CF13-12	00CF13-13	00CF13-15
	Laboratory Sample Identification:	00-A67047	00-A65437	00-A65438	00-A64802	00-A64803	00-A64804	00-A65431
Metals	**Units**							
Arsenic	ug/L	13 =	9 =	10 =	17 =	11 =	11 =	5 U
Barium	ug/L	220 =	200 U	200 U	200 U	200 U	294 =	724 =
Cadmium	ug/L	1 =	1 U	1 U	2 =	1 =	2 =	NR
Cobalt	ug/L	5 U	5 U	5 U	NR	NR	NR	NR
Iron	mg/L	5.19 =	3.46 J	3.44 J	1.73 J	7.23 J	18.6 J	0.307 J
Lead	ug/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Manganese	ug/L	NR	2180 J	3140 =	1550 =	1580 =	1880 =	1640 =
Mercury	ug/L	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NR
Vanadium	ug/L	5 U	5 U	5 U	NR	NR	NR	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

	Field Site Identifier:	OML	OML	OML	OML	OML
	Field Sample Location:	MW-06S	MW-08M	MW-08S	MW-14S	MW-14S
	Sample Interval:	N/A	N/A	N/A	N/A	N/A
	Matrix:	Water	Water	Water	Water	Water, Dup
	Sample Collection Date:	05/11/2000	05/11/2000	05/11/2000	05/10/2000	05/10/2000
	Field Sample Identification:	00CF13-14	00CF13-17	00CF13-16	00CF13-19	00CF13-21
	Laboratory Sample Identification:	00-A65430	00-A65433	00-A65432	00-A64805	00-A64806
Metals	**Units**					
Arsenic	ug/L	5 U	5 U	5 U	5 U	5 U
Barium	ug/L	200 U	550 =	200 U	200 U	200 U
Cadmium	ug/L	NR	NR	NR	6 R	NR
Cobalt	ug/L	NR	NR	NR	NR	NR
Iron	mg/L	0.292 J	0.53 J	0.371 J	8.16 J	7.94 J
Lead	ug/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Manganese	ug/L	1090 =	2200 =	664 =	2820 =	2750 =
Mercury	ug/L	NR	NR	NR	0.2 U	NR
Vanadium	ug/L	NR	NR	NR	NR	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		ACKERMAN	EW-01	EW-02	EW-03	EW-04	EW-05	HUBLEY
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water	Water	Water
Sample Collection Date:		05/11/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/12/2000	05/11/2000
Field Sample Identification:		00CF13-01	00CF13-03	00CF13-04	00CF13-05	00CF13-06	00CF13-07	00CF13-02
Laboratory Sample Identification:		00-A65435	00-A67042	00-A67043	00-A67044	00-A67045	00-A67046	00-A65436
General Chem	**Units**							
pH	ph units	7.4 =	7.6 =	7.3 =	7.2 =	7.4 =	7.4 =	7.6 =
Chemical Oxygen Demand	mg/L	NR	NR	NR	NR	NR	NR	NR
Color	color unit	1 =	2 =	13 =	8 =	12 =	14 =	24 =
Odor	t.o.n.	1 =	1 =	8 =	1 =	1 =	2 =	1 =
Oil & Grease, Total Rec	mg/L	0.12 =	0.45 =	0.42 =	0.34 =	0.28 =	0.29 =	0.12 =
Total Dissolved Solids (Residue, Filterable)	mg/L	304 =	238 =	216 =	192 =	200 =	150 =	108 =
Turbidity	ntu	6 =	19 =	88 =	55 =	42 =	7 =	1 U

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		MW-01M	MW-01S	MW-01S	MW-06M	MW-06S	MW-08M	MW-08S
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water, Dup	Water	Water	Water	Water
Sample Collection Date:		05/12/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000	05/11/2000
Field Sample Identification:		00CF13-09	00CF13-08	00CF13-20	00CF13-15	00CF13-14	00CF13-17	00CF13-16
Laboratory Sample Identification:		00-A67047	00-A65437	00-A65438	00-A65431	00-A65430	00-A65433	00-A65432
General Chem	**Units**							
pH	ph units	7.2 =	6.8 =	6.69 =	7.4 =	7.5 =	7.23 =	7.1 =
Chemical Oxygen Demand	mg/L	NR	6 =	8 =	NR	NR	NR	NR
Color	color unit	15 =	29 =	90 =	18 =	23 =	9 =	4 =
Odor	t.o.n.	1 =	1 =	1 =	1 =	1 =	1 =	1 =
Oil & Grease, Total Rec	mg/L	0.26 =	0.13 =	0.19 =	0.11 =	0.15 =	0.12 =	0.33 =
Total Dissolved Solids (Residue, Filterable)	mg/L	102 =	180 =	172 =	192 =	184 =	284 =	360 =
Turbidity	ntu	30 =	5 =	6 =	1 U	1 U	1 U	4 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
May, 2000

Field Site Identifier:		OML	OML
Field Sample Location:		MW-14S	MW-14S
Sample Interval:		N/A	N/A
Matrix:		Water	Water, Dup
Sample Collection Date:		05/10/2000	05/10/2000
Field Sample Identification:		00CF13-19	00CF13-21
Laboratory Sample Identification:		00-A64805	00-A64806
General Chem	**Units**		
pH	ph units	6.1 =	6.3 =
Chemical Oxygen Demand	mg/L	NR	NR
Color	color unit	6 =	12 =
Odor	t.o.n.	256 U	256 U
Oil & Grease, Total Rec	mg/L	0.83 =	3.56 =
Total Dissolved Solids (Residue, Filterable)	mg/L	120 =	126 =
Turbidity	ntu	4 =	9 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		ACKERMAN	EW-01	EW-02	EW-03	EW-03	EW-04	EW-05
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water, Dup	Water	Water
Sample Collection Date:		09/19/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000
Field Sample Identification:		00CF13-27	00CF13-29	00CF13-30	00CF13-31	00CF13-46	00CF13-32	00CF13-33
Laboratory Sample Identification:		00-A132862	00-A133520	00-A133521	00-A133522	00-A133518	00-A133523	00-A133524
Volatiles	**Units**							
1,1,1-Trichloroethane	ug/L	0.33 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-Dichloroethane	ug/L	0.36 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-Dichloroethene	ug/L	0.35 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Benzene	ug/L	0.32 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Ethylbenzene	ug/L	0.14 U	2.2 =	0.8 =	0.4 =	0.4 U	1.5 =	0.4 U
Tetrachloroethene	ug/L	0.11 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Toluene	ug/L	0.37 U	0.3 J	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Trichloroethene	ug/L	0.34 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Xylenes, Total	ug/L	0.12 U	20.8 =	8.2 =	5.5 =	5.4 =	4.3 =	1.2 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		HUBLEY	MW-01M	MW-01S	MW-01S	MW-02M	MW-04S	MW-05S
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water, Dup	Water	Water	Water
Sample Collection Date:		09/20/2000	09/19/2000	09/19/2000	09/19/2000	09/18/2000	09/18/2000	09/18/2000
Field Sample Identification:		00CF13-28	00CF13-35	00CF13-34	00CF13-45	00CF13-37	00CF13-38	00CF13-39
Laboratory Sample Identification:		00-A133516	00-A132861	00-A132858	00-A132859	00-A132855	00-A132856	00-A132857
Volatiles	**Units**							
1,1,1-Trichloroethane	ug/L	0.33 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-Dichloroethane	ug/L	0.36 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-Dichloroethene	ug/L	0.35 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Benzene	ug/L	0.32 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Ethylbenzene	ug/L	0.14 U	0.4 U	0.4 U	0.4 U	0.4 U	3.2 =	10.5 =
Tetrachloroethene	ug/L	0.11 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Toluene	ug/L	0.37 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 J
Trichloroethene	ug/L	0.34 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Xylenes, Total	ug/L	0.12 U	0.4 U	0.4 U	0.4 U	0.4 U	18.5 =	155 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		ACKERMAN	EW-01	EW-02	EW-03	EW-03	EW-04	EW-05
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water, Dup	Water	Water
Sample Collection Date:		09/19/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000
Field Sample Identification:		00CF13-27	00CF13-29	00CF13-30	00CF13-31	00CF13-46	00CF13-32	00CF13-33
Laboratory Sample Identification:		00-A132862	00-A133520	00-A133521	00-A133522	00-A133518	00-A133523	00-A133524
Metals	**Units**							
Arsenic	ug/L	5 U	7 =	9 =	19 =	18 =	16 =	8 =
Barium	ug/L	20 =	408 =	592 =	735 =	754 =	572 =	275 =
Cadmium	ug/L	NR	1 U	1 U	1 U	1 U	1 U	1 U
Cobalt	ug/L	NR	NR	NR	NR	NR	NR	NR
Iron	mg/L	3.37 J	2.11 J	5.74 J	8.12 J	8.4 J	4.47 J	1.68 J
Lead	ug/L	1.5 U	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ
Manganese	ug/L	147 J	1390 J	1810 J	2220 J	2280 J	1990 J	1820 J
Mercury	ug/L	NR	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Vanadium	ug/L	NR	NR	NR	NR	NR	NR	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		HUBLEY	MW-01M	MW-01S	MW-01S	MW-02M	MW-04S	MW-05S
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water, Dup	Water	Water	Water
Sample Collection Date:		09/20/2000	09/19/2000	09/19/2000	09/19/2000	09/18/2000	09/18/2000	09/18/2000
Field Sample Identification:		00CF13-28	00CF13-35	00CF13-34	00CF13-45	00CF13-37	00CF13-38	00CF13-39
Laboratory Sample Identification:		00-A133516	00-A132861	00-A132858	00-A132859	00-A132855	00-A132856	00-A132857
Metals	**Units**							
Arsenic	ug/L	5 U	5 U	5 U	5 U	12 =	10 =	11 =
Barium	ug/L	90 =	225 =	32 =	34 =	98 =	231 =	330 =
Cadmium	ug/L	NR	1 U	1 U	1 U	2 =	1 U	1 =
Cobalt	ug/L	NR	5 U	5 U	5 U	NR	NR	NR
Iron	mg/L	0.06 J	2.83 J	0.152 J	0.35 J	22.3 J	7.05 J	18.2 J
Lead	ug/L	1.5 UJ	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Manganese	ug/L	420 J	1740 J	1220 J	1340 J	2210 J	1790 J	2100 J
Mercury	ug/L	NR	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Vanadium	ug/L	NR	5 U	5 U	5 U	NR	NR	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML
Field Sample Location:		MW-06M	MW-06S	MW-08M	MW-08S	MW-14S
Sample Interval:		N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water
Sample Collection Date:		09/19/2000	09/19/2000	09/19/2000	09/19/2000	09/20/2000
Field Sample Identification:		00CF13-41	00CF13-40	00CF13-43	00CF13-42	00CF13-44
Laboratory Sample Identification:		00-A132864	00-A132863	00-A132866	00-A132865	00-A133517
Metals	**Units**					
Arsenic	ug/L	5 U	5 U	5 U	5 U	5 U
Barium	ug/L	649 =	114 =	543 =	151 =	89 =
Cadmium	ug/L	NR	NR	NR	NR	NR
Cobalt	ug/L	NR	NR	NR	NR	NR
Iron	mg/L	0.05 J	0.05 J	0.05 J	0.05 J	1.84 J
Lead	ug/L	1.5 U	1.5 U	1.5 U	1.5 U	1.5 UJ
Manganese	ug/L	1530 J	1480 J	2170 J	391 J	1210 J
Mercury	ug/L	NR	NR	NR	NR	NR
Vanadium	ug/L	NR	NR	NR	NR	NR

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		ACKERMAN	EW-01	EW-02	EW-03	EW-03	EW-04	EW-05
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water	Water, Dup	Water	Water
Sample Collection Date:		09/19/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000	09/20/2000
Field Sample Identification:		00CF13-27	00CF13-29	00CF13-30	00CF13-31	00CF13-46	00CF13-32	00CF13-33
Laboratory Sample Identification:		00-A132862	00-A133520	00-A133521	00-A133522	00-A133518	00-A133523	00-A133524
General Chem	**Units**							
pH	ph units	7.18 =	7.3 =	7.2 =	7.15 =	7.15 =	7.29 =	7.42 =
Color	color unit	1 =	16 =	17 =	32 =	1 =	16 =	32 =
Odor	t.o.n.	128 =	16 =	128 =	256 =	128 =	64 =	64 =
Oil & Grease, Total Rec	mg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Total Dissolved Solids (Residue, Filterable)	mg/L	260 =	460 =	370 =	350 =	350 =	320 =	330 =
Turbidity	ntu	122 =	30.2 =	79 =	106 =	95 =	54.4 =	6.98 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML	OML	OML	OML	OML	OML
Field Sample Location:		HUBLEY	MW-01M	MW-01S	MW-01S	MW-06M	MW-06S	MW-08M
Sample Interval:		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Matrix:		Water	Water	Water	Water, Dup	Water	Water	Water
Sample Collection Date:		09/20/2000	09/19/2000	09/19/2000	09/19/2000	09/19/2000	09/19/2000	09/19/2000
Field Sample Identification:		00CF13-28	00CF13-35	00CF13-34	00CF13-45	00CF13-41	00CF13-40	00CF13-43
Laboratory Sample Identification:		00-A133516	00-A132861	00-A132858	00-A132859	00-A132864	00-A132863	00-A132866
General Chem	**Units**							
pH	ph units	7.78 =	7.25 =	7.13 =	7.13 =	7.59 =	7.65 =	7.52 =
Color	color unit	18 =	18 =	13 =	20 =	12 =	22 =	7 =
Odor	t.o.n.	1 =	128 =	1 =	1 =	1 =	1 =	1 =
Oil & Grease, Total Rec	mg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Total Dissolved Solids (Residue, Filterable)	mg/L	152 =	180 =	220 =	210 =	168 =	208 =	224 =
Turbidity	ntu	1 U	33.6 =	24.4 =	16.7 =	1 U	3.3 =	3.4 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

Onalaska Municipal Landfill
Groundwater Monitoring Results
September, 2000

Field Site Identifier:		OML	OML
Field Sample Location:		MW-08S	MW-14S
Sample Interval:		N/A	N/A
Matrix:		Water	Water
Sample Collection Date:		09/19/2000	09/20/2000
Field Sample Identification:		00CF13-42	00CF13-44
Laboratory Sample Identification:		00-A132865	00-A133517
General Chem	**Units**		
pH	ph units	7.11 =	6.34 =
Color	color unit	1 =	4 =
Odor	t.o.n.	1 =	16 =
Oil & Grease, Total Rec	mg/L	0.4 U	0.652 =
Total Dissolved Solids (Residue, Filterable)	mg/L	220 =	240 =
Turbidity	ntu	24.6 =	7.2 =

QUALIFIER KEY: "U" - Analyte not found at the listed detection limit; "J" - Estimated Result; "B" - Analyte detected in Blank; "=" - Analyte found; "R" - Rejected; "NR" - Not Reported

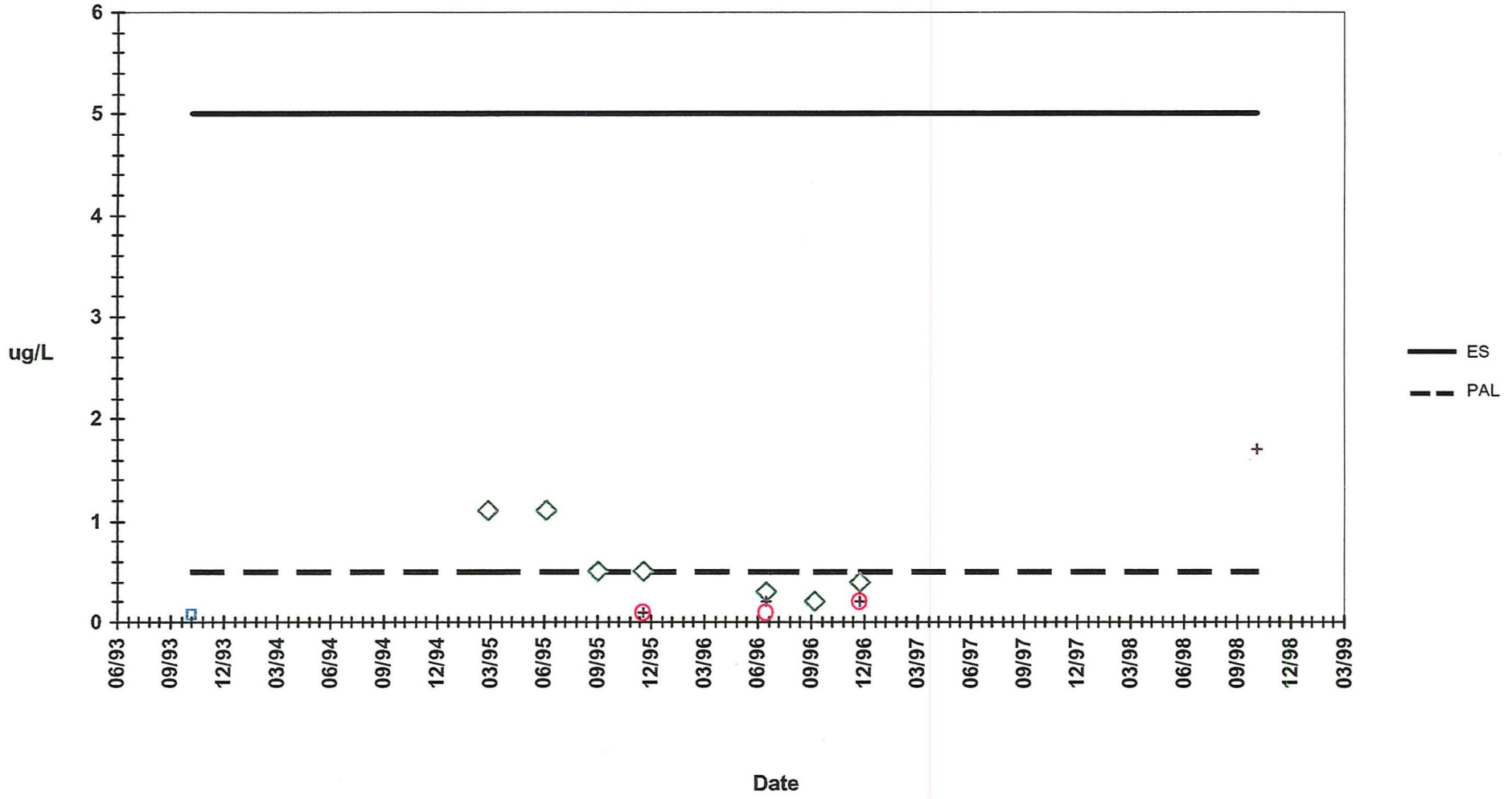
Appendix B

Graphed Groundwater Monitoring Results to Date

Onalaska Municipal Landfill

Extraction Wells - Detects Only

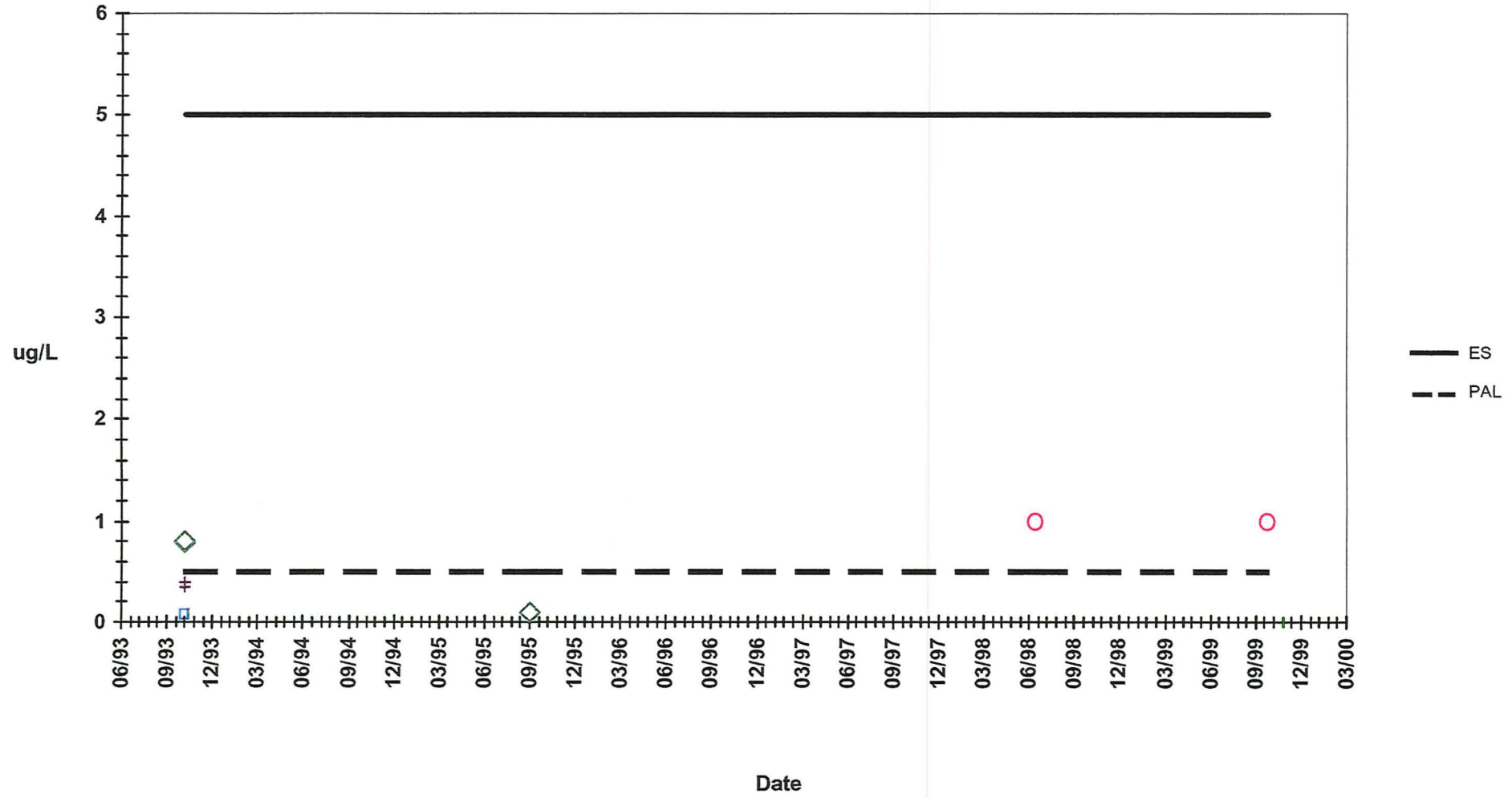
Benzene



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

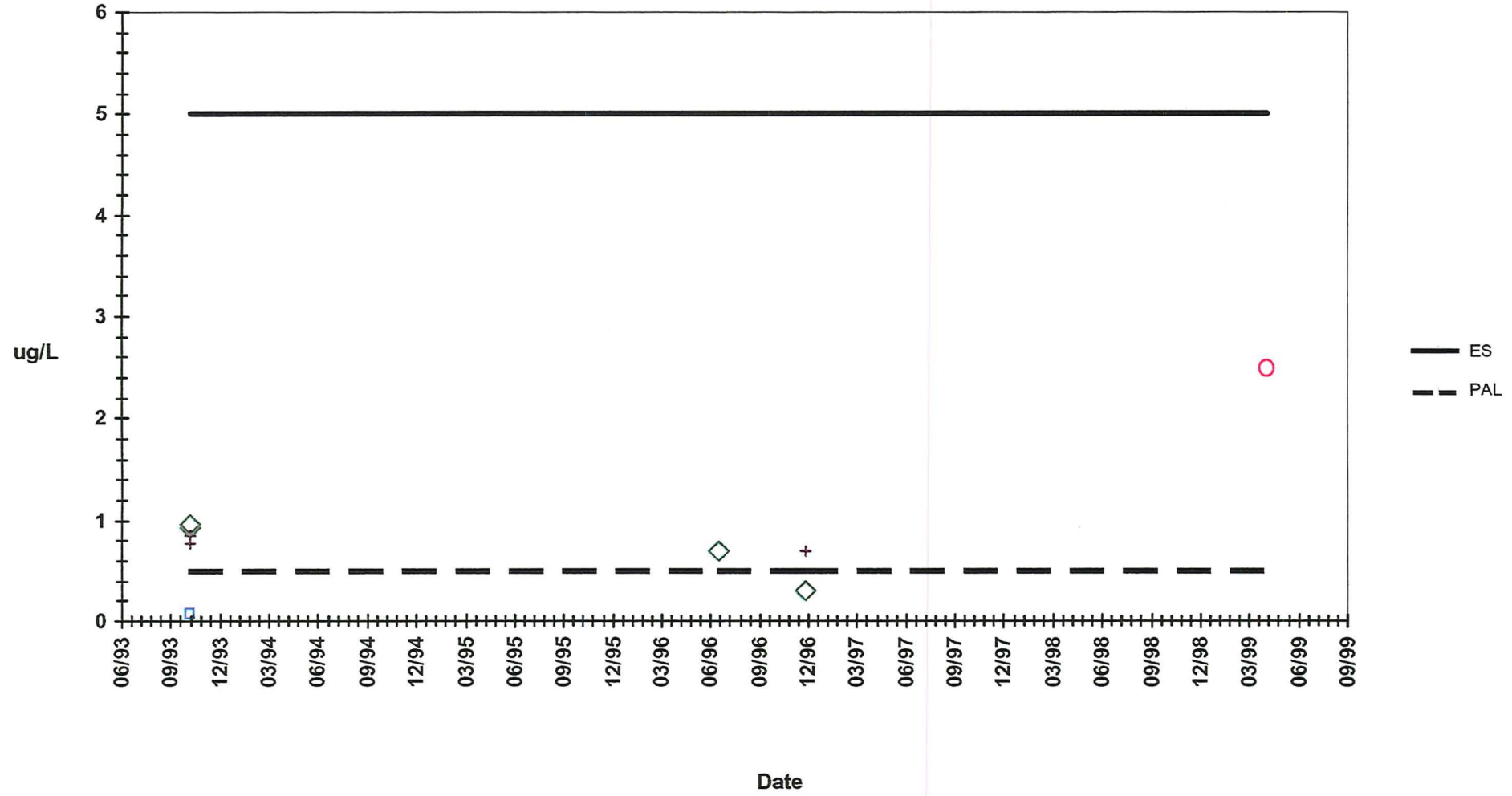
Benzene



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

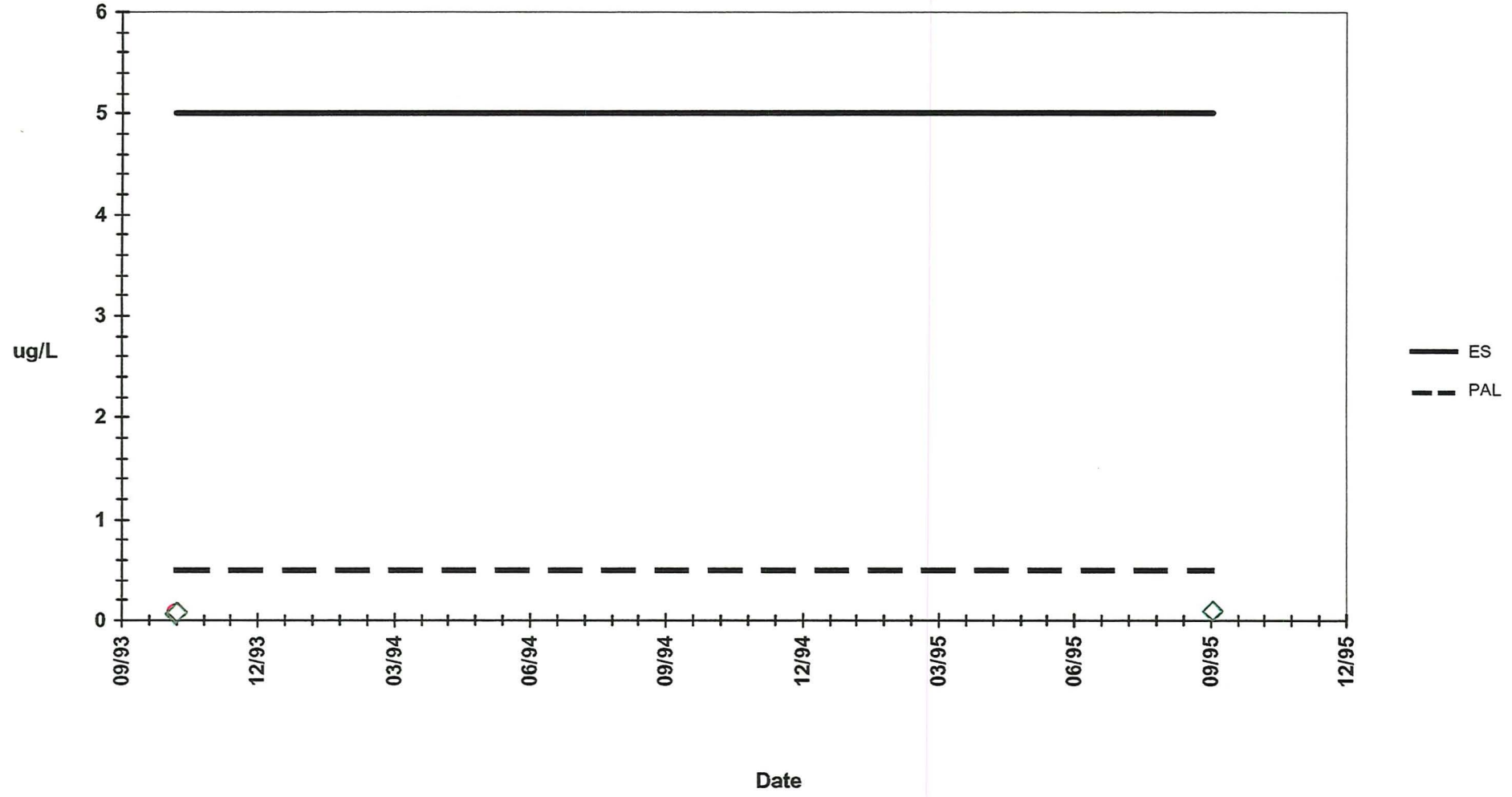
Benzene



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

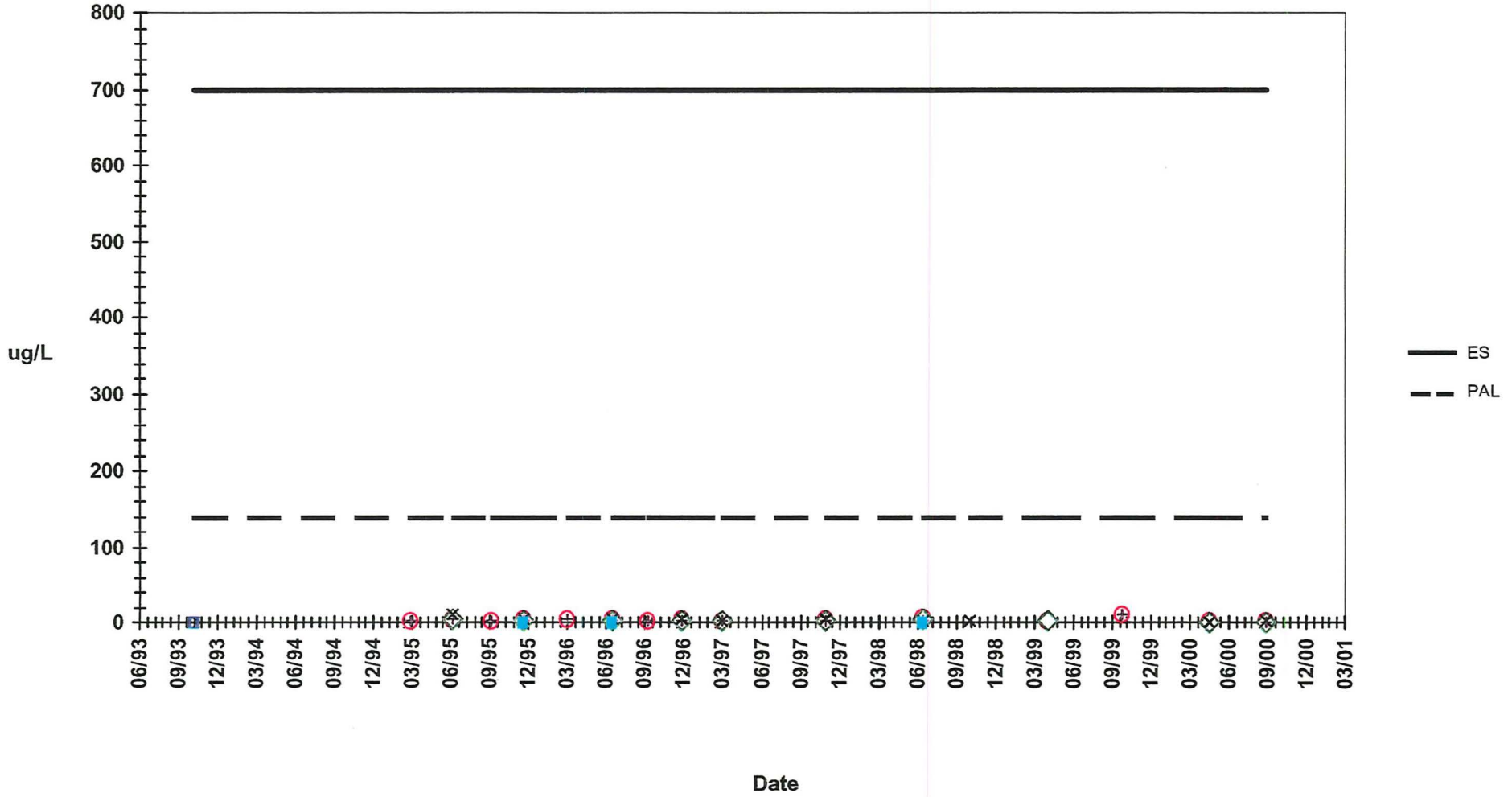
Benzene



Onalaska Municipal Landfill

Extraction Wells - Detects Only

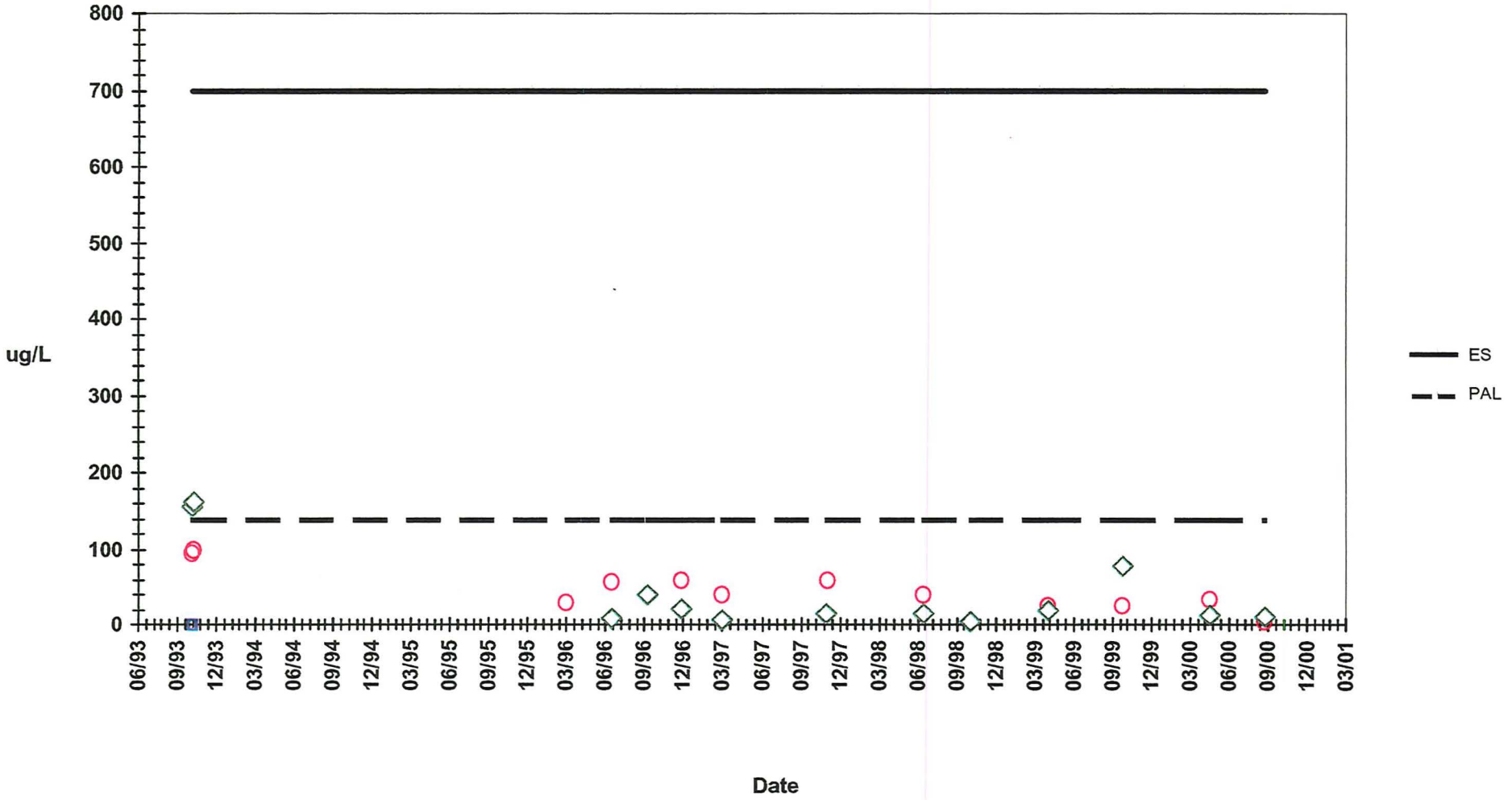
Ethylbenzene



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

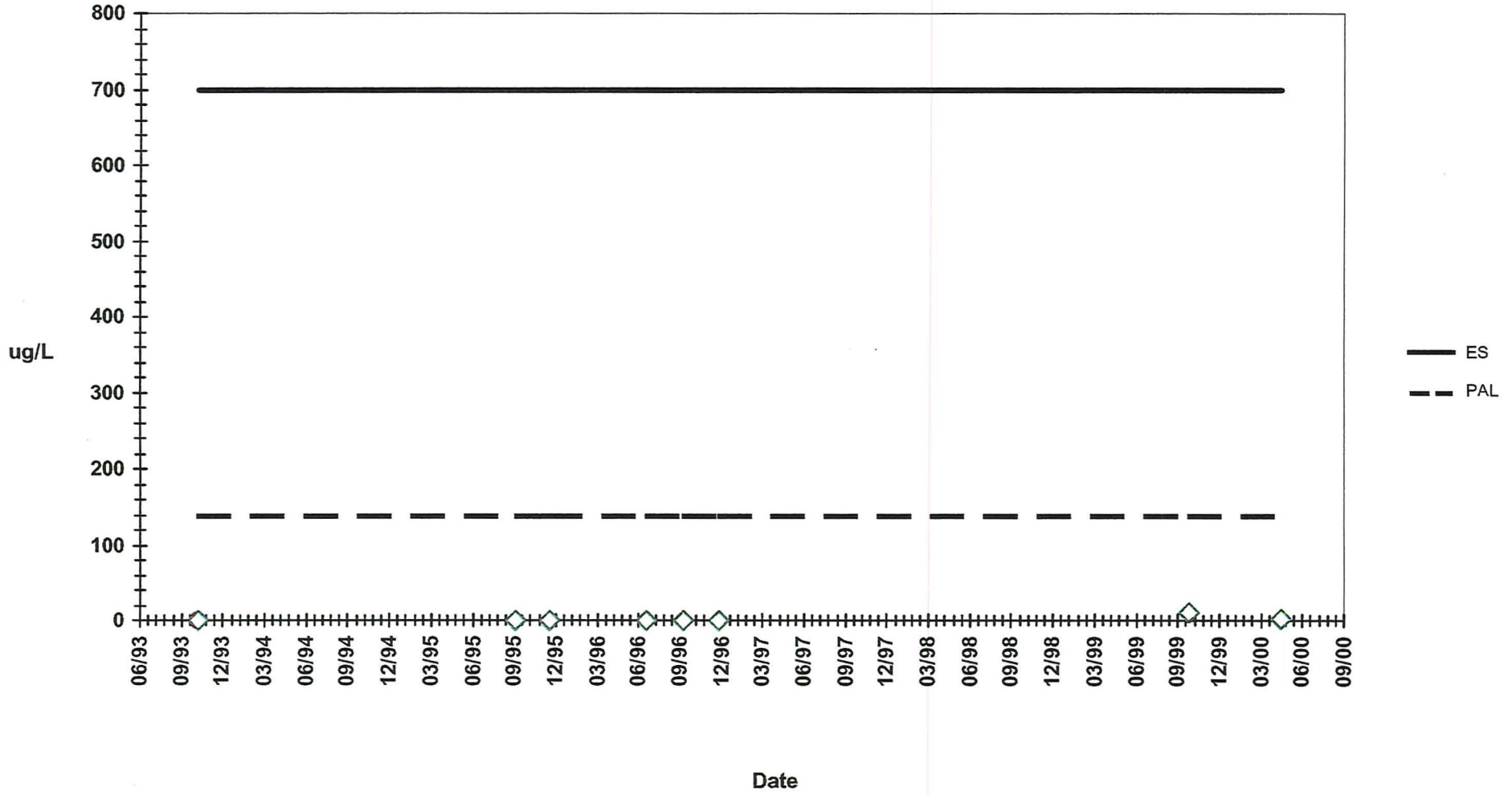
Ethylbenzene



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

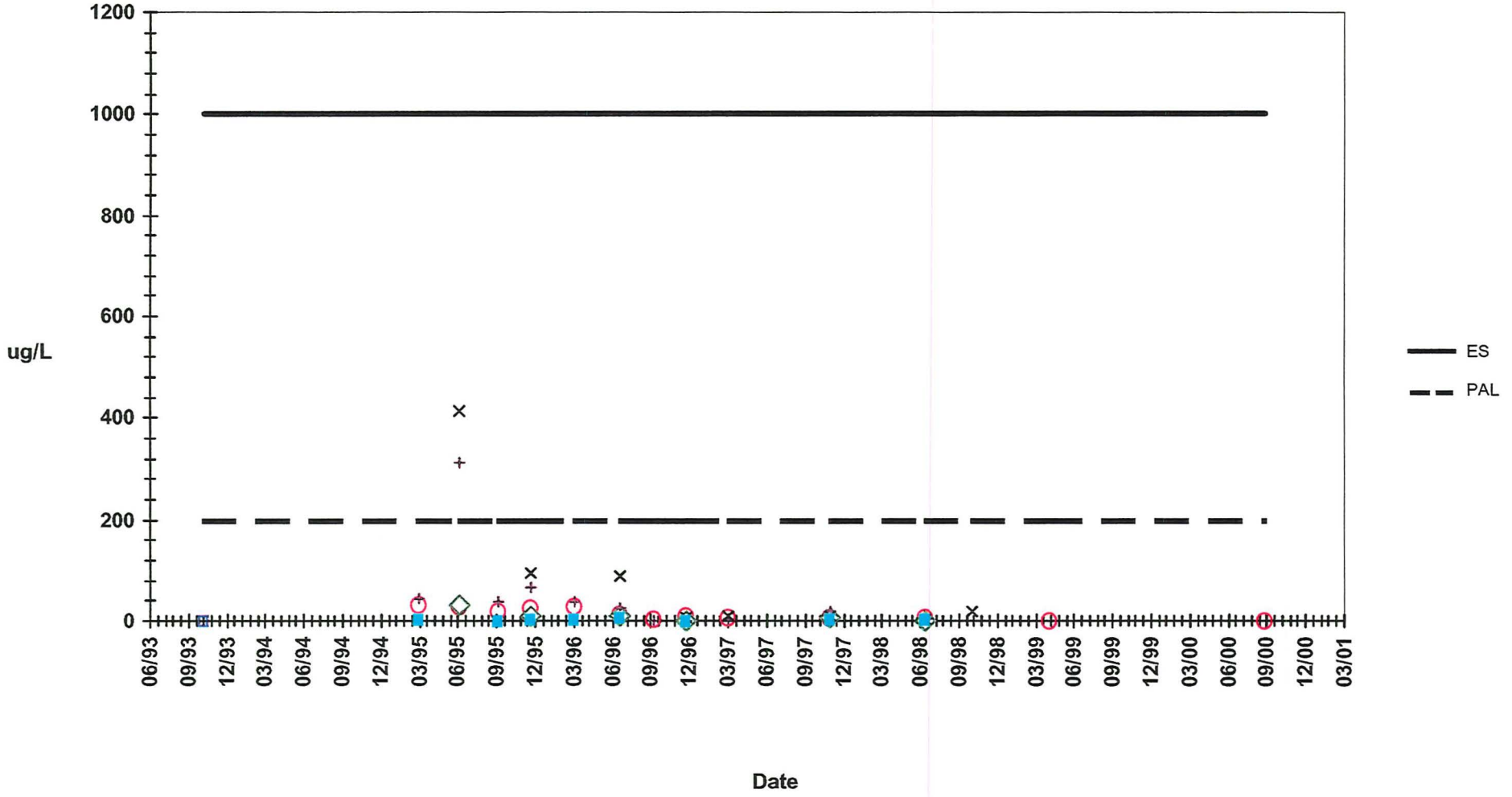
Ethylbenzene



Onalaska Municipal Landfill

Extraction Wells - Detects Only

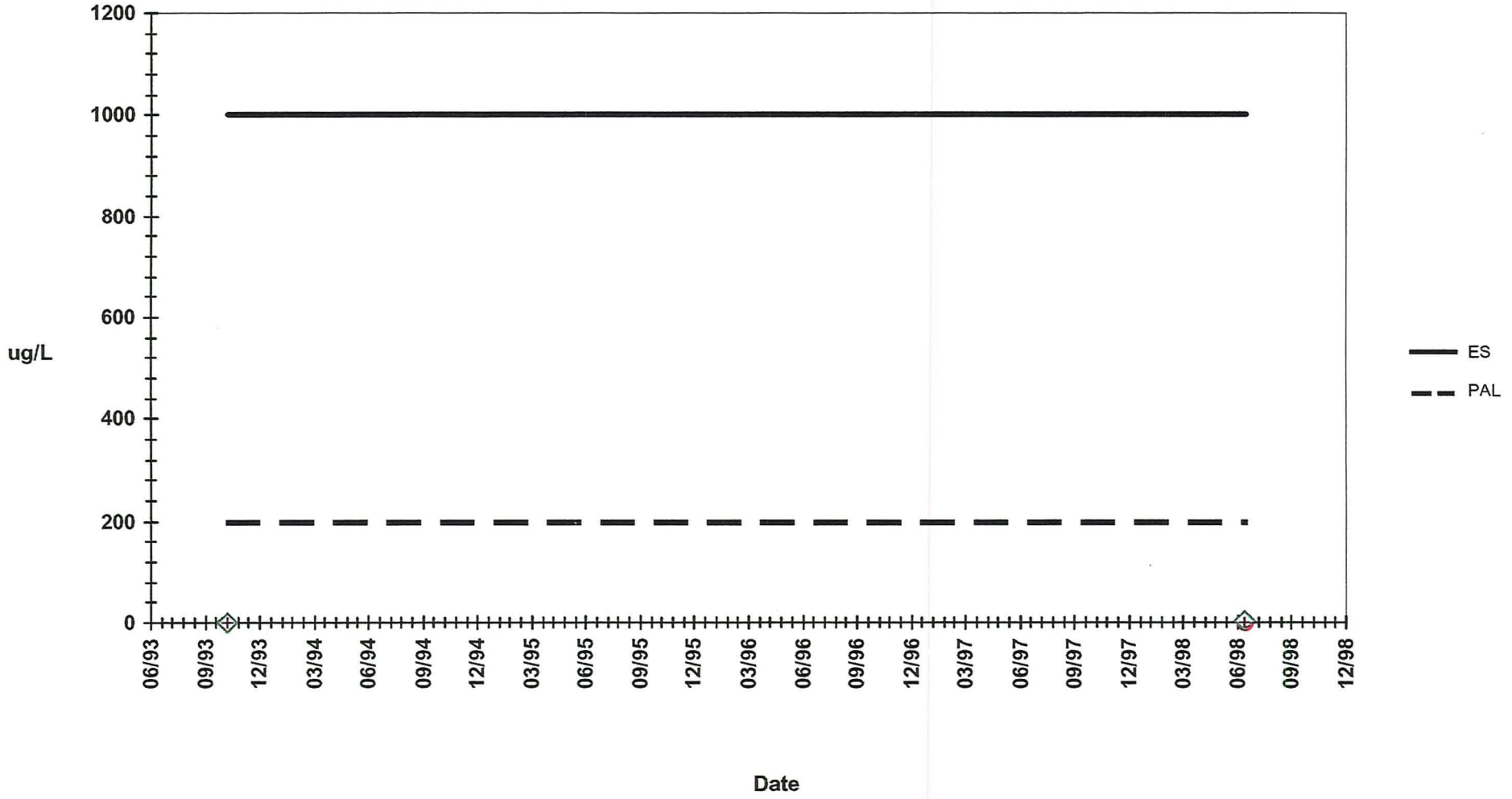
Toluene



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

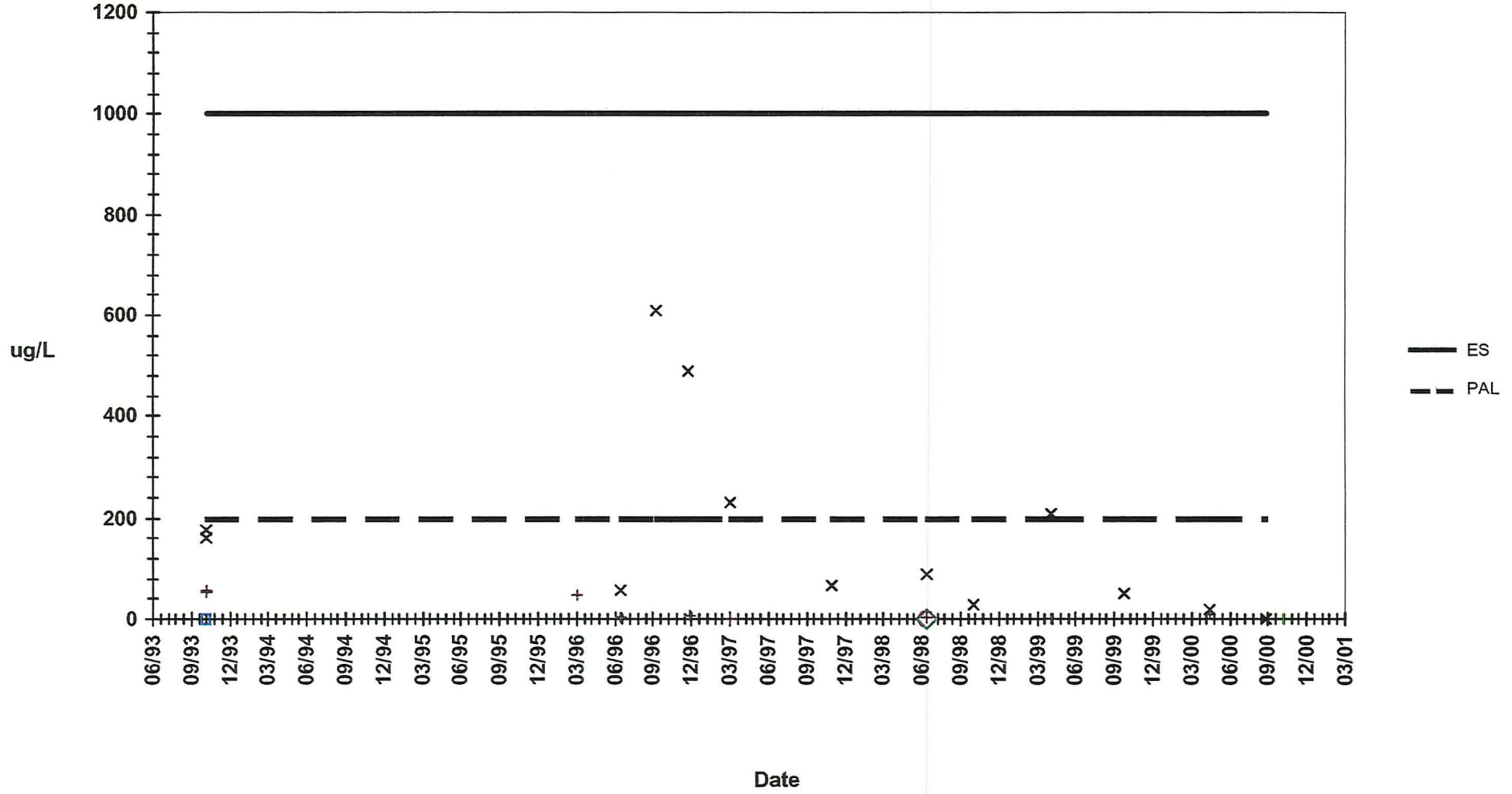
Toluene



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

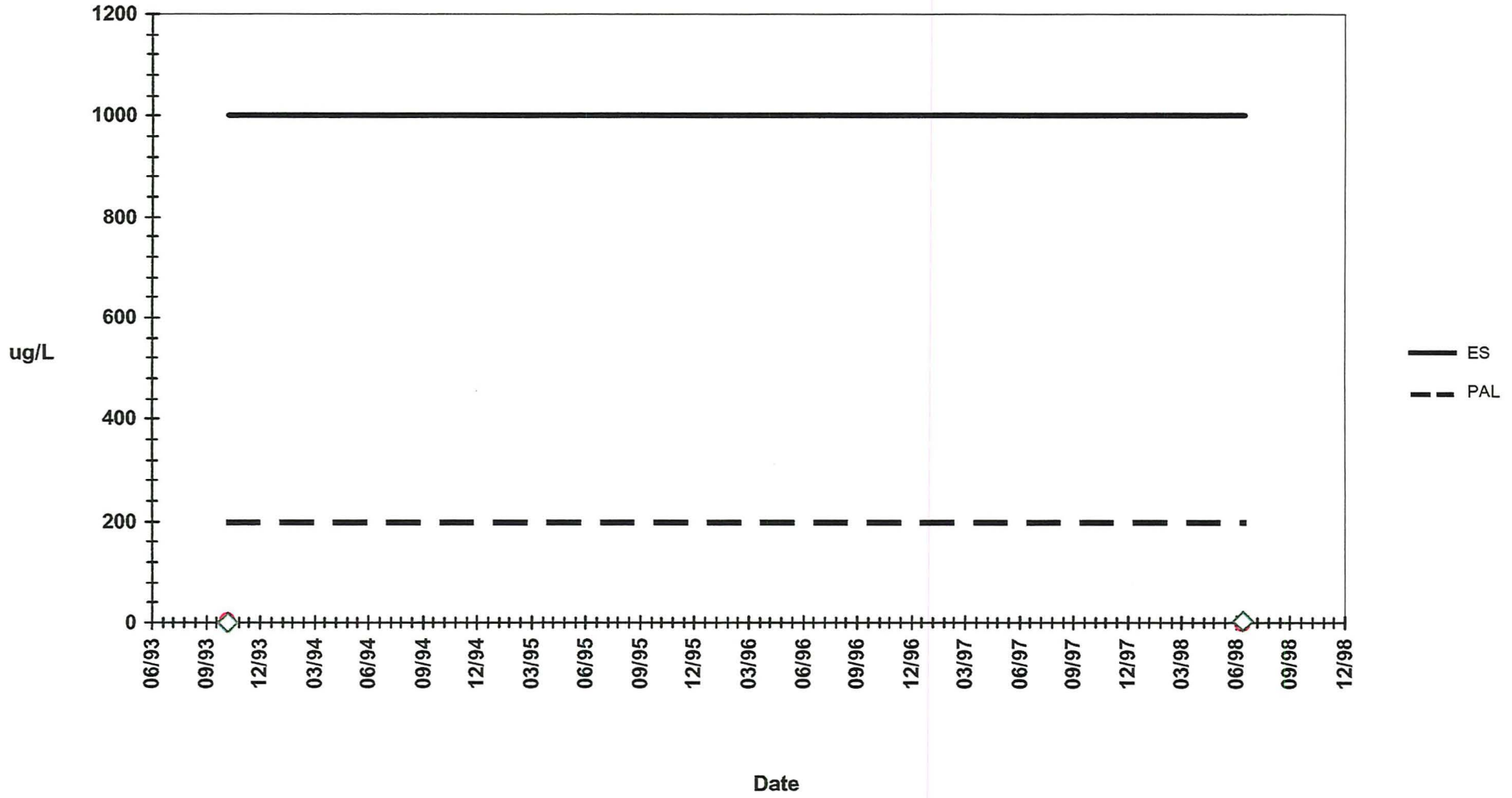
Toluene



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

Toluene

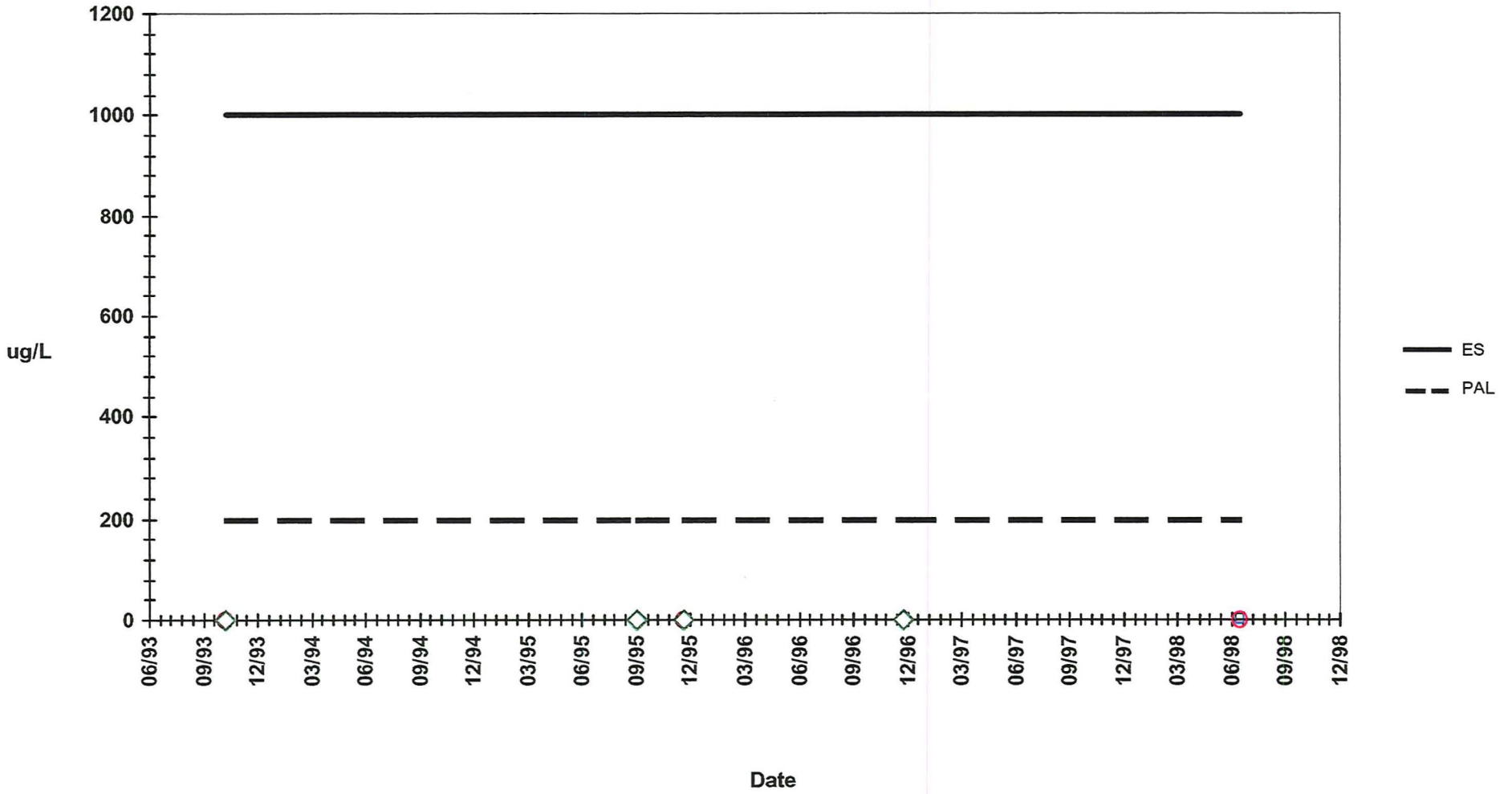


MW-01S MW-06S MW-08S

Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

Toluene

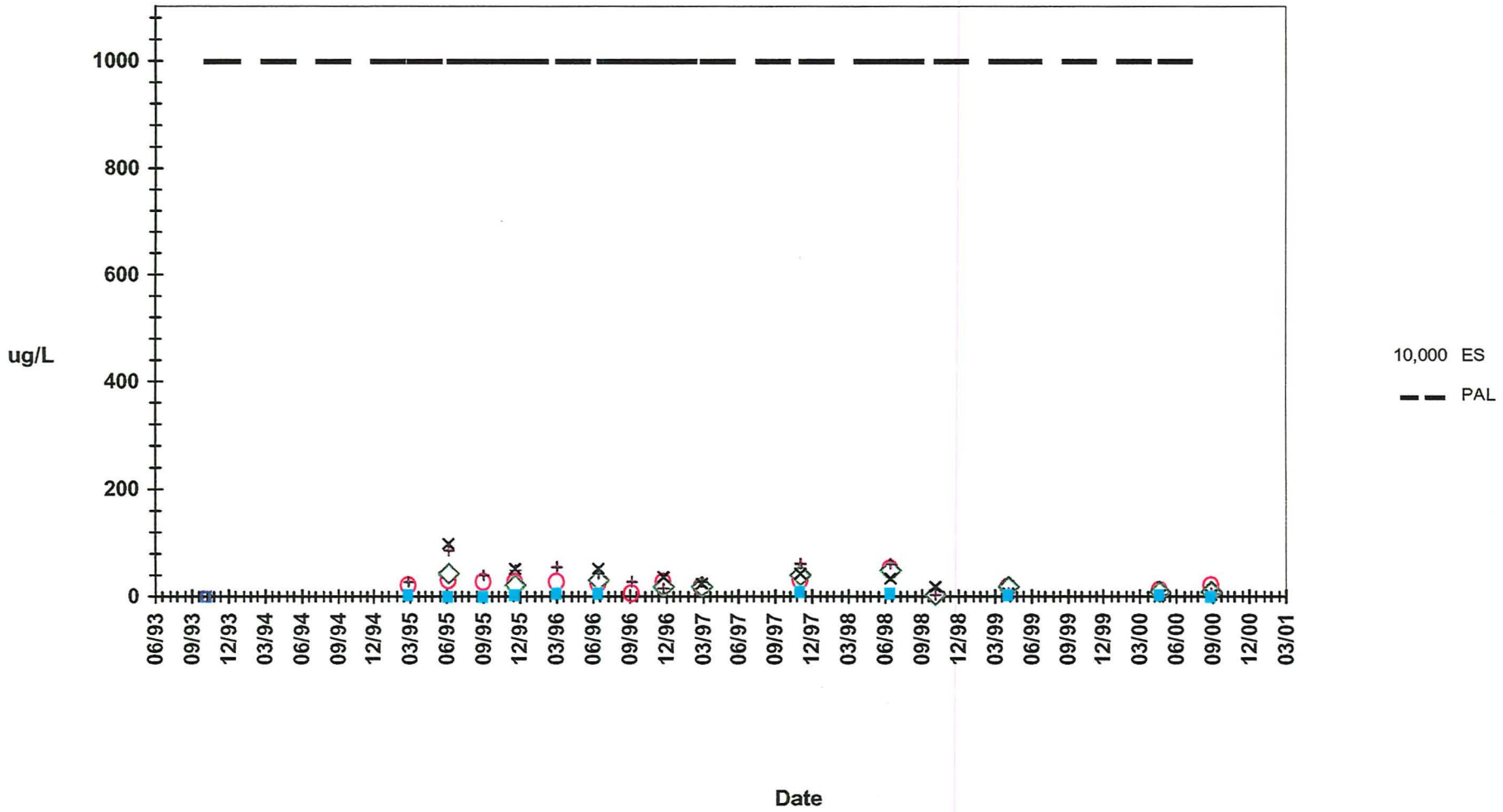


MW-01S MW-12S MW-14S

Onalaska Municipal Landfill

Extraction Wells - Detects Only

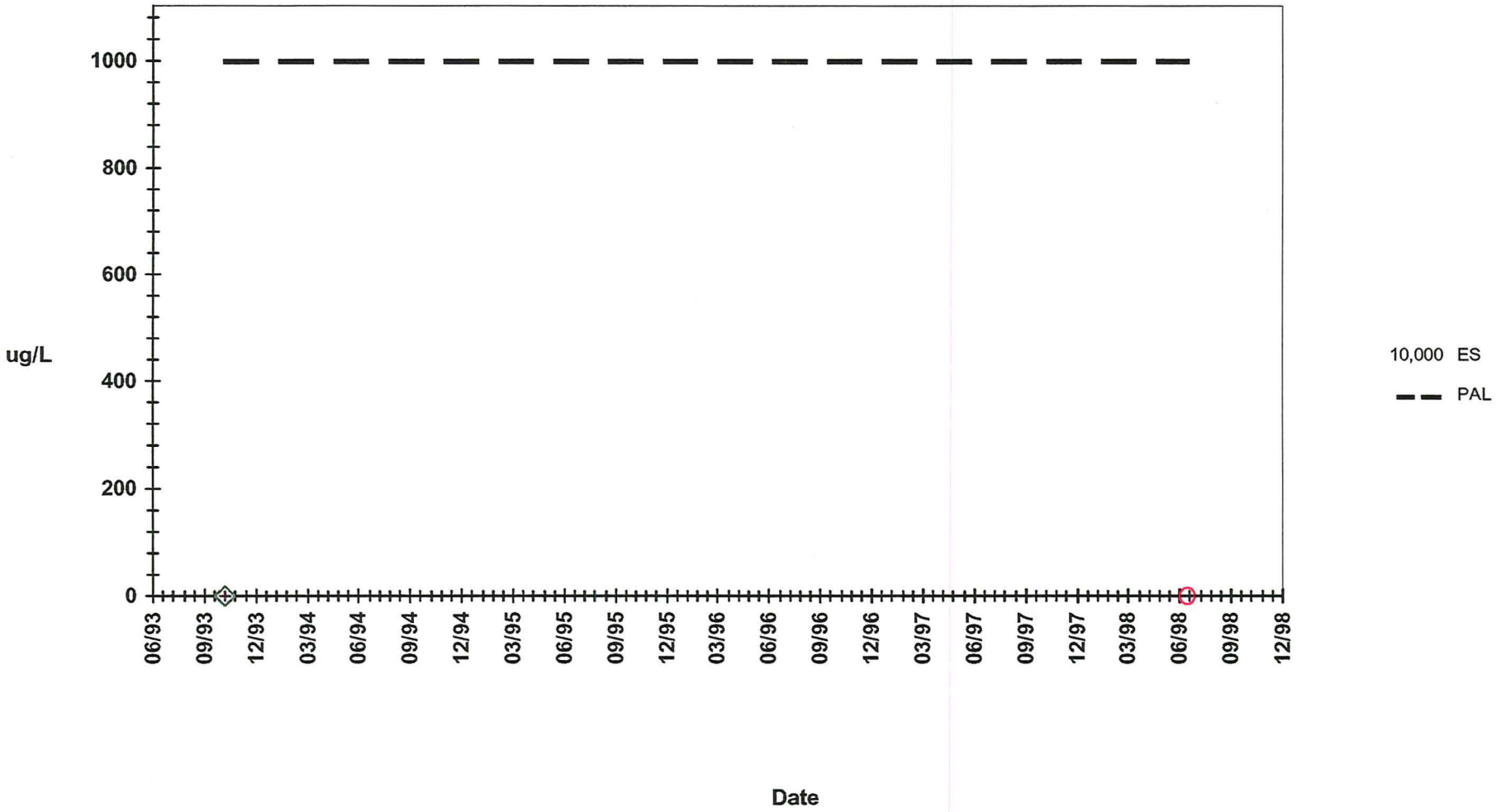
Xylenes, Total



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

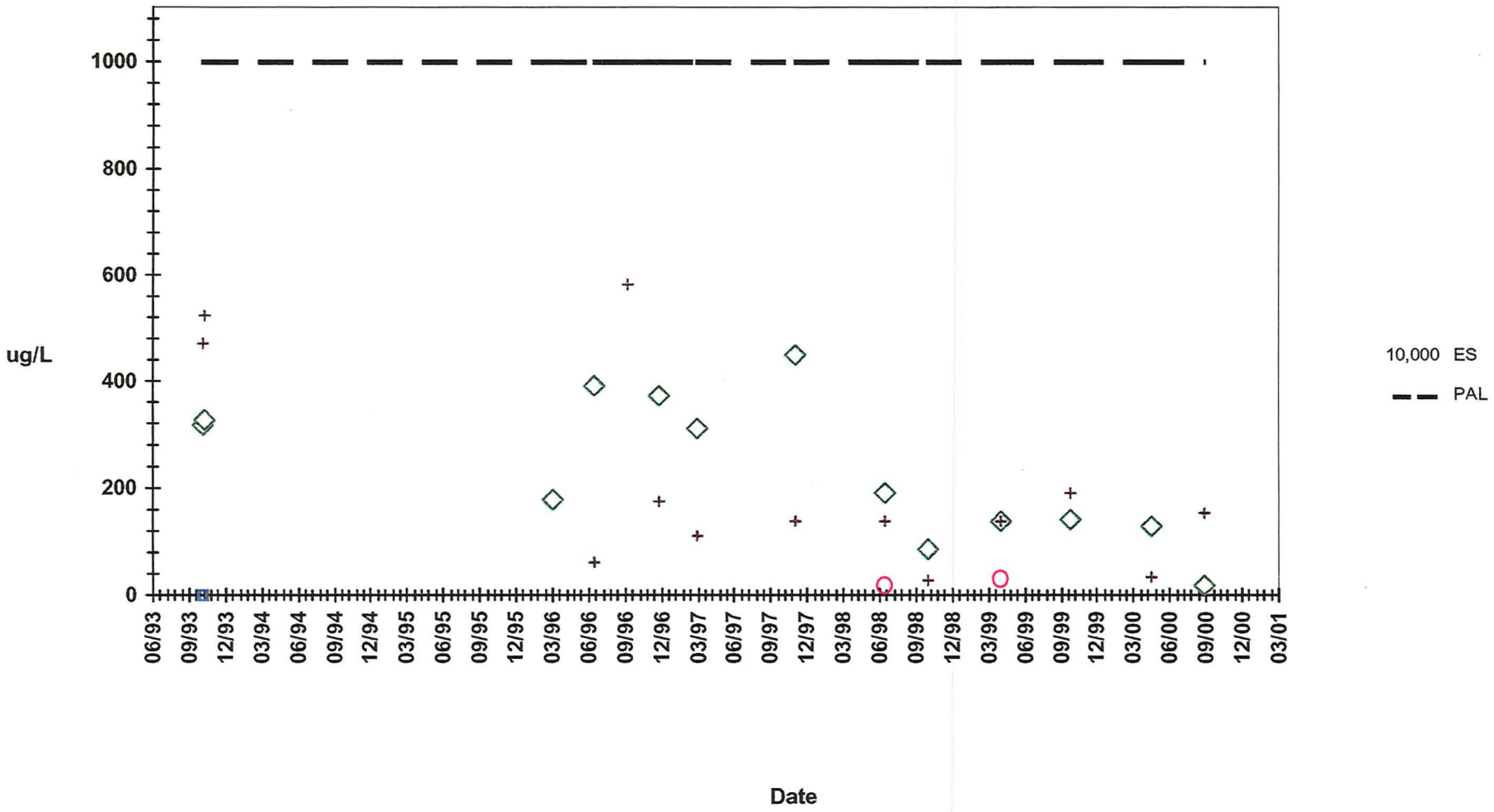
Xylenes, Total



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

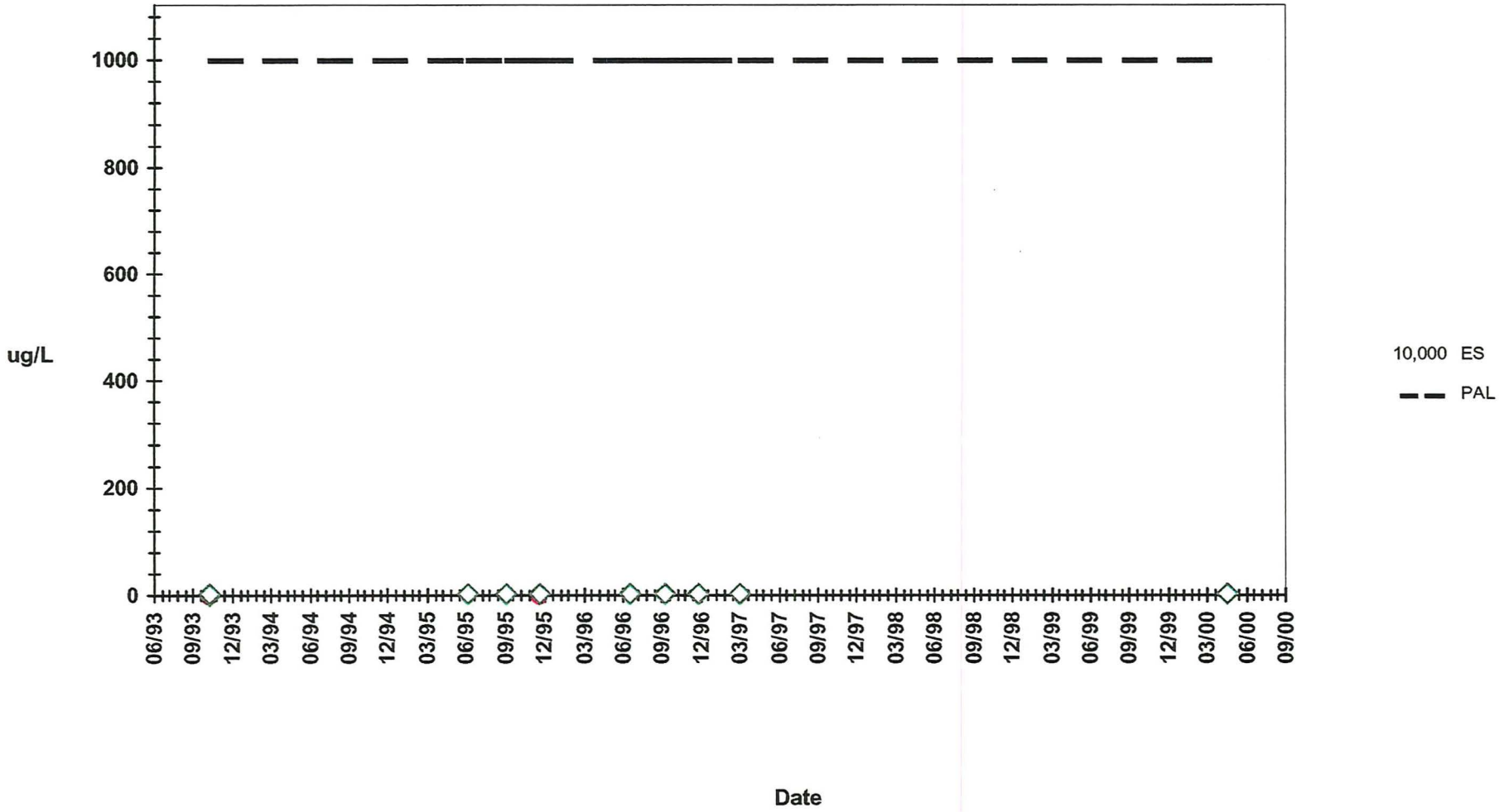
Xylenes, Total



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

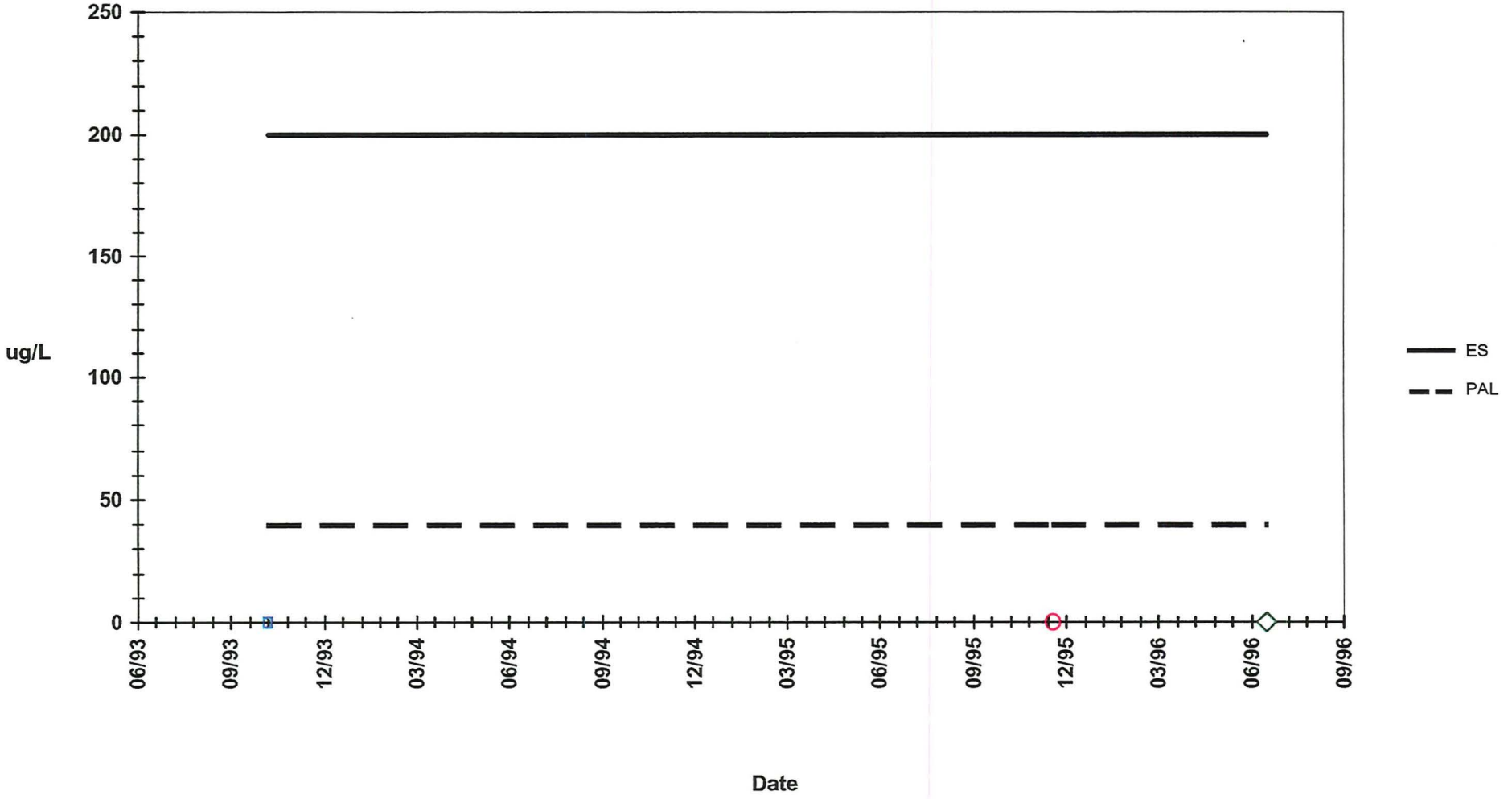
Xylenes, Total



Onalaska Municipal Landfill

Extraction Wells - Detects Only

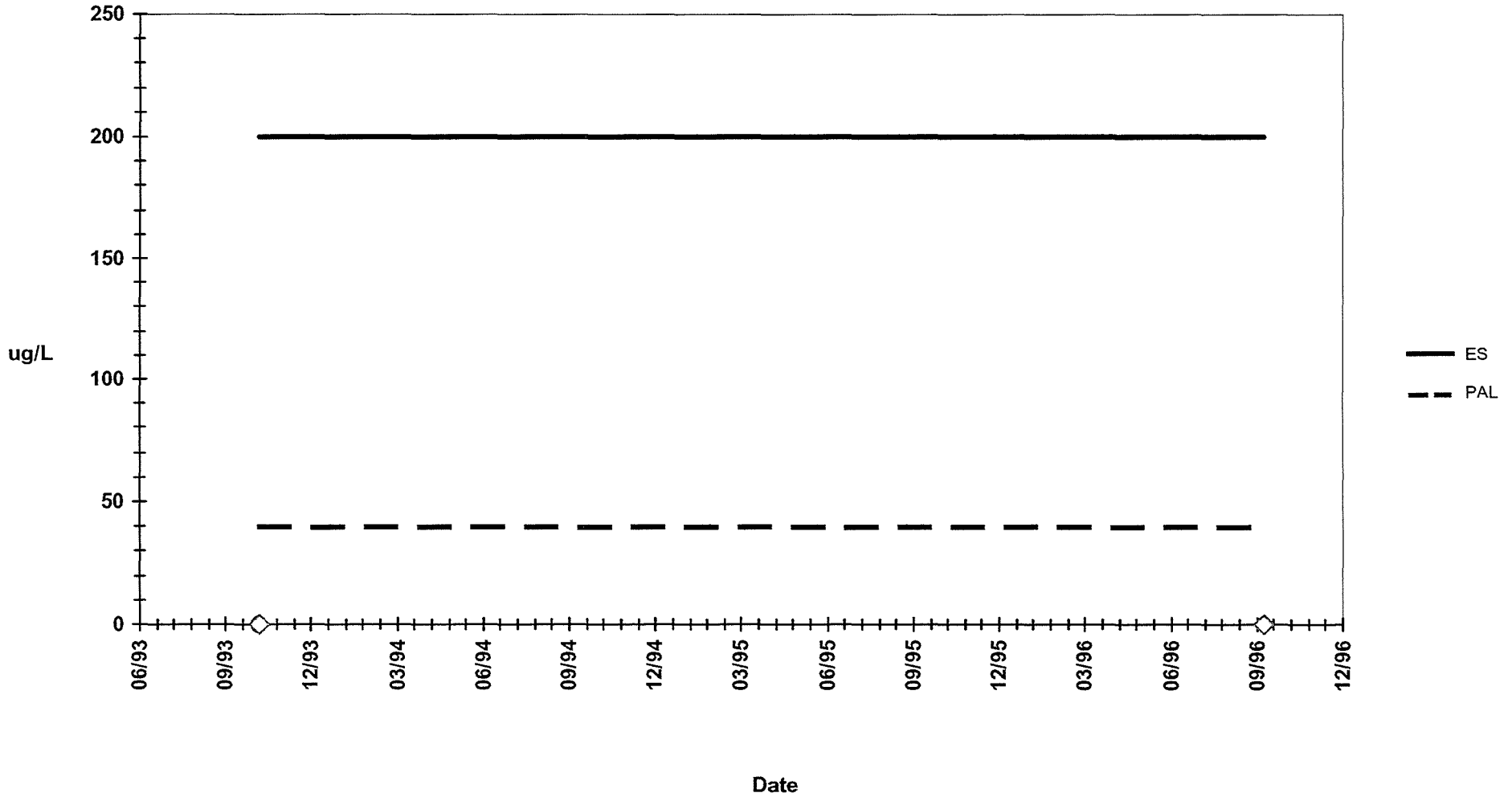
1,1,1-Trichloroethane



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

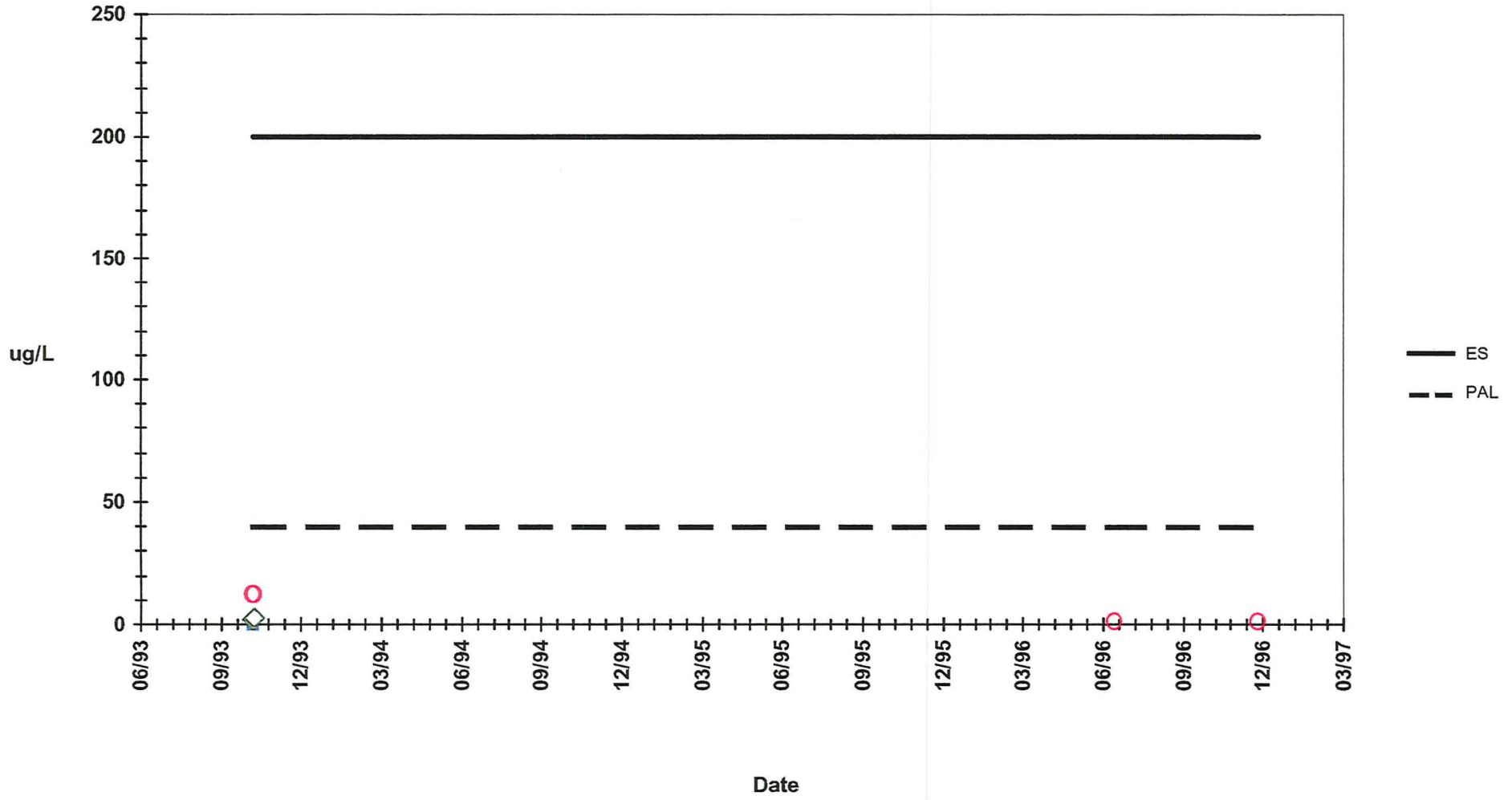
1,1,1-Trichloroethane



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

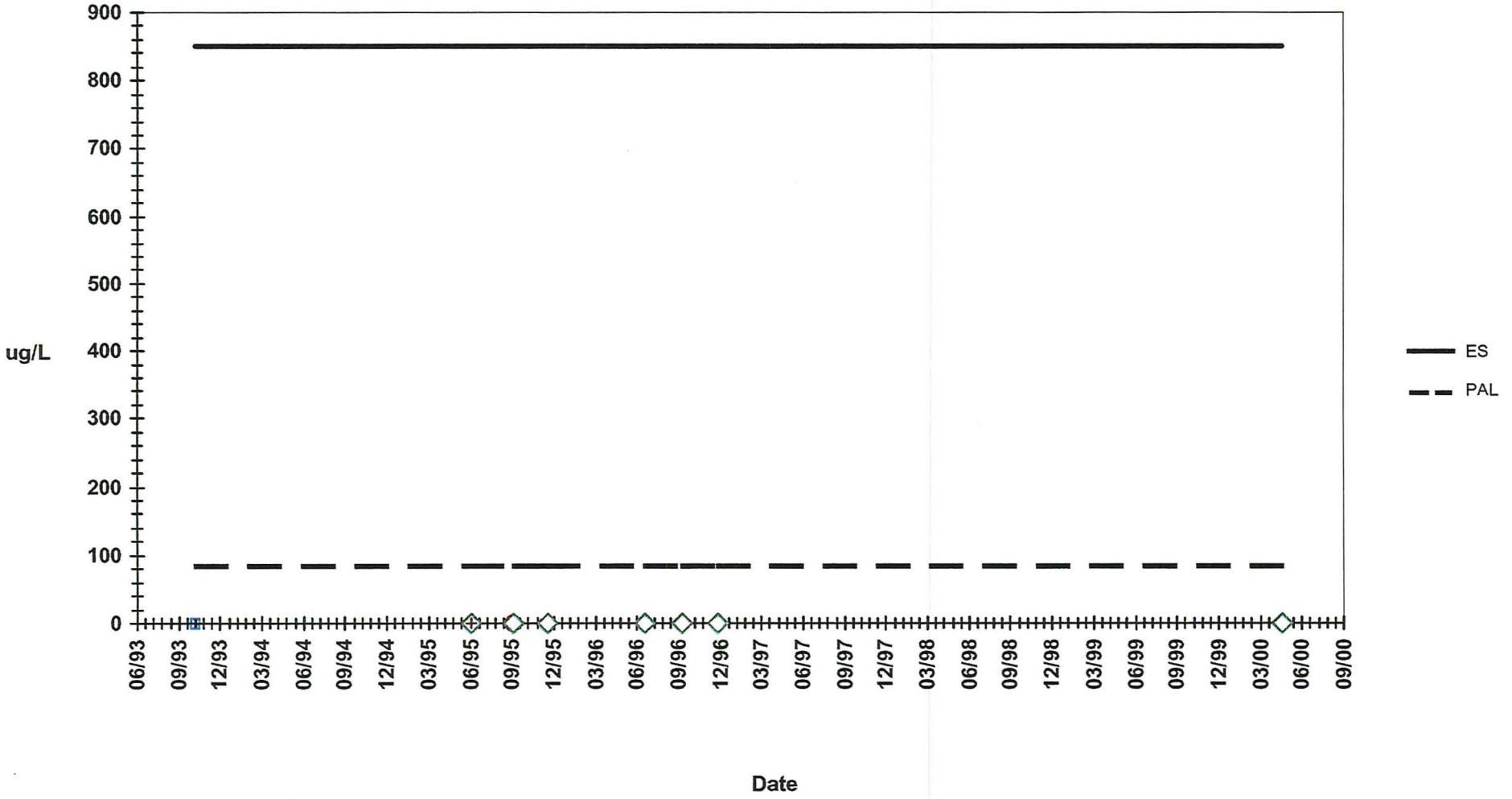
1,1,1-Trichloroethane



Onalaska Municipal Landfill

Extraction Wells - Detects Only

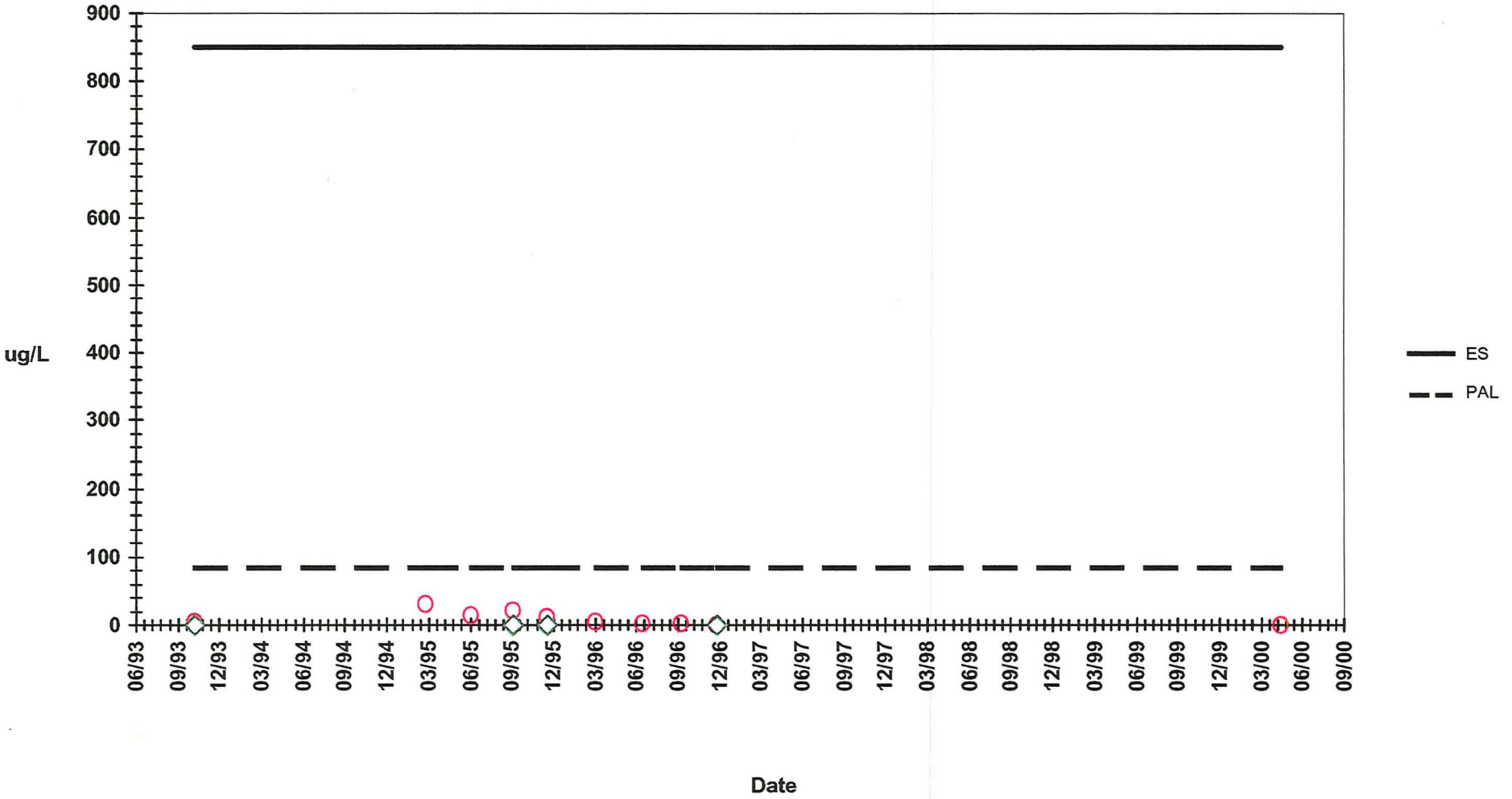
1,1-Dichloroethane



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

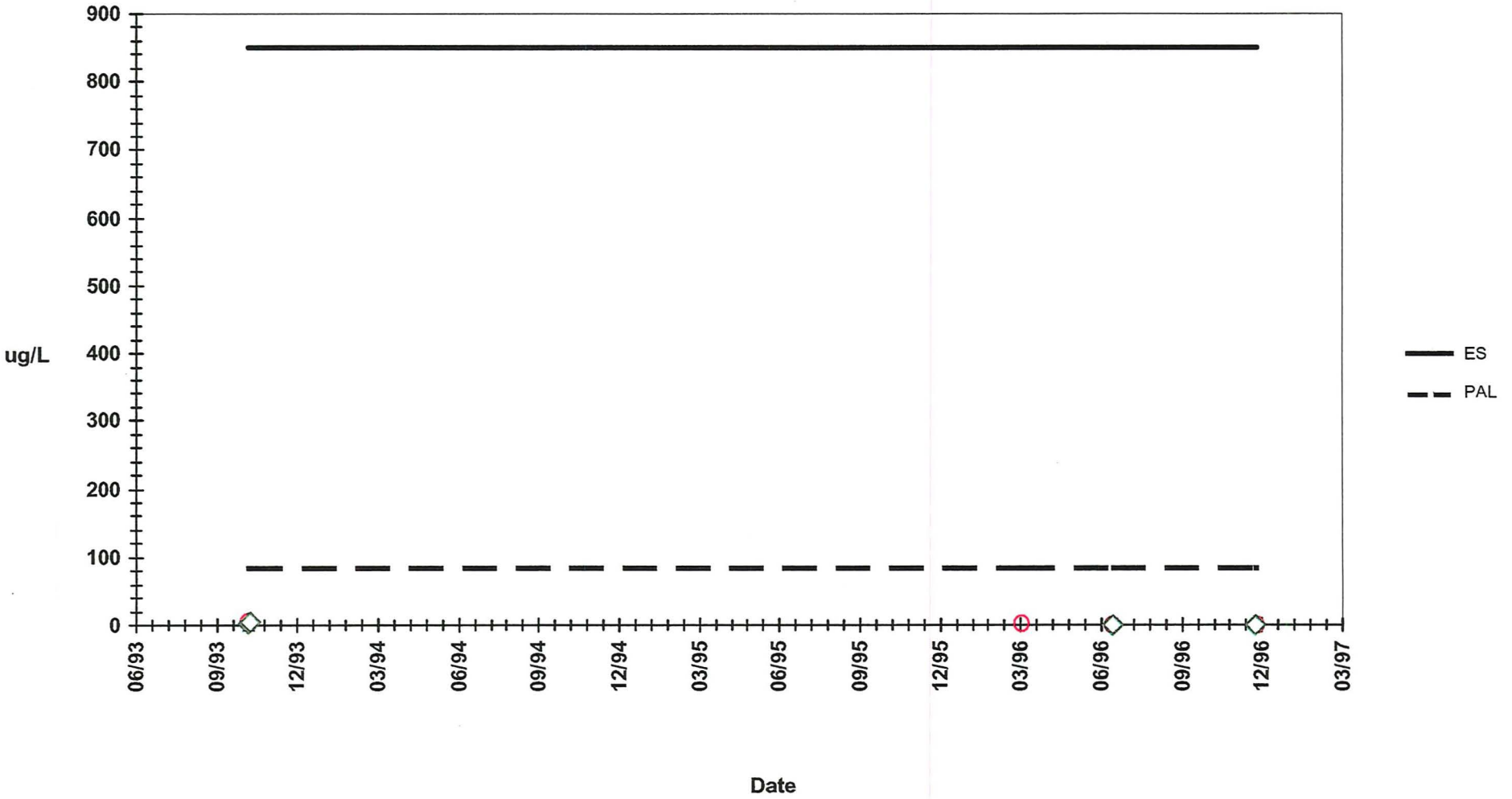
1,1-Dichloroethane



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

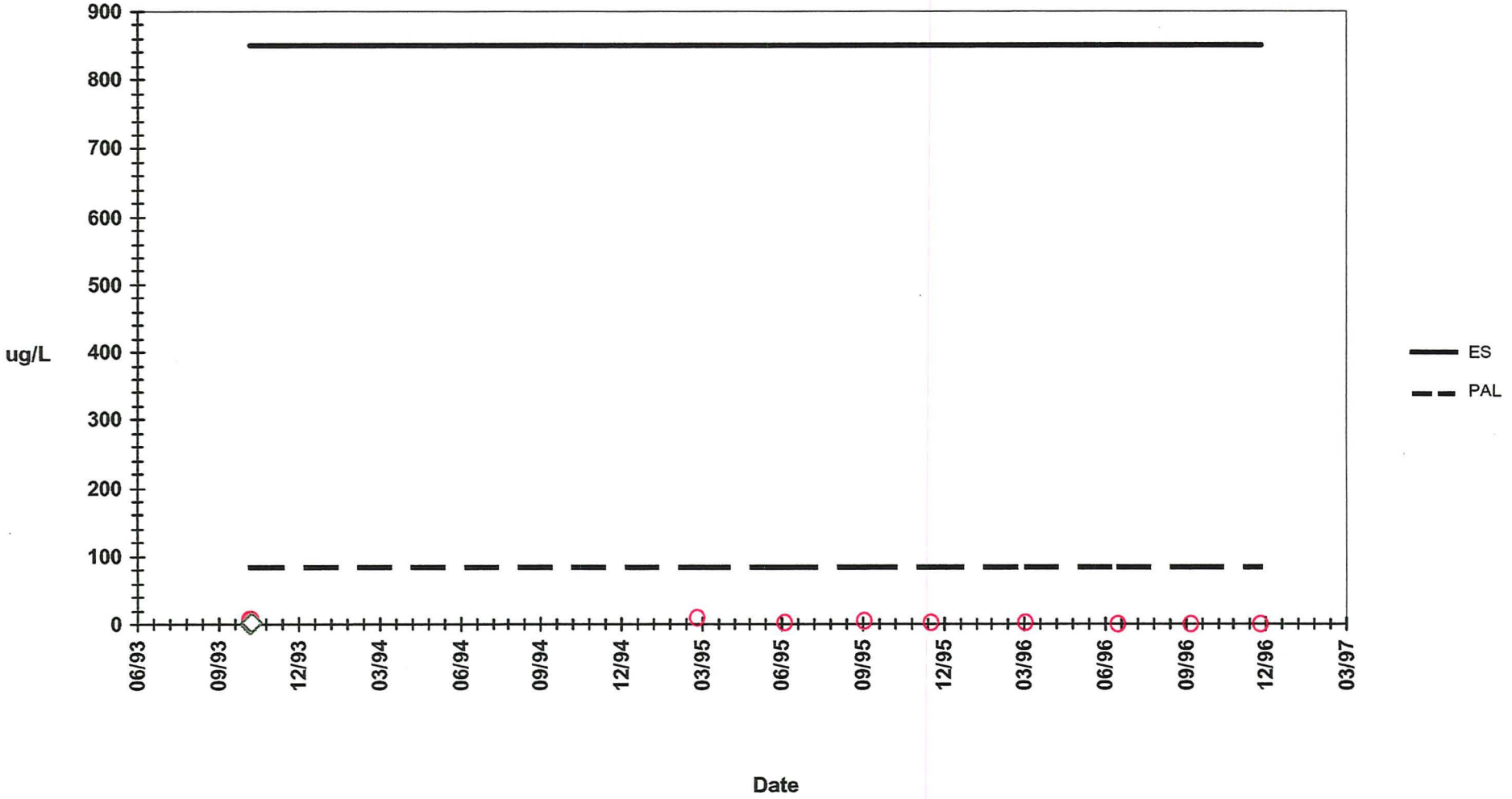
1,1-Dichloroethane



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

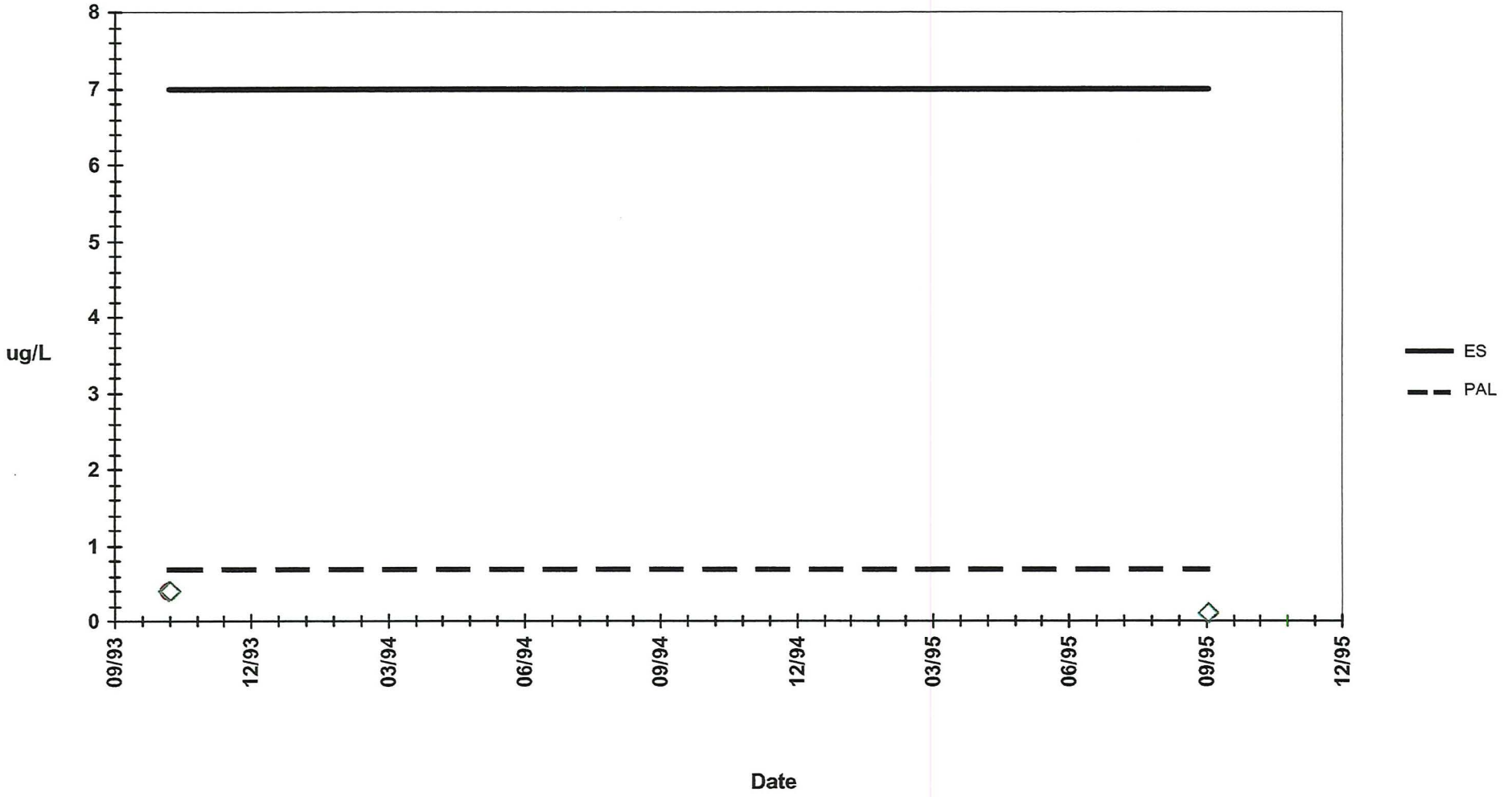
1,1-Dichloroethane



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

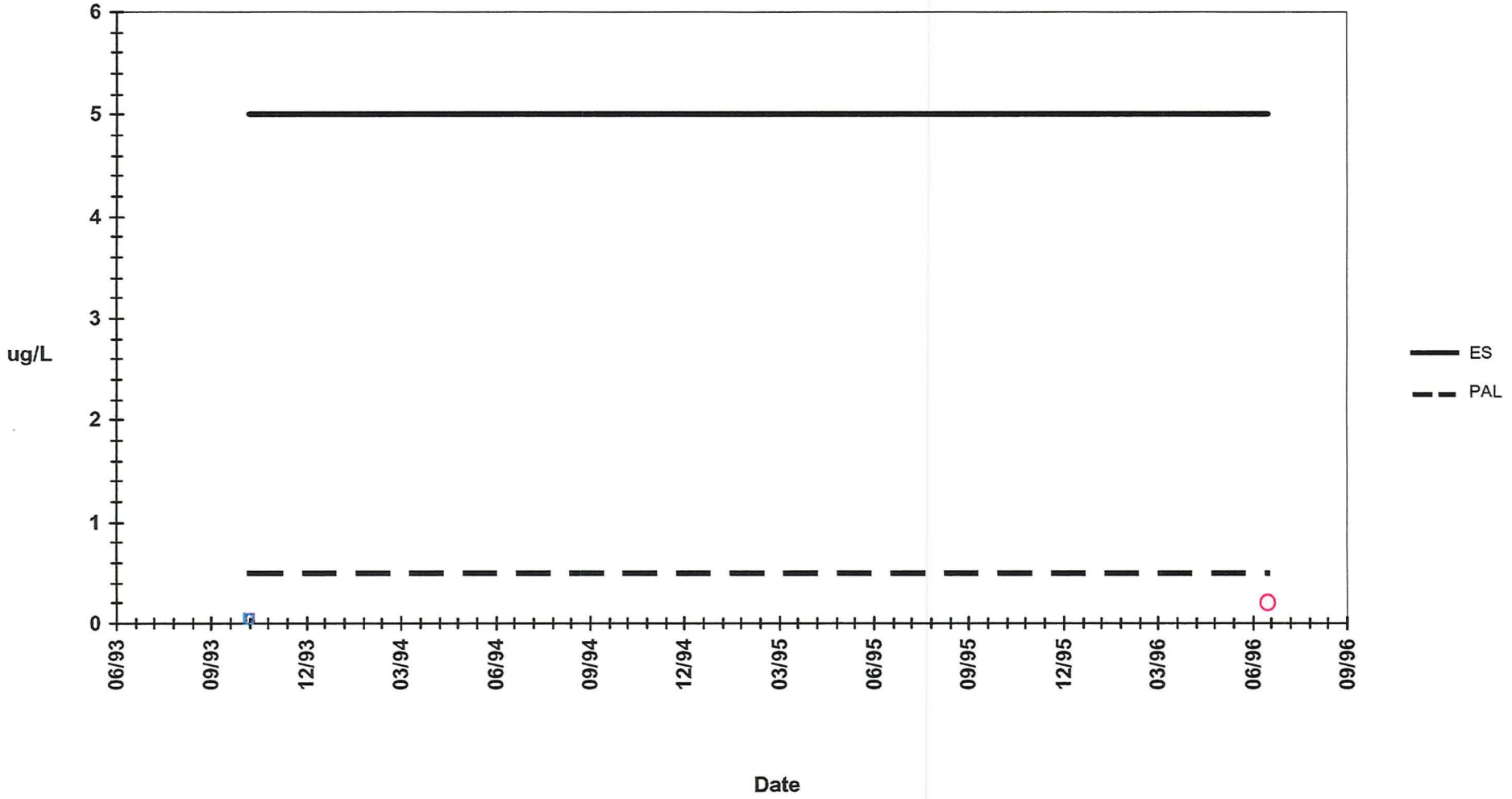
1,1-Dichloroethene



Onalaska Municipal Landfill

Extraction Wells - Detects Only

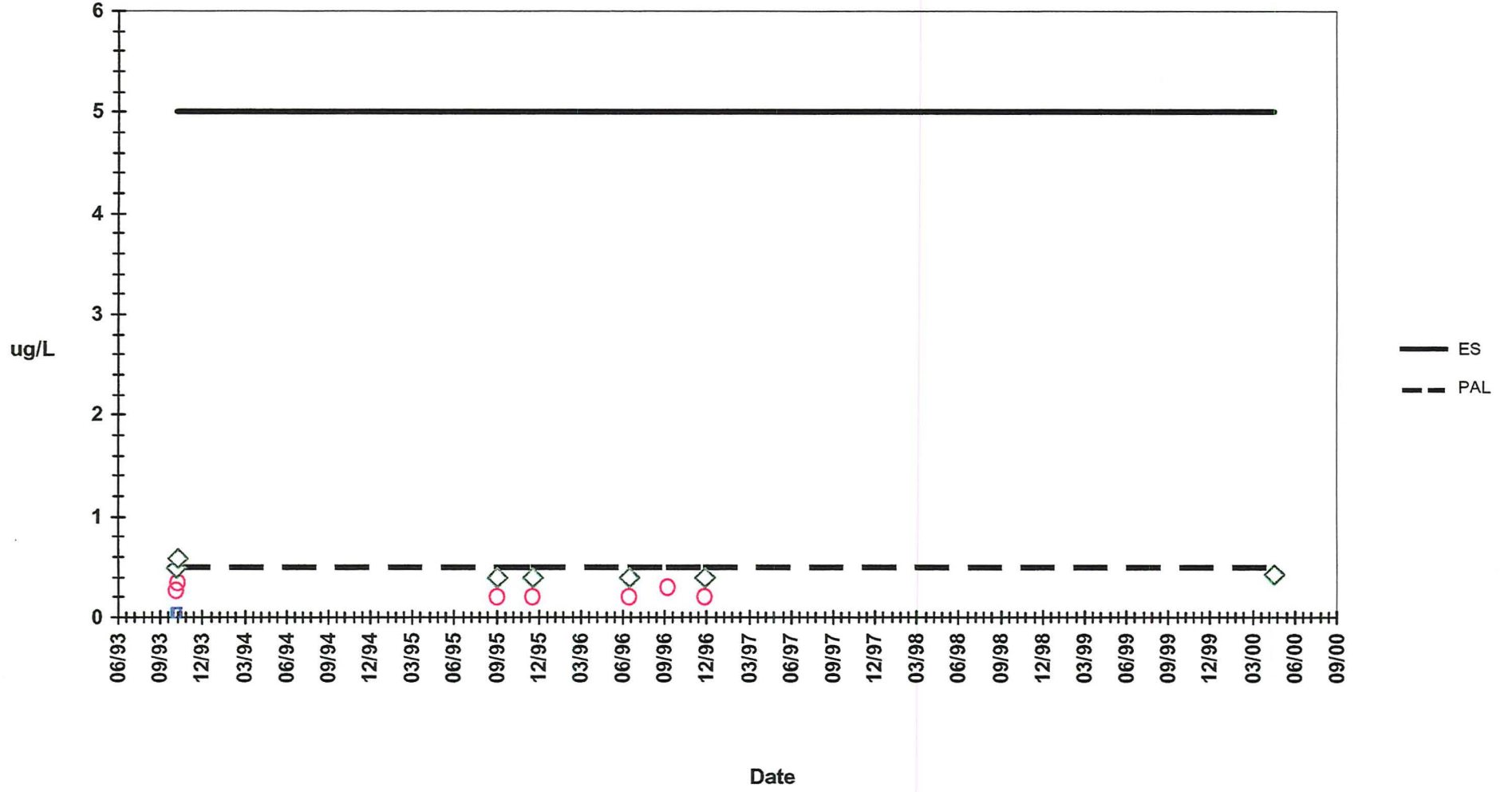
Trichloroethene



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

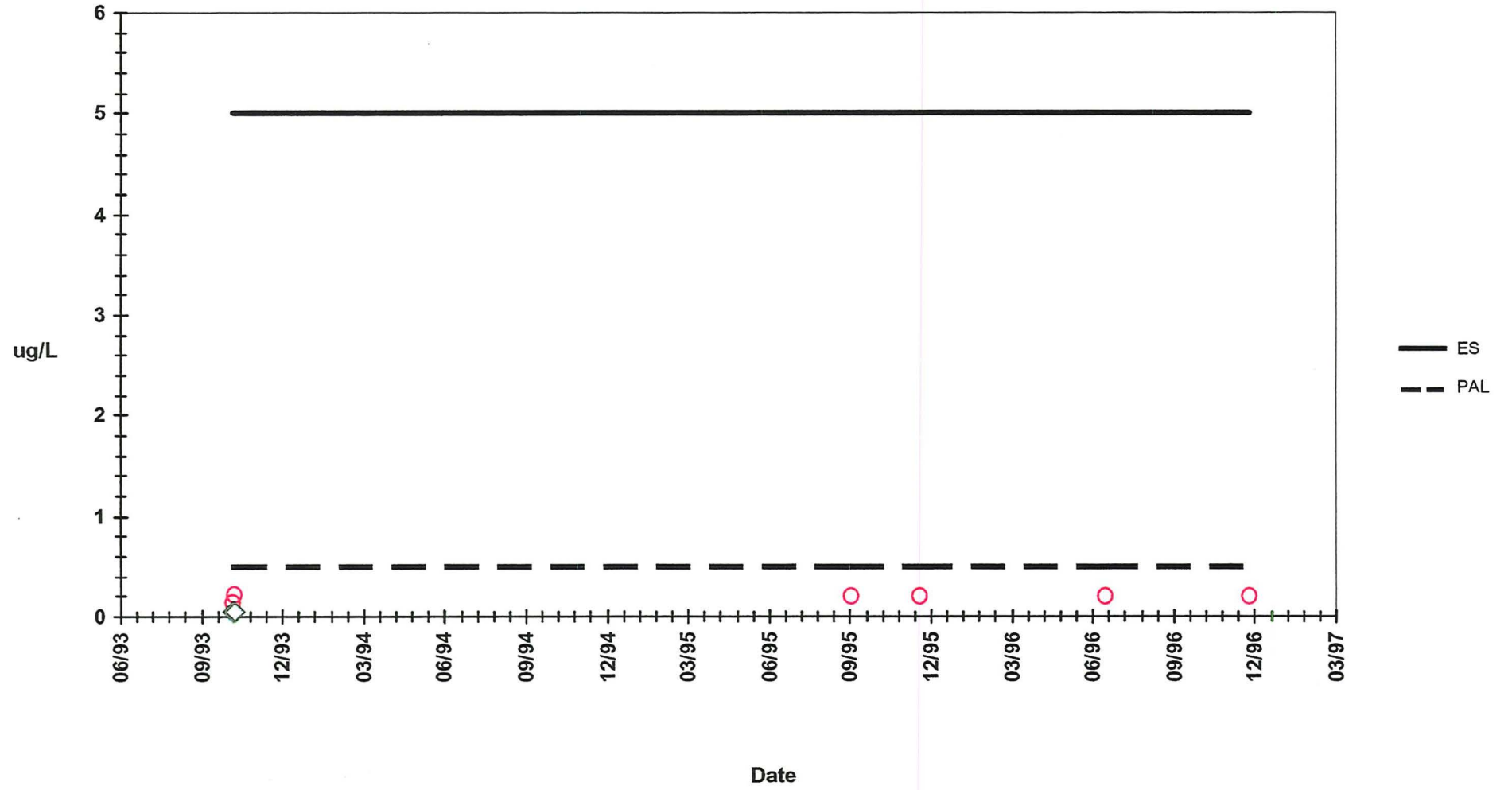
Trichloroethene



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

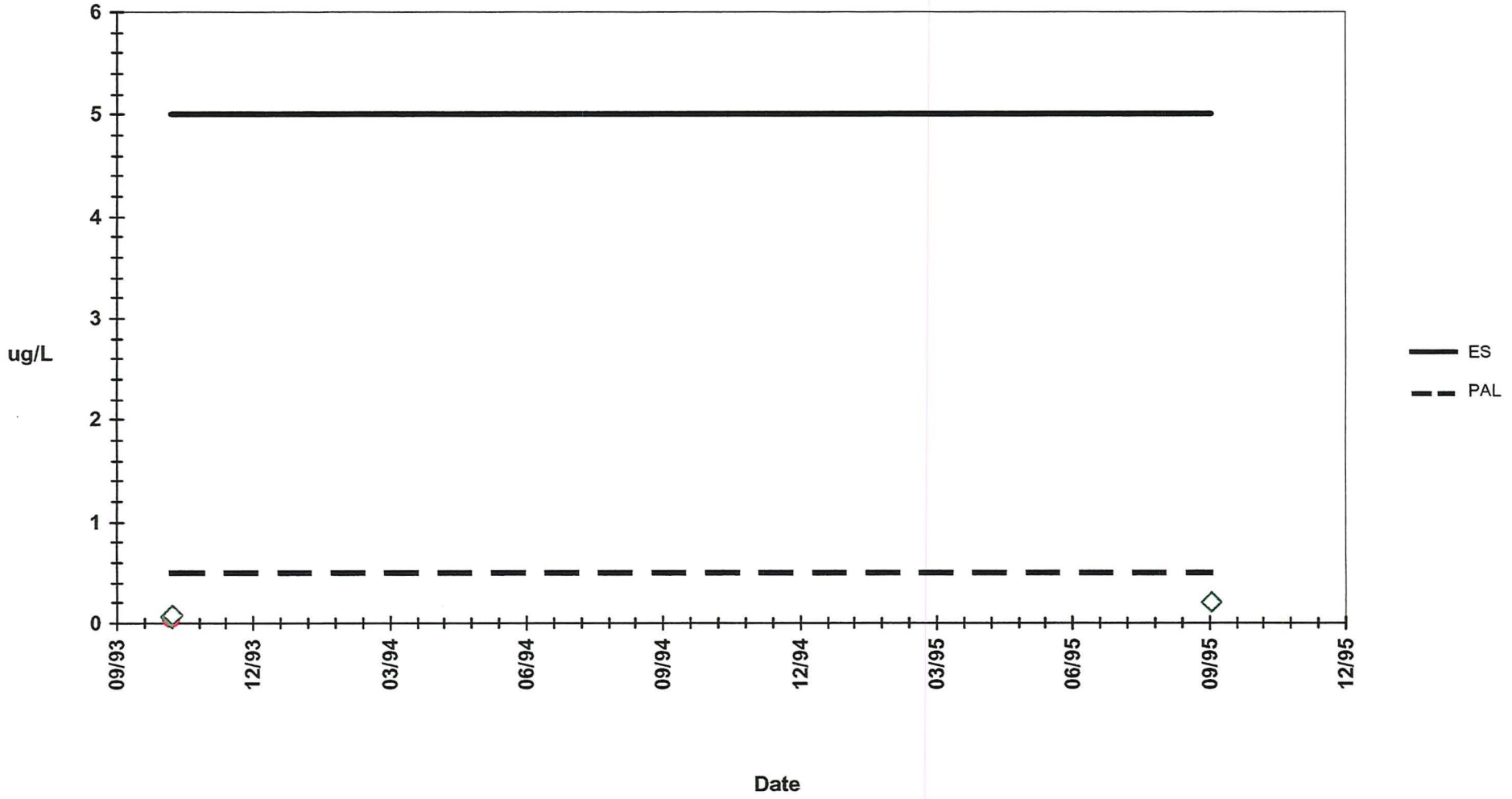
Trichloroethene



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

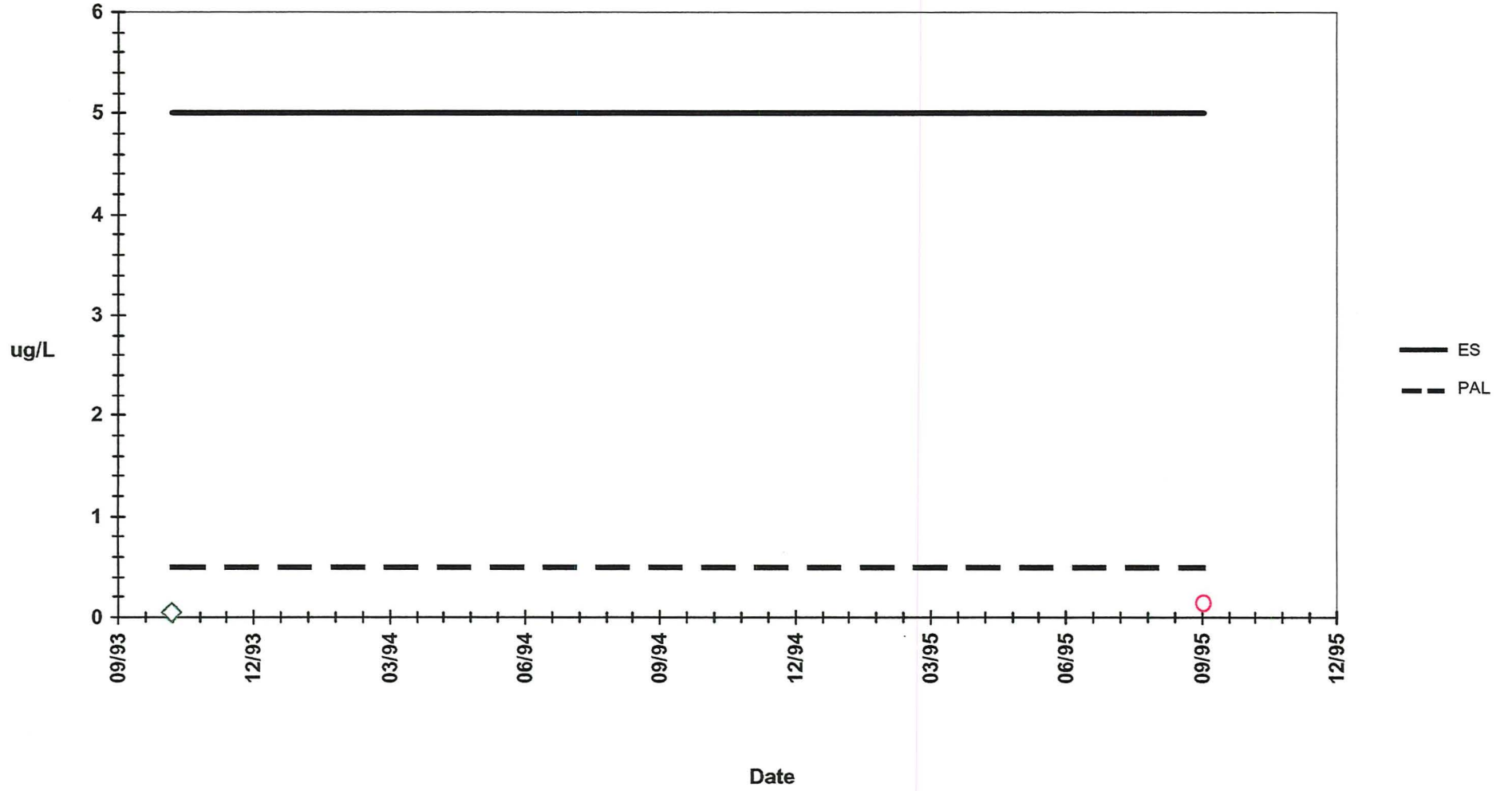
Trichloroethene



Onalaska Municipal Landfill

Residential Wells - Detects Only

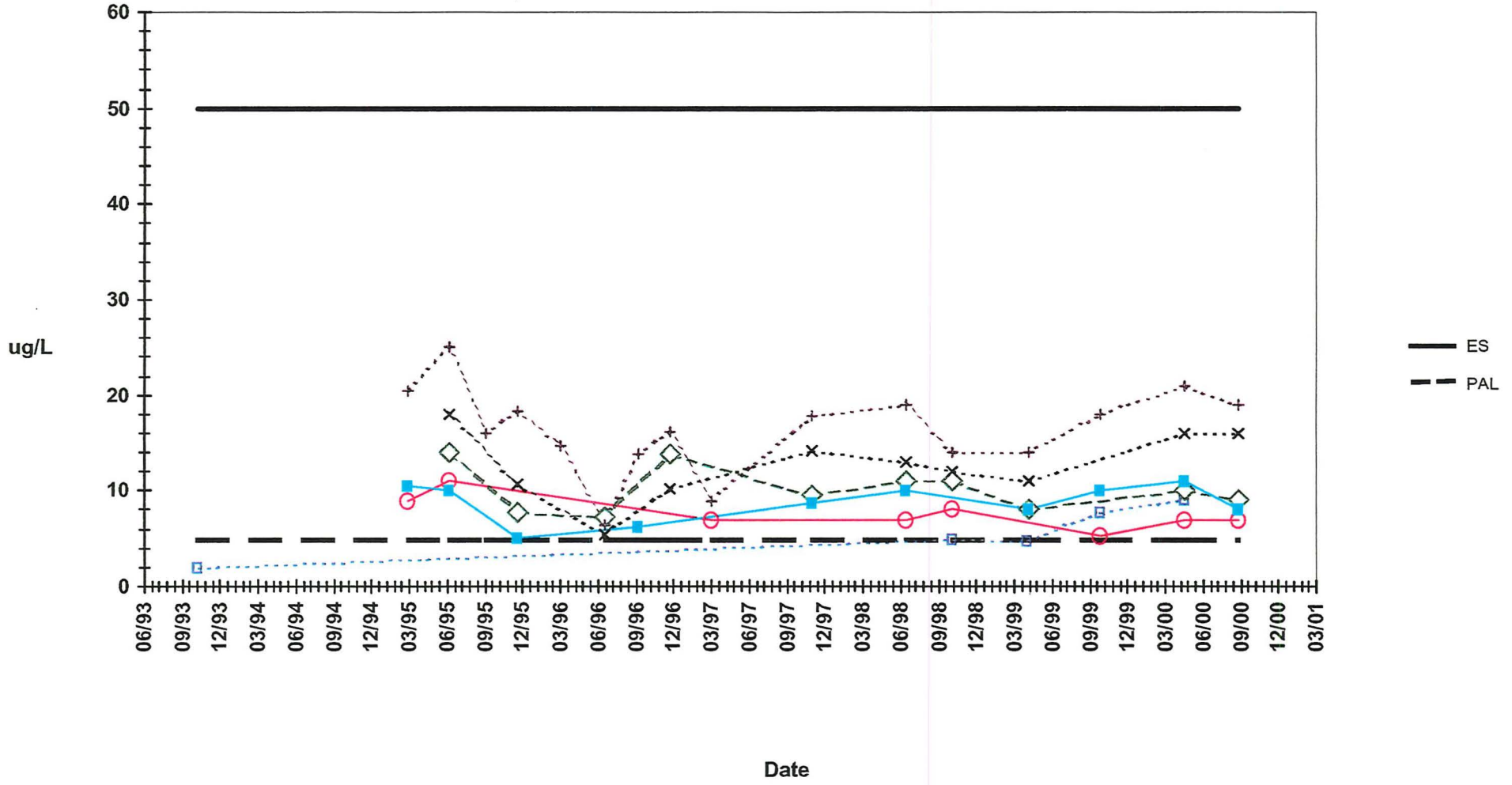
Trichloroethene



Onalaska Municipal Landfill

Extraction Wells - Detects Only

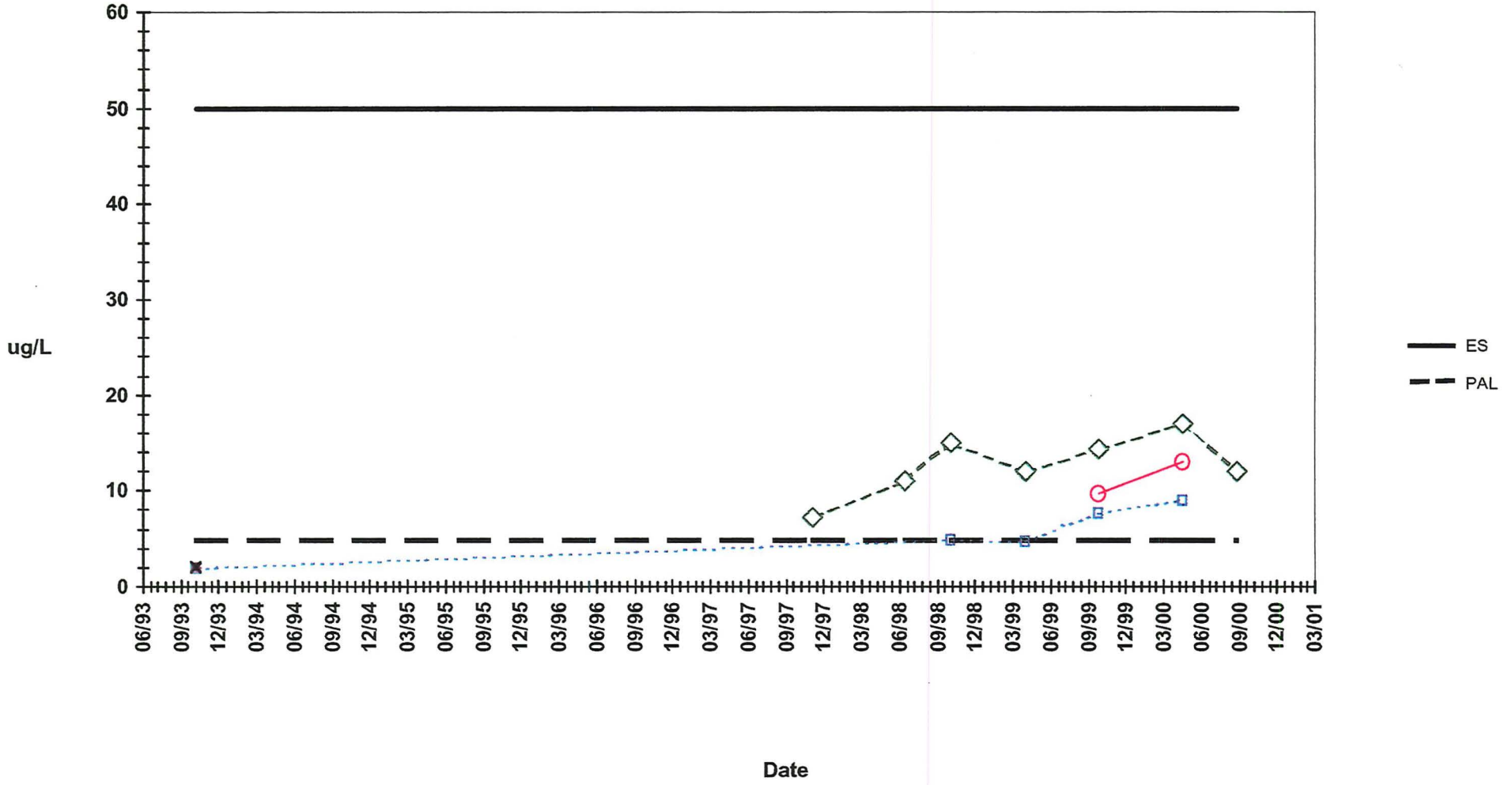
Arsenic



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

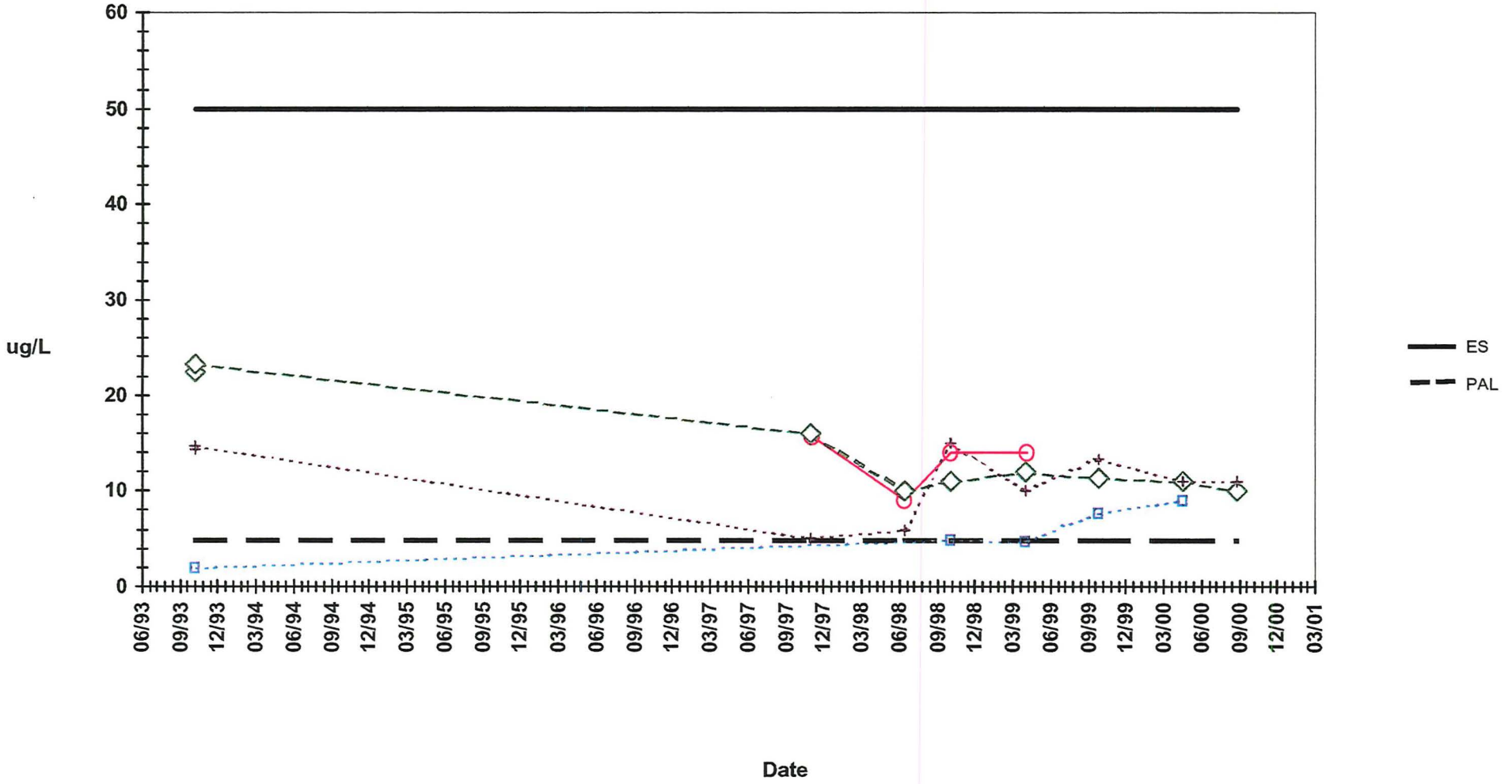
Arsenic



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

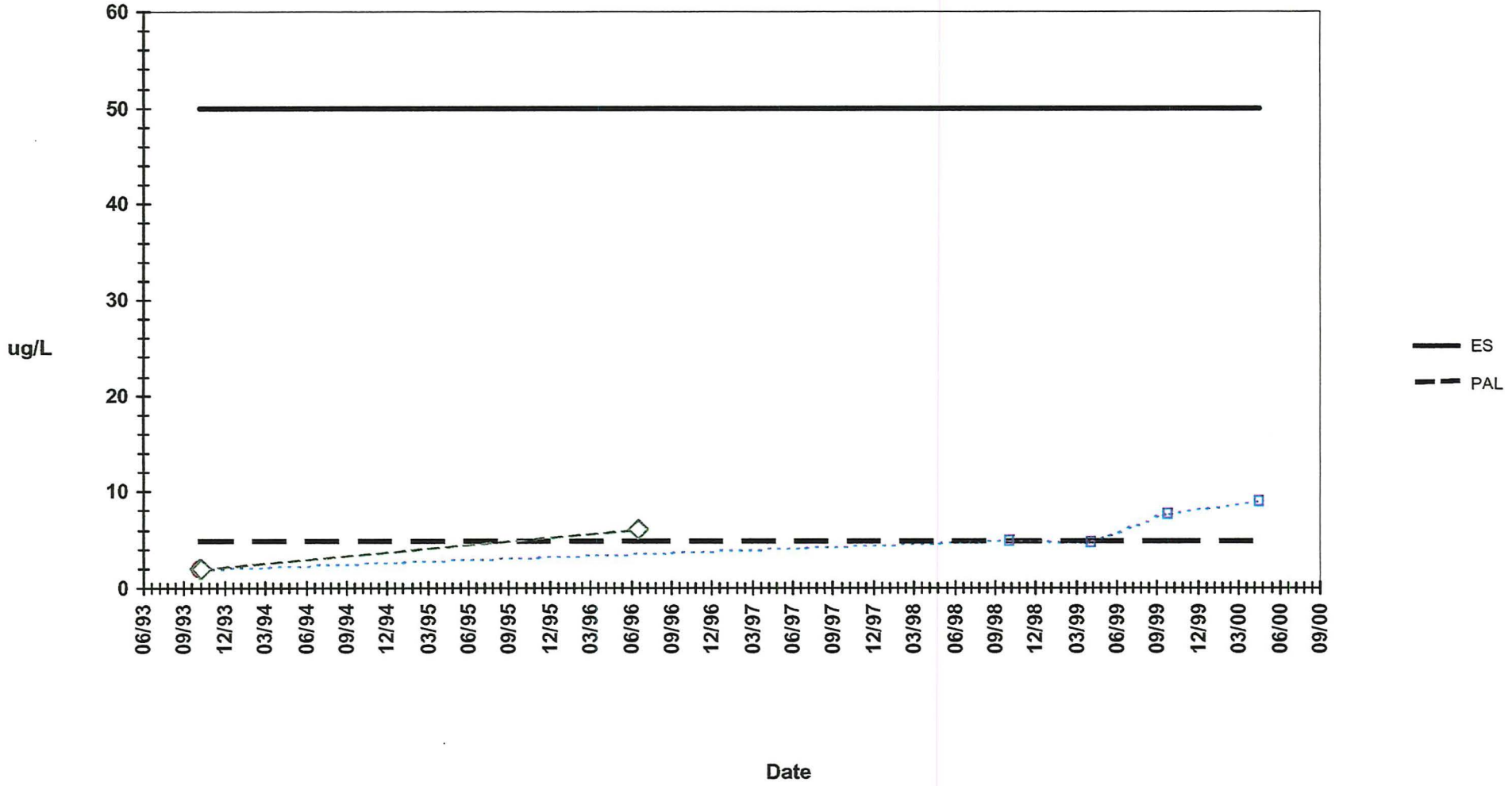
Arsenic



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

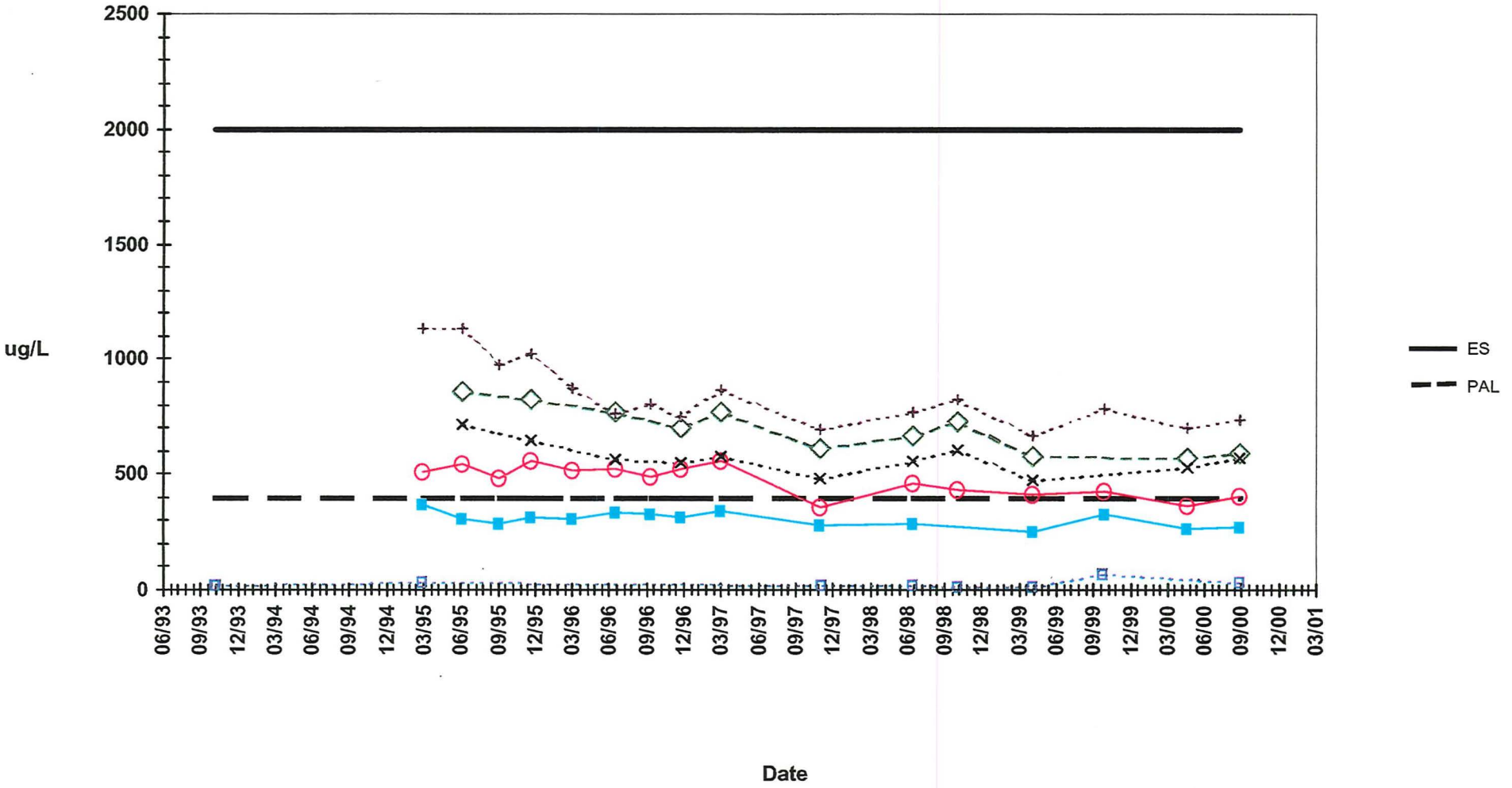
Arsenic



Onalaska Municipal Landfill

Extraction Wells - Detects Only

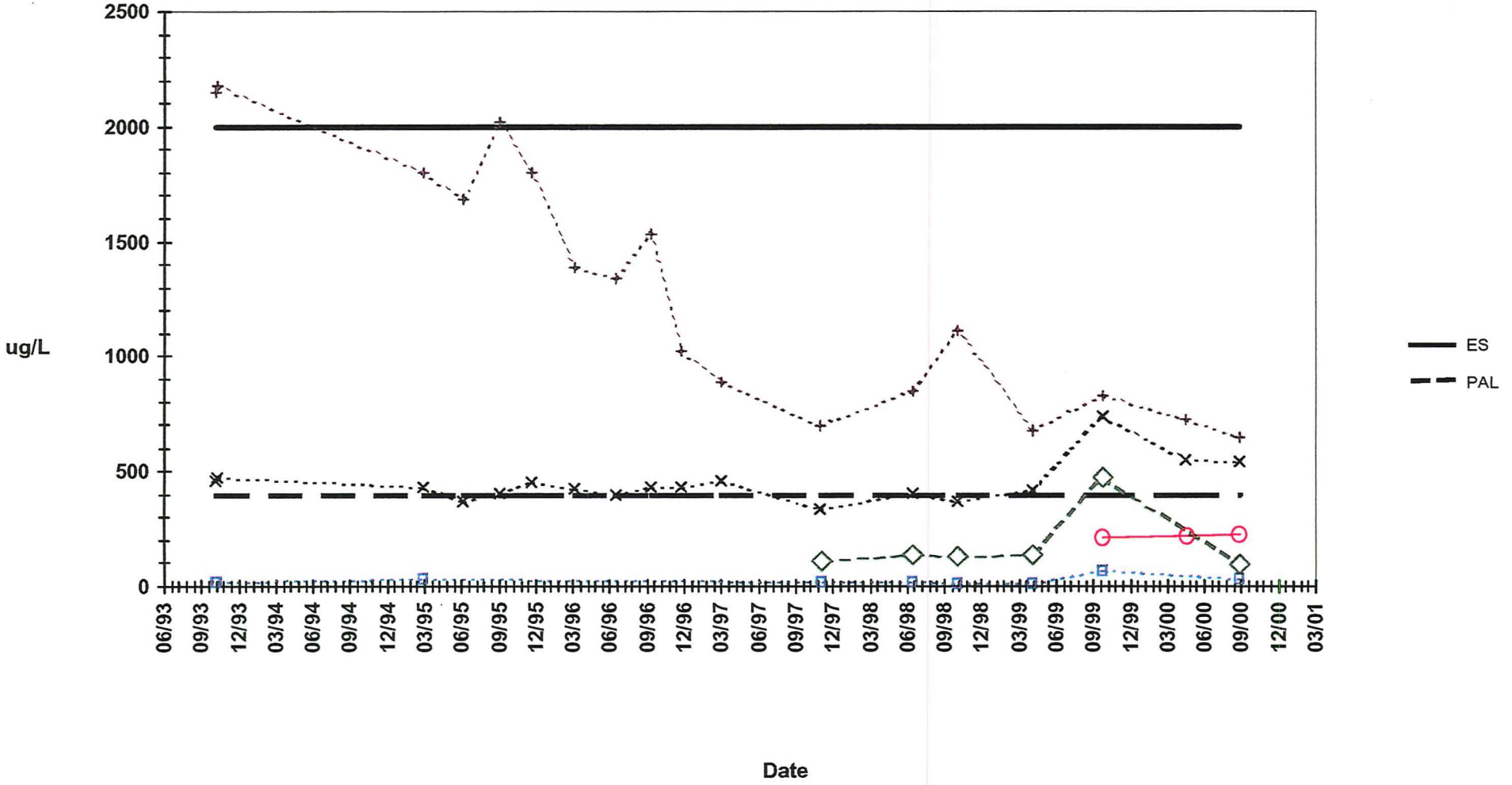
Barium



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

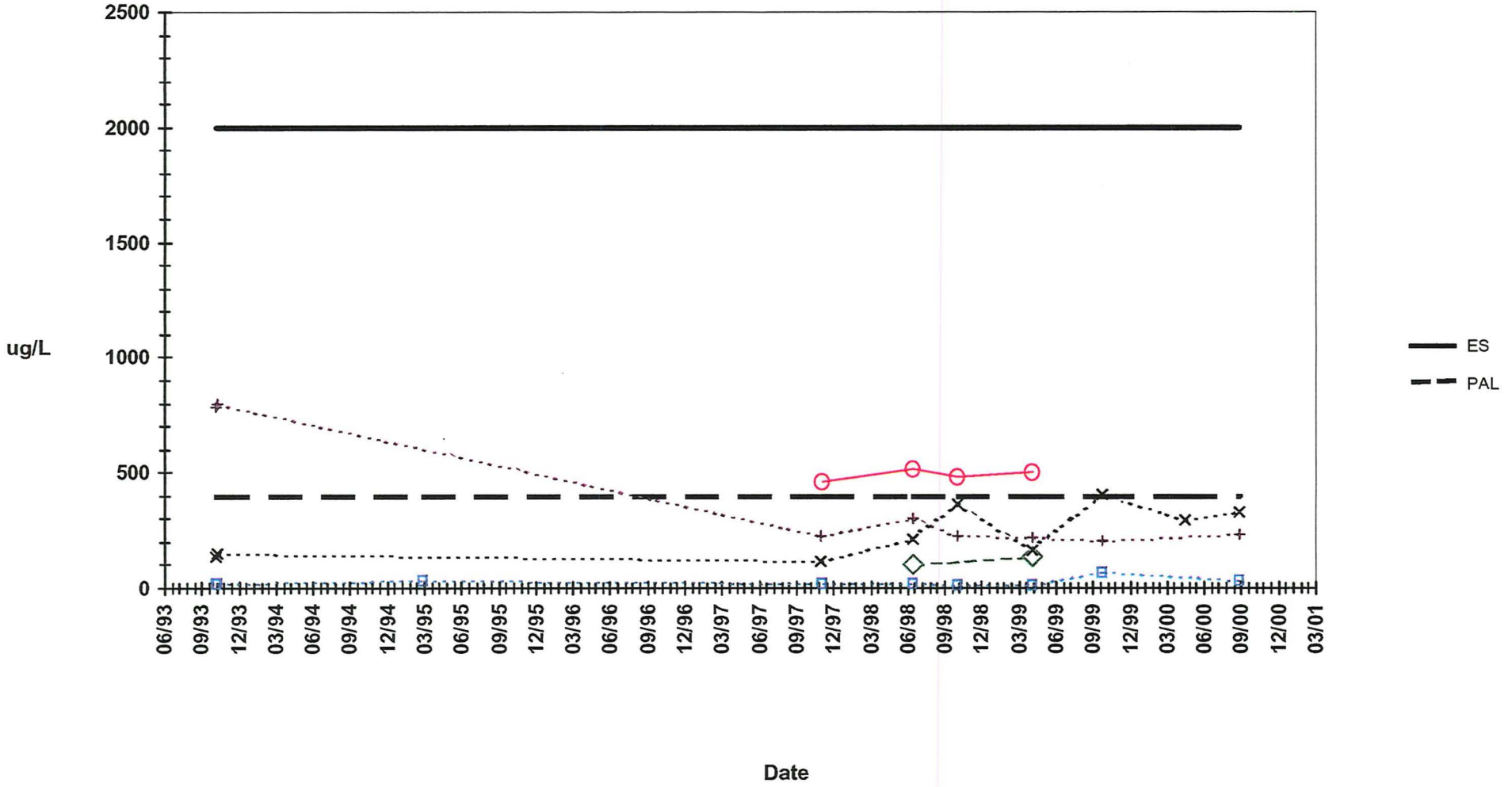
Barium



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

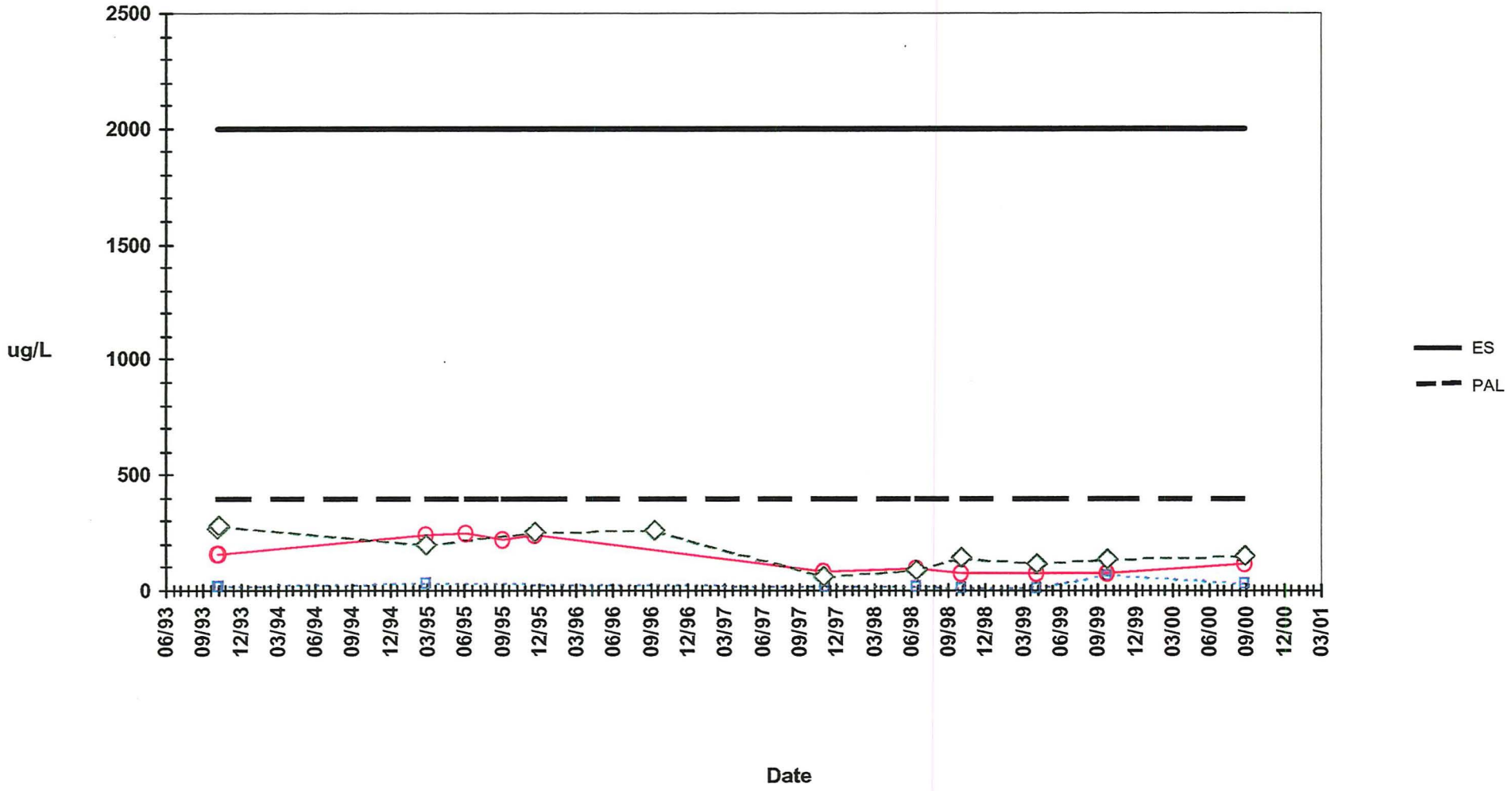
Barium



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

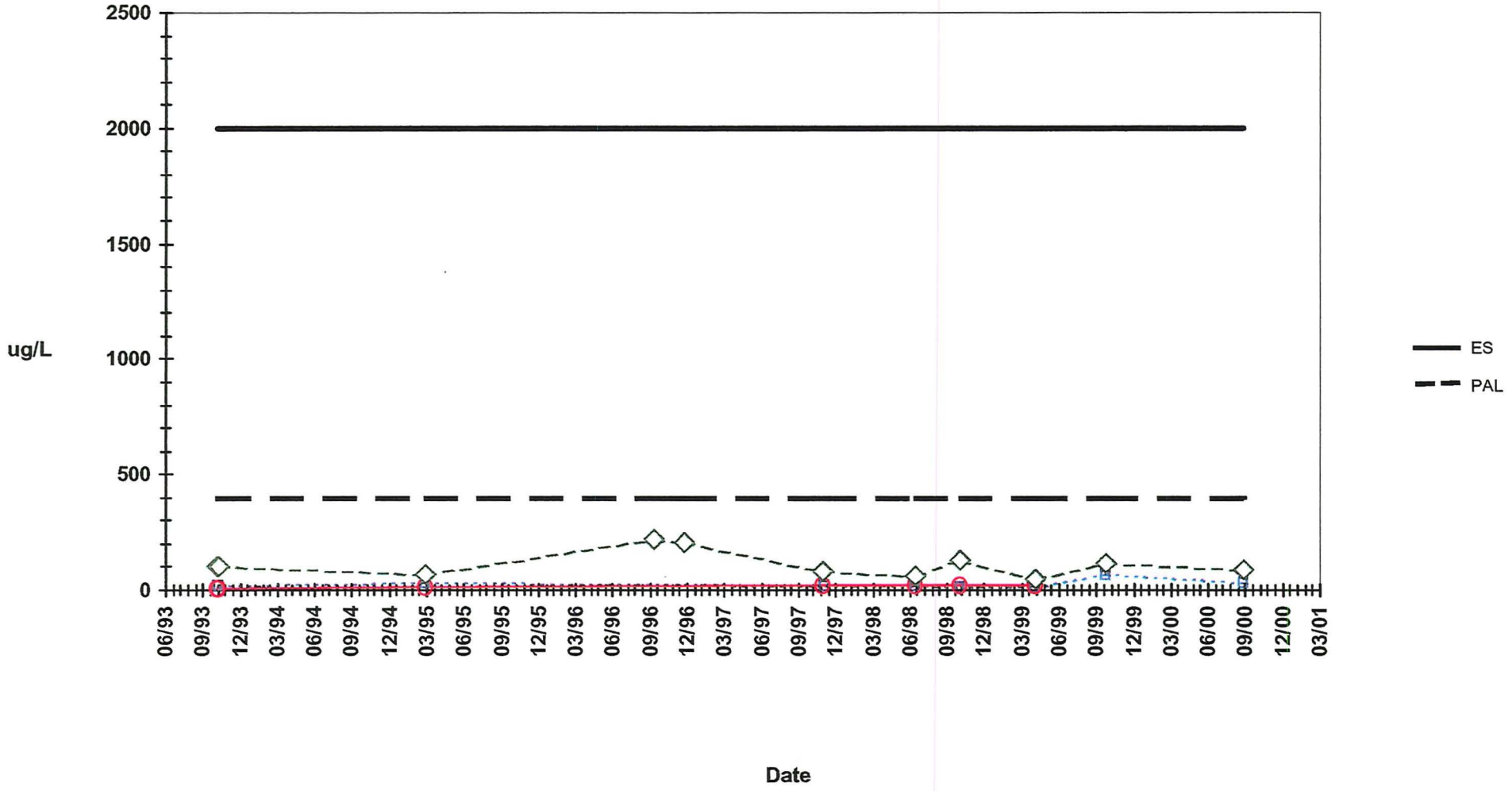
Barium



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

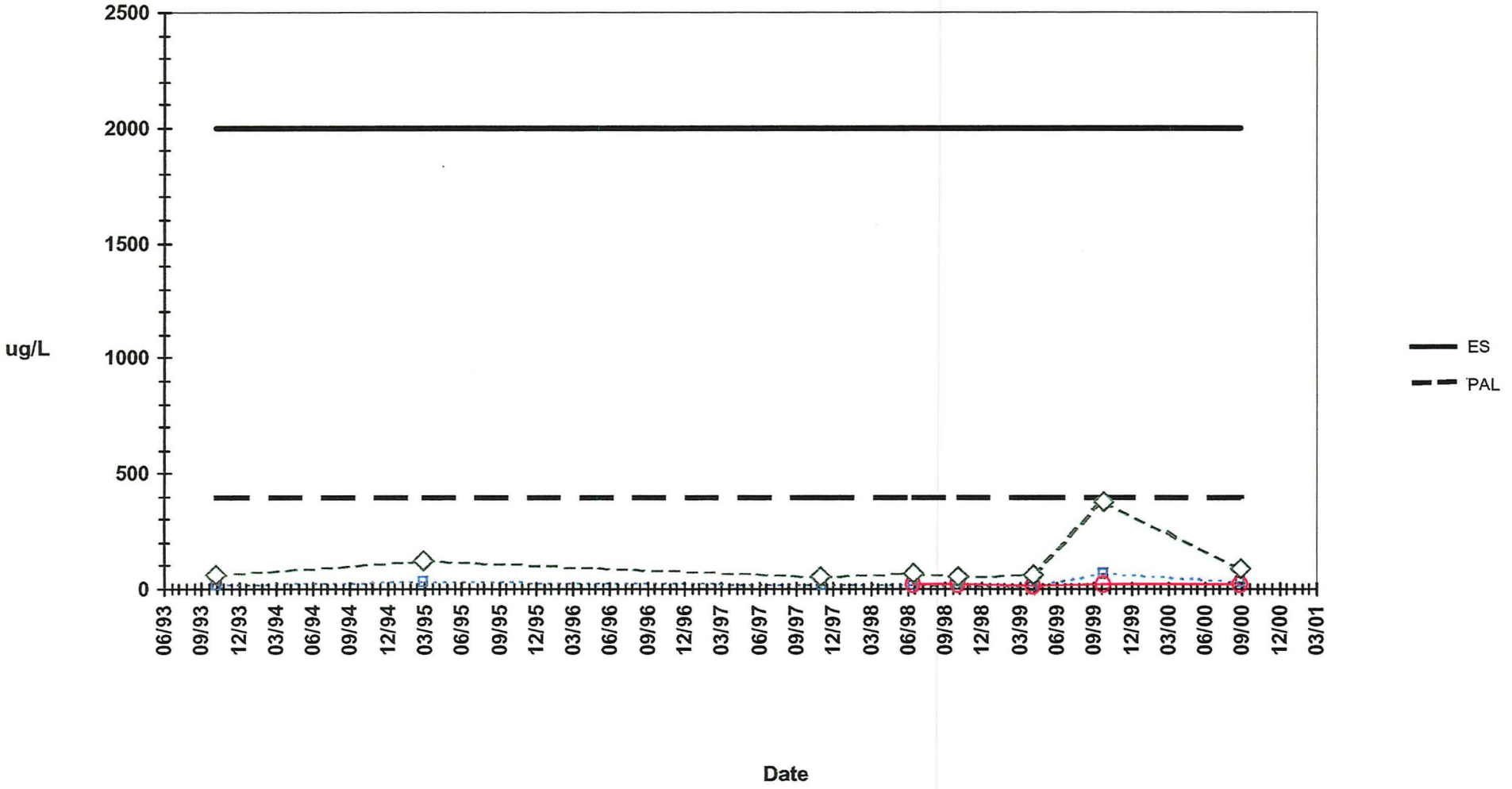
Barium



Onalaska Municipal Landfill

Residential Wells - Detects Only

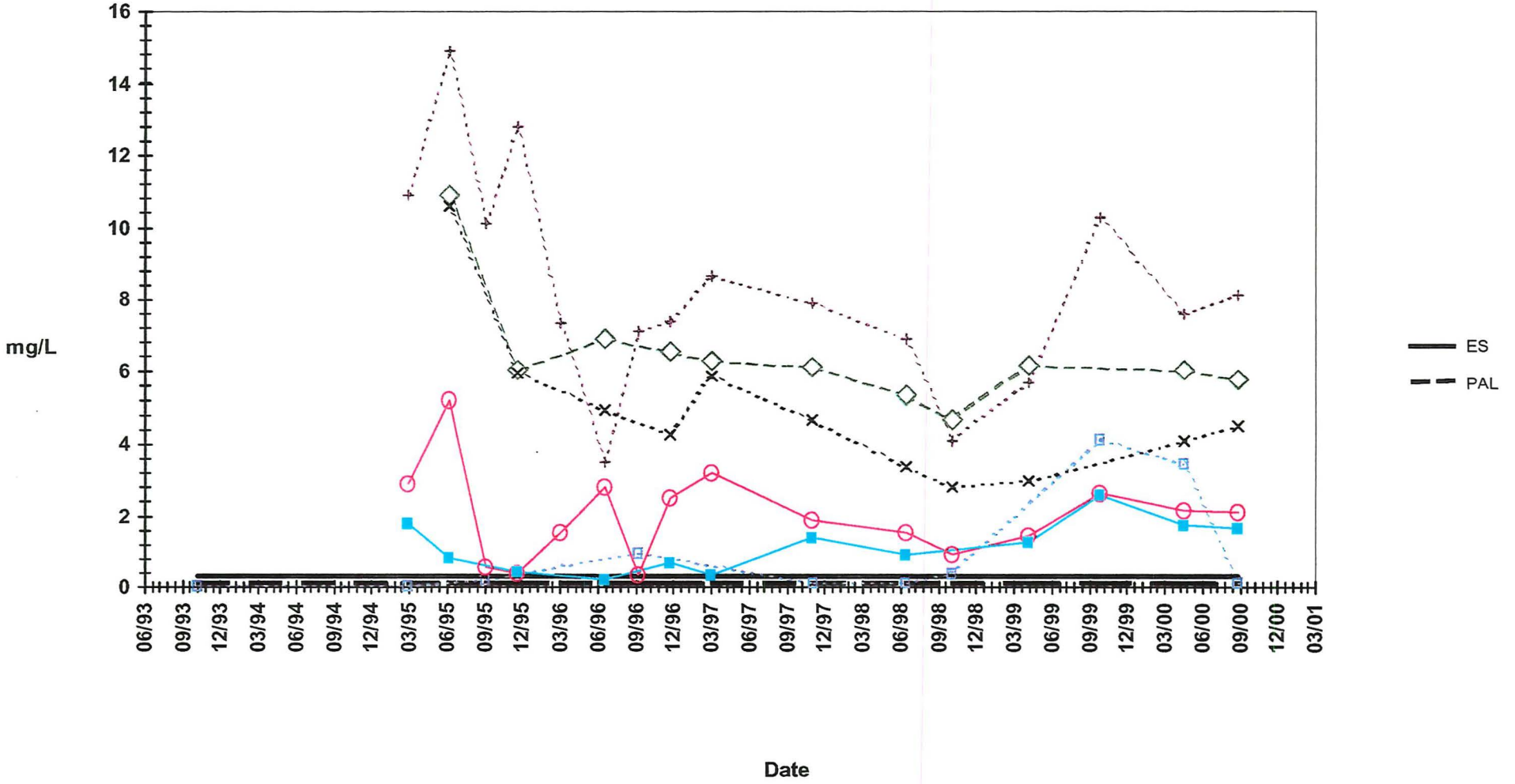
Barium



Onalaska Municipal Landfill

Extraction Wells - Detects Only

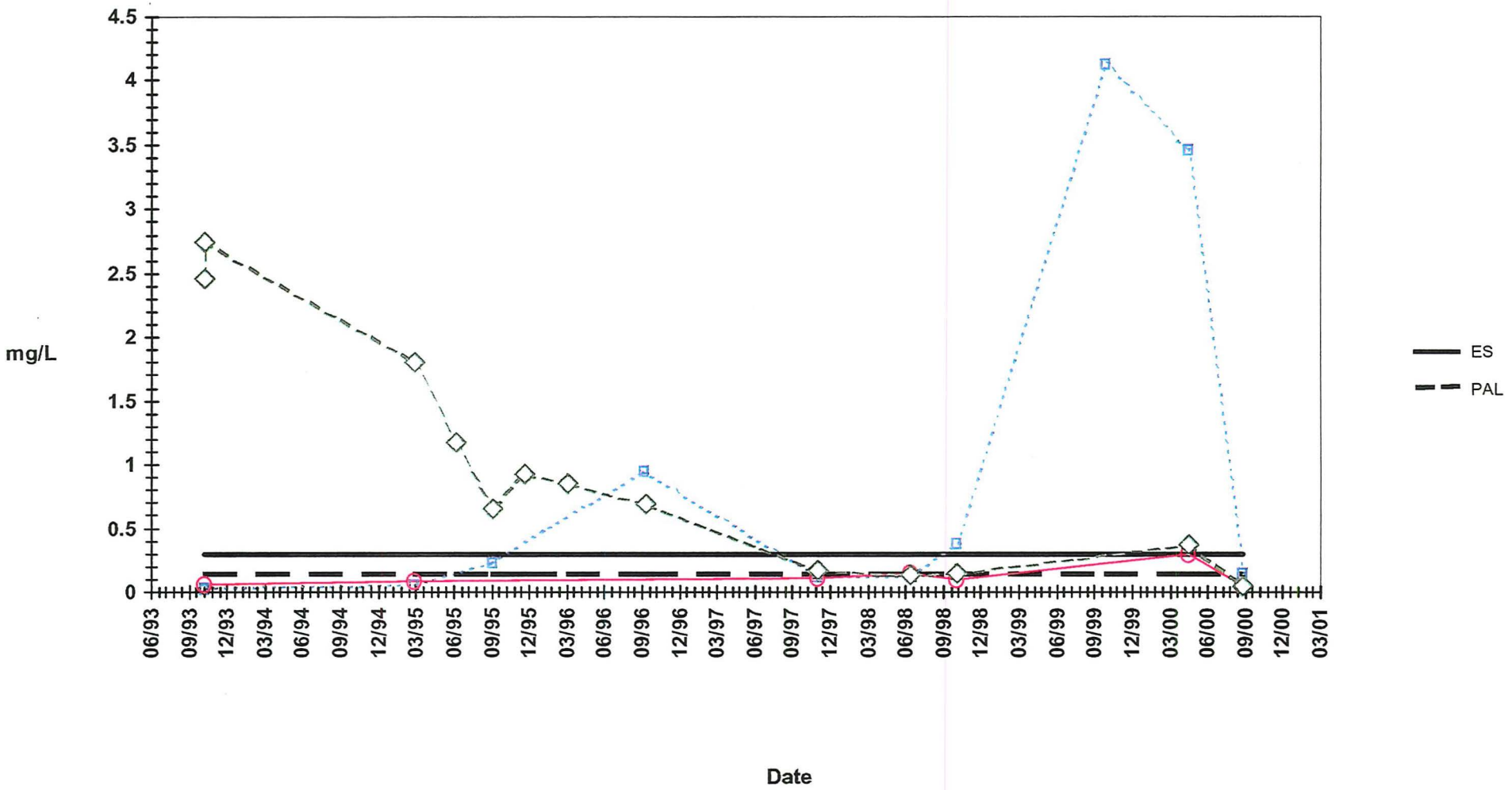
Iron



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

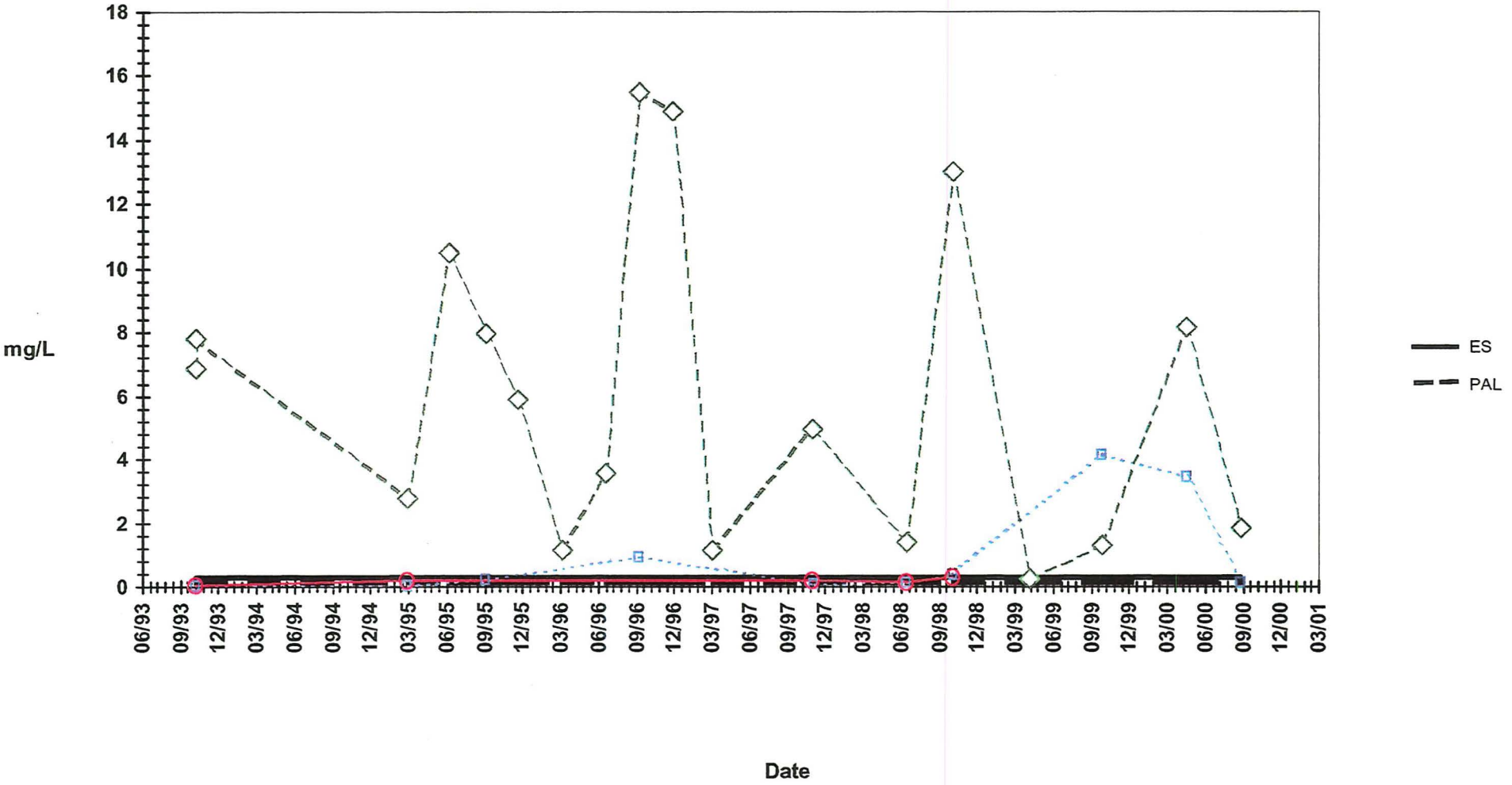
Iron



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

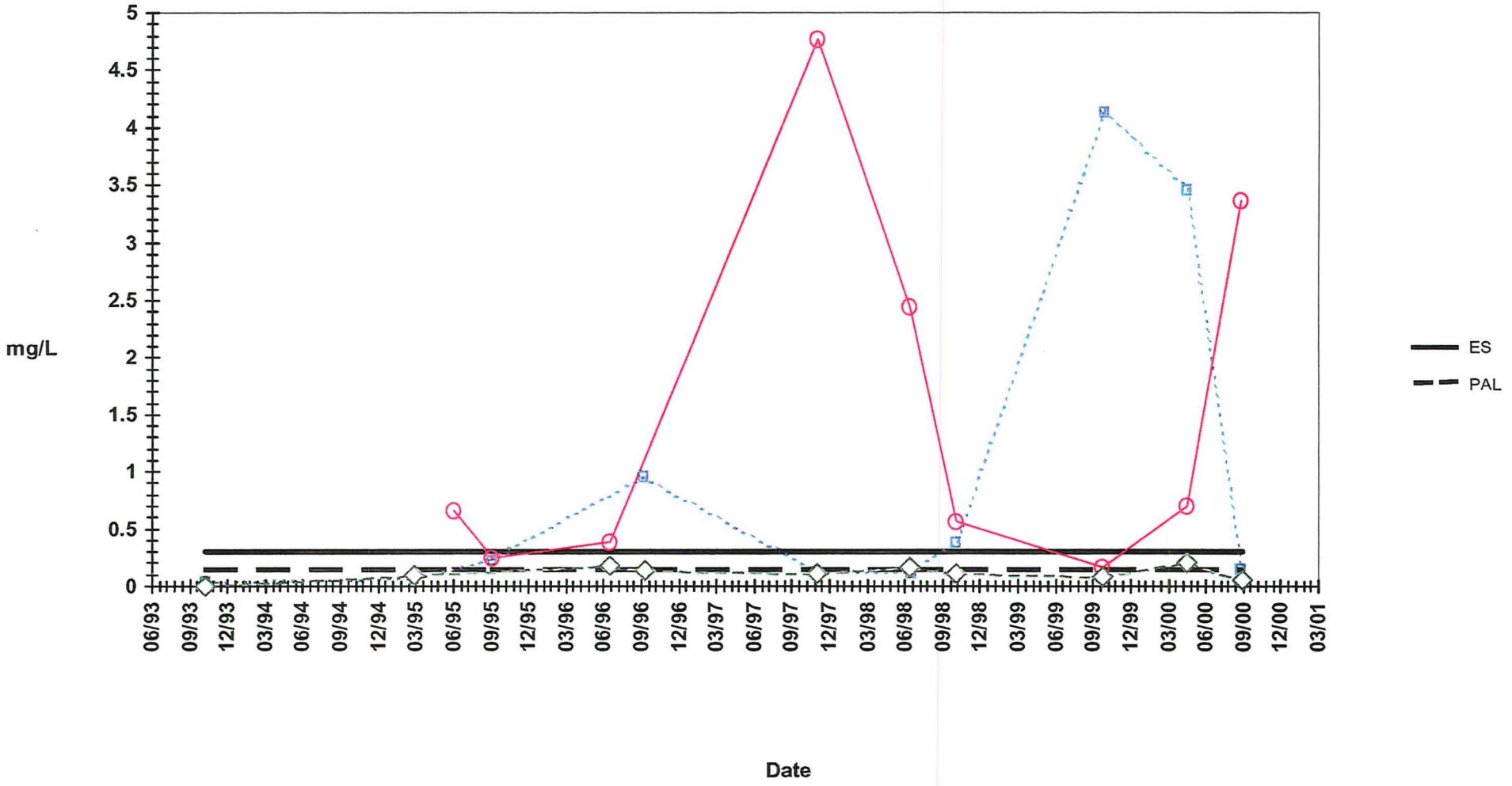
Iron



Onalaska Municipal Landfill

Residential Wells - Detects Only

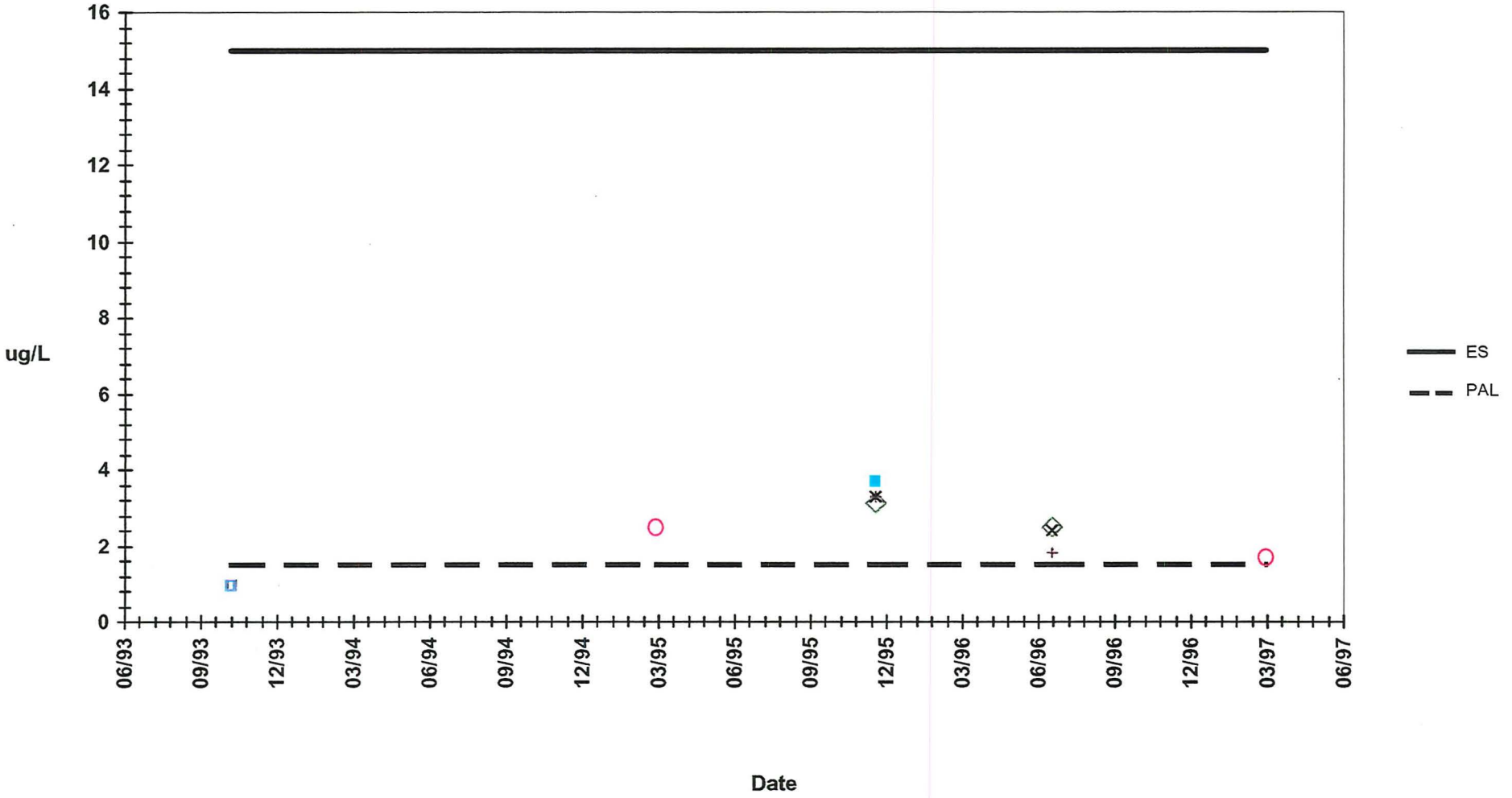
Iron



Onalaska Municipal Landfill

Extraction Wells - Detects Only

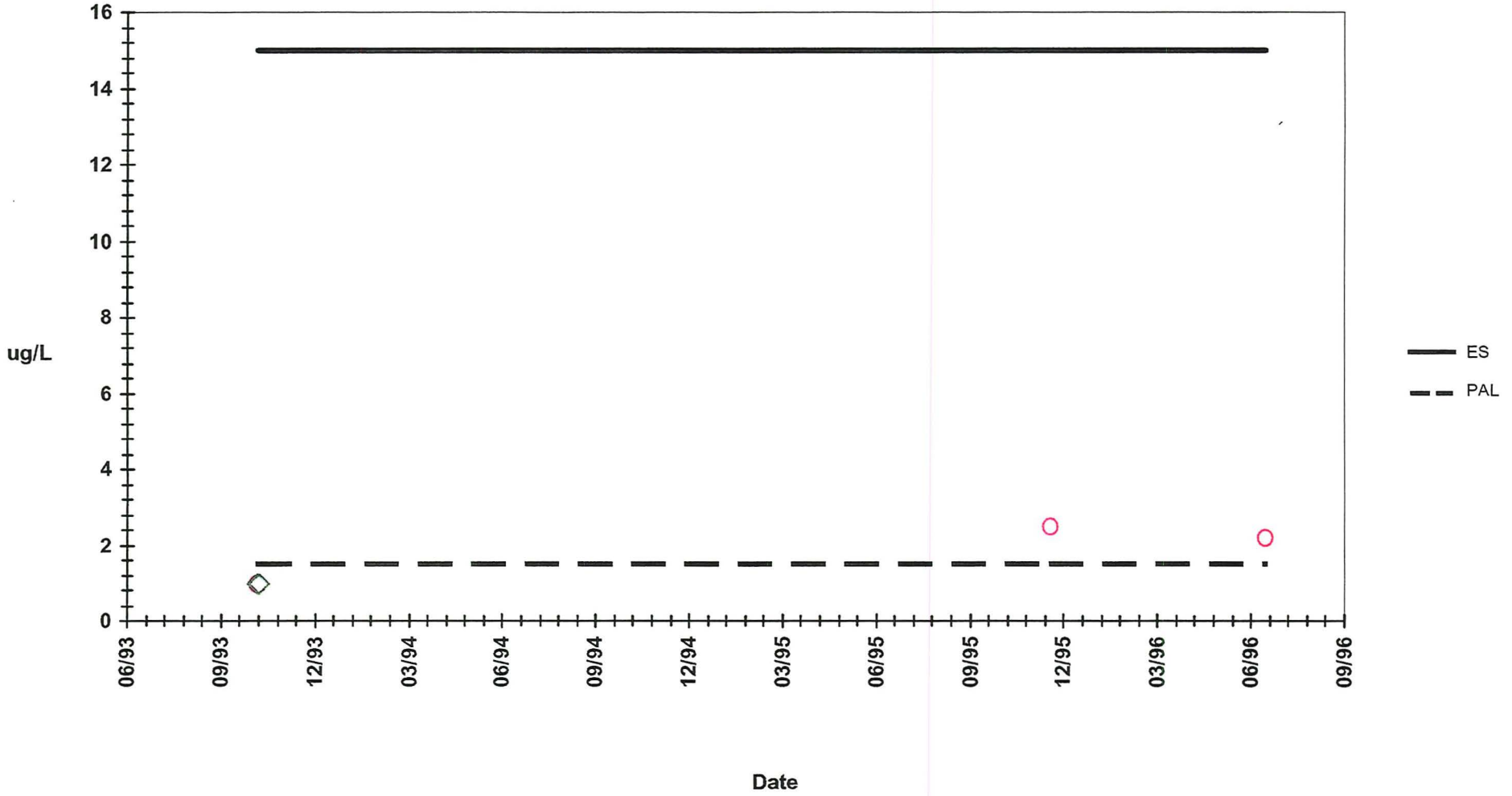
Lead



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

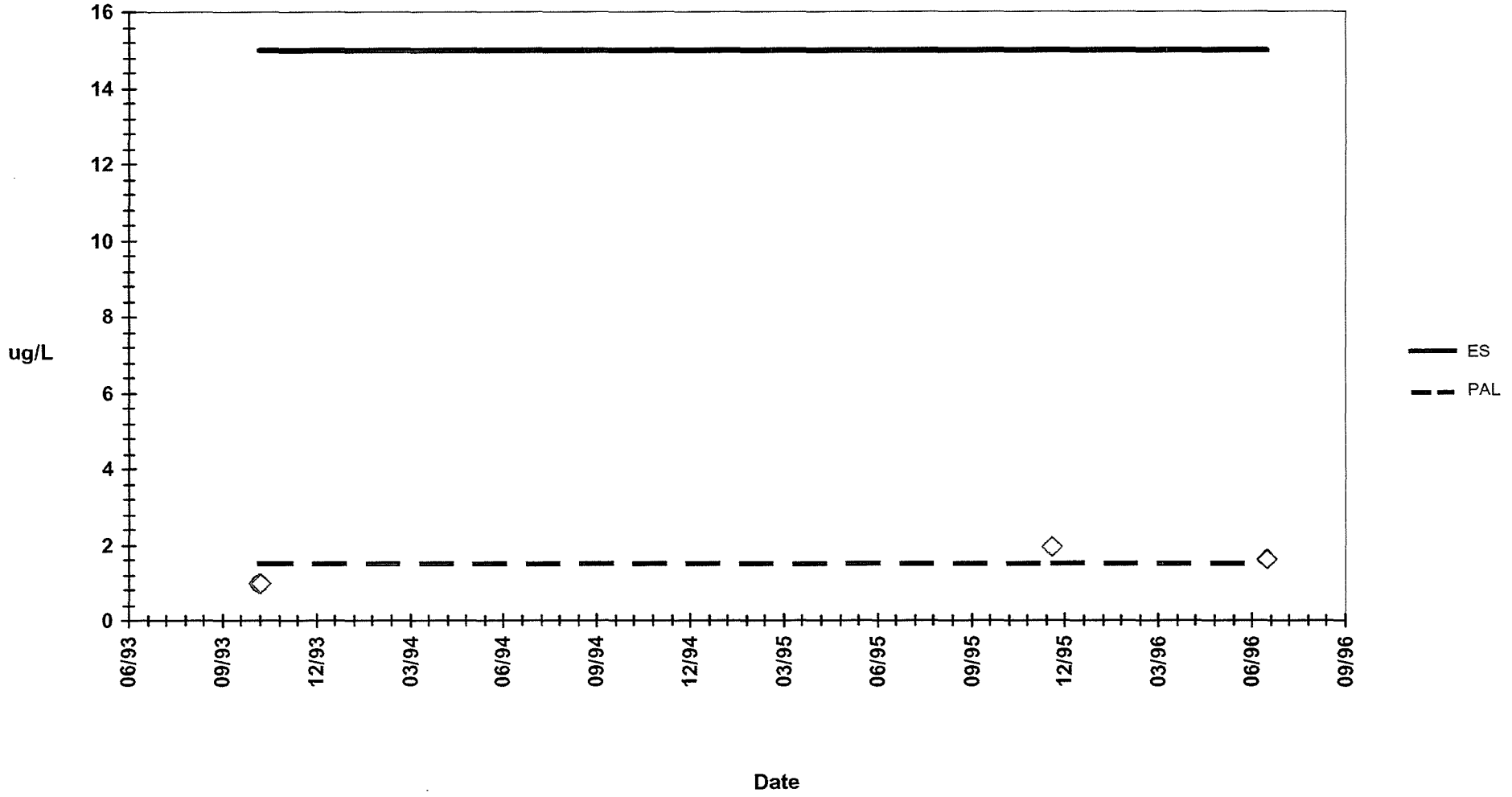
Lead



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

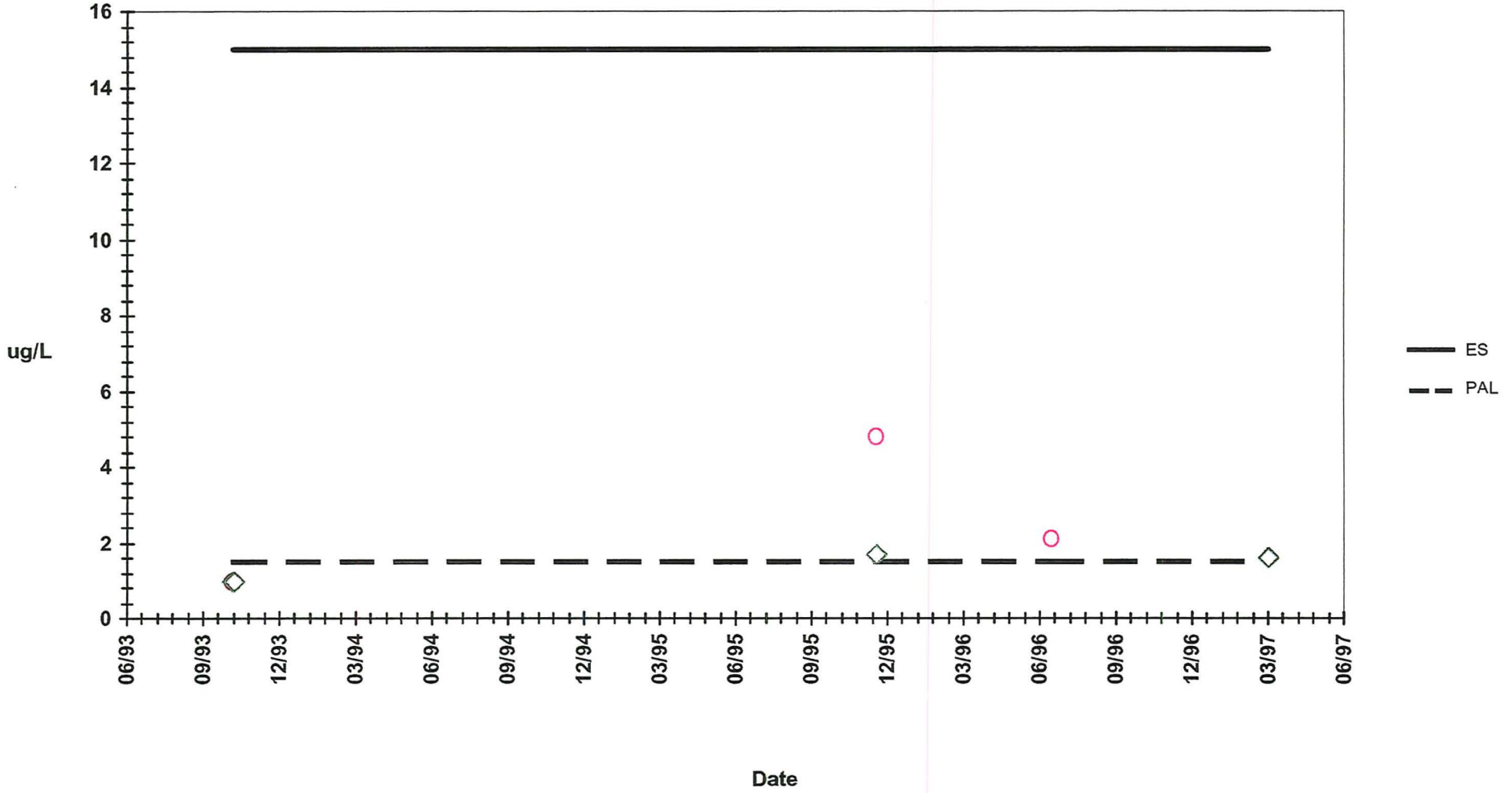
Lead



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

Lead

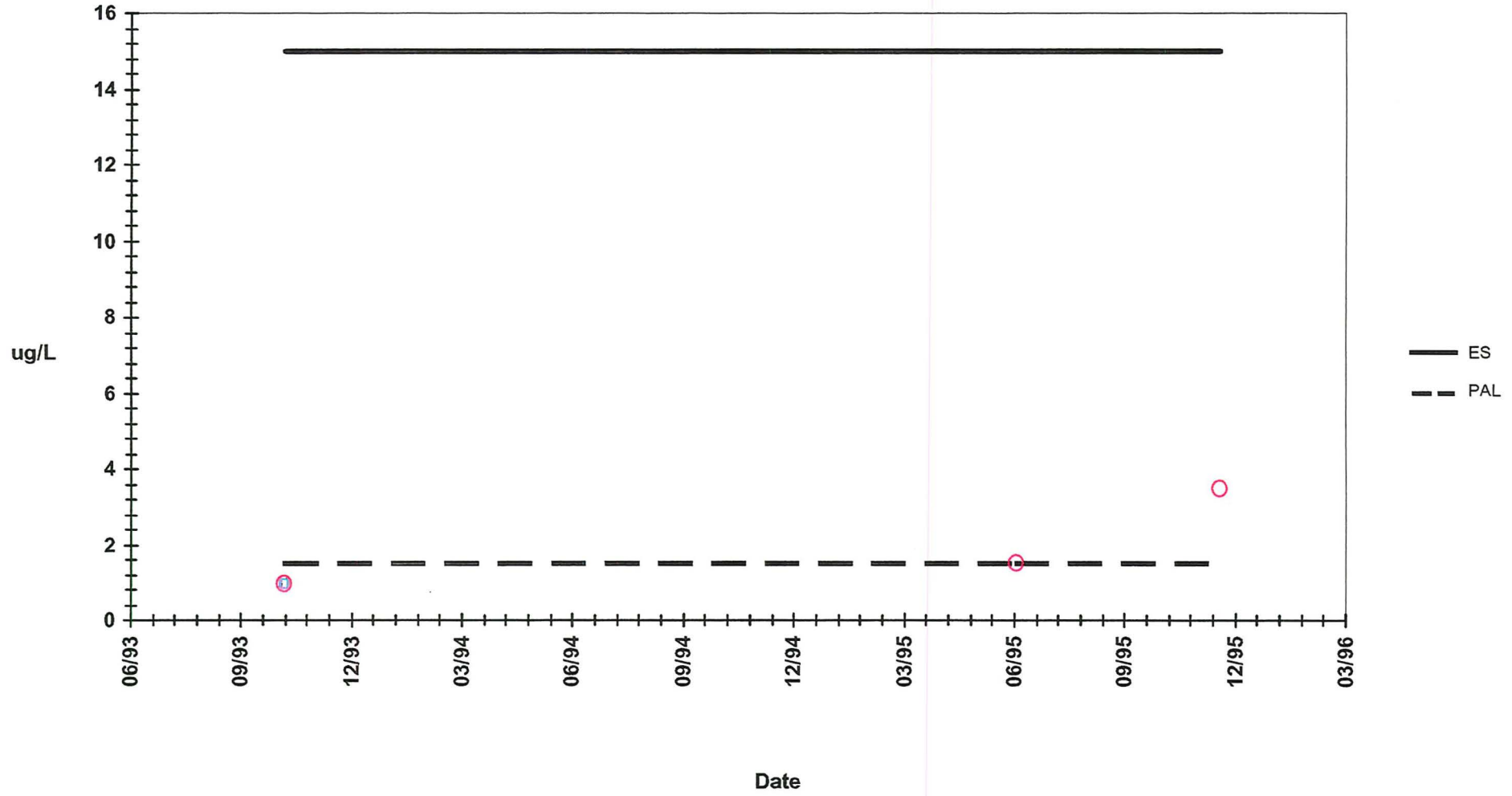


MW-01S MW-12S MW-14S

Onalaska Municipal Landfill

Residential Wells - Detects Only

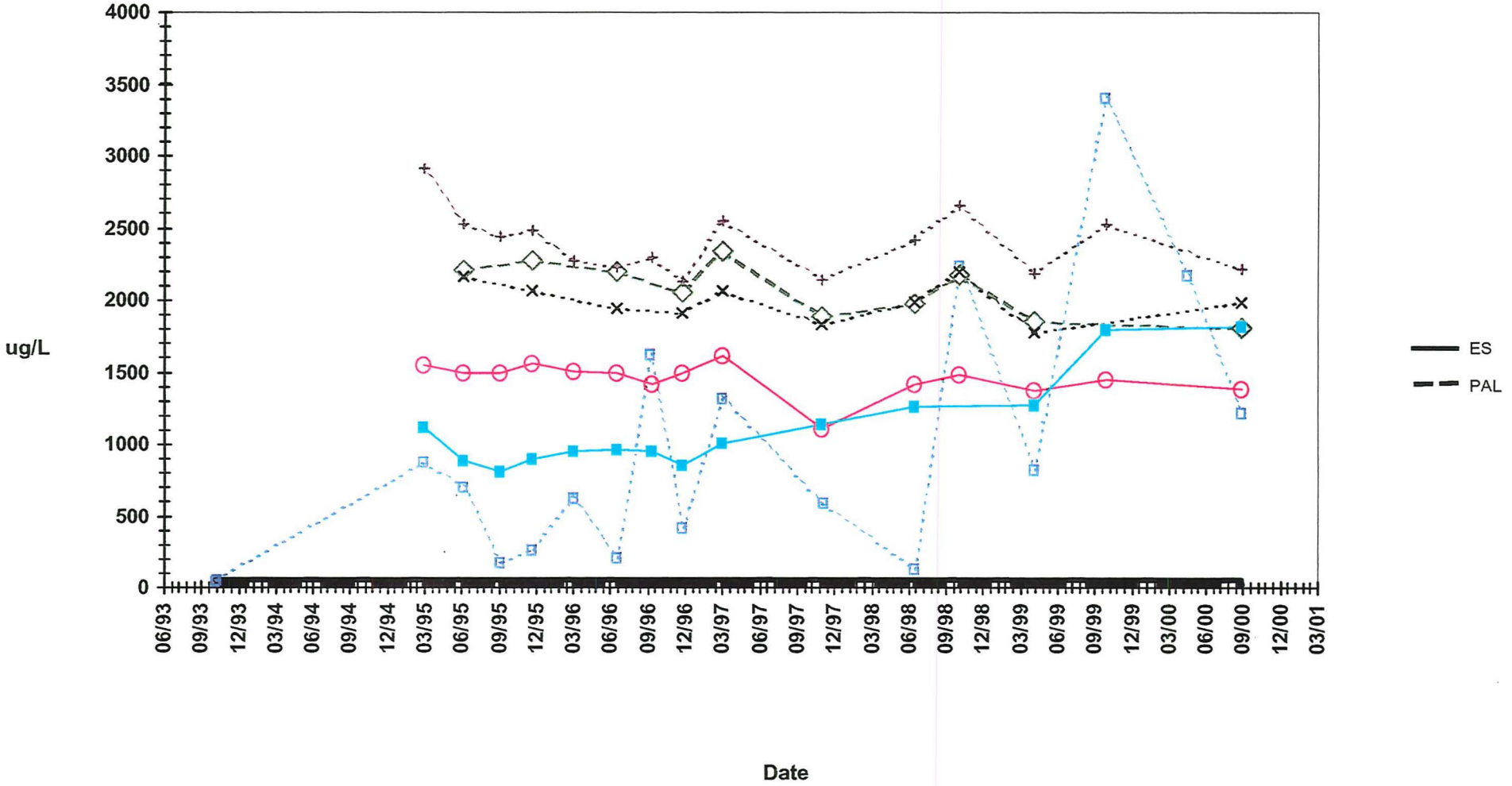
Lead



Onalaska Municipal Landfill

Extraction Wells - Detects Only

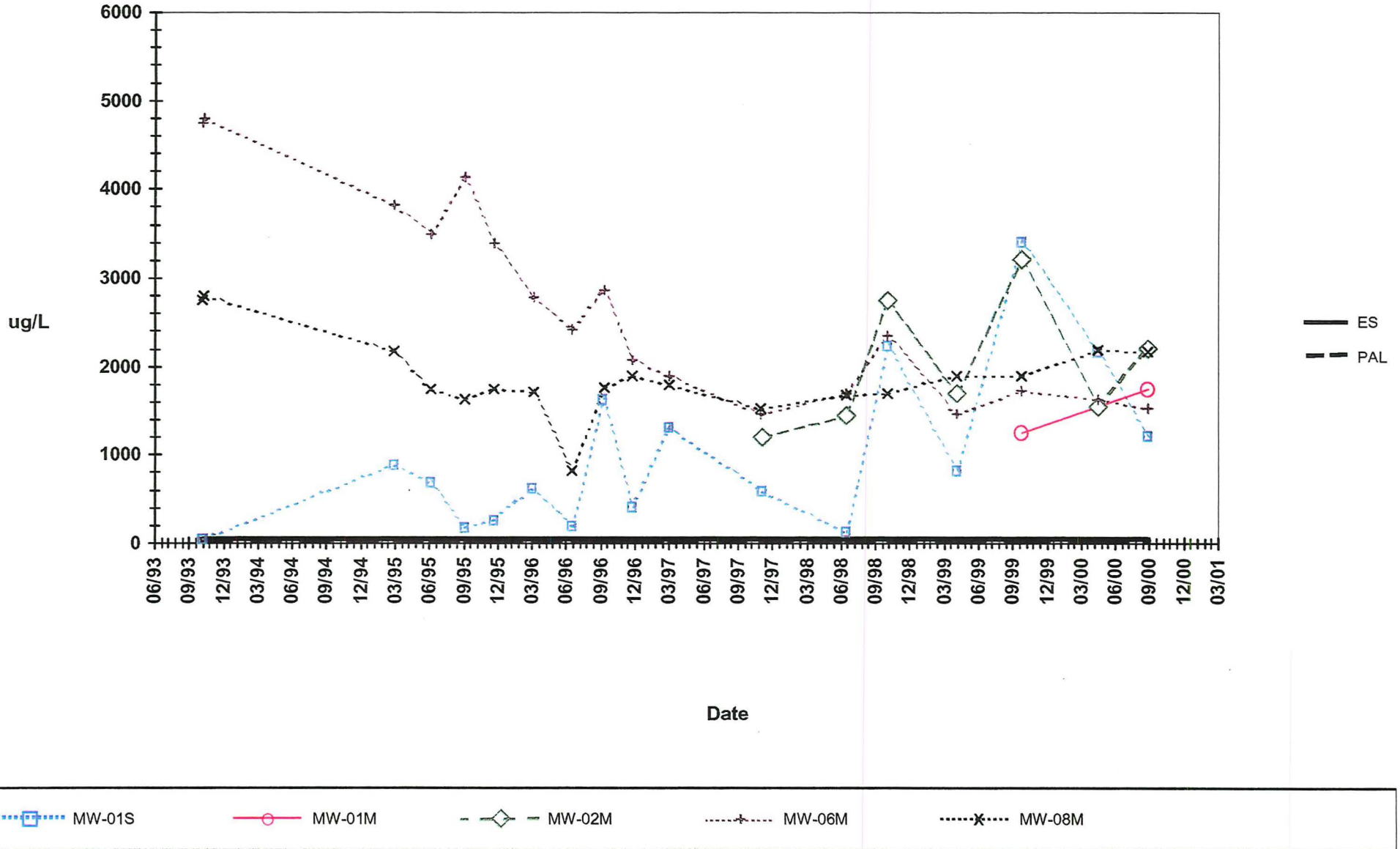
Manganese



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

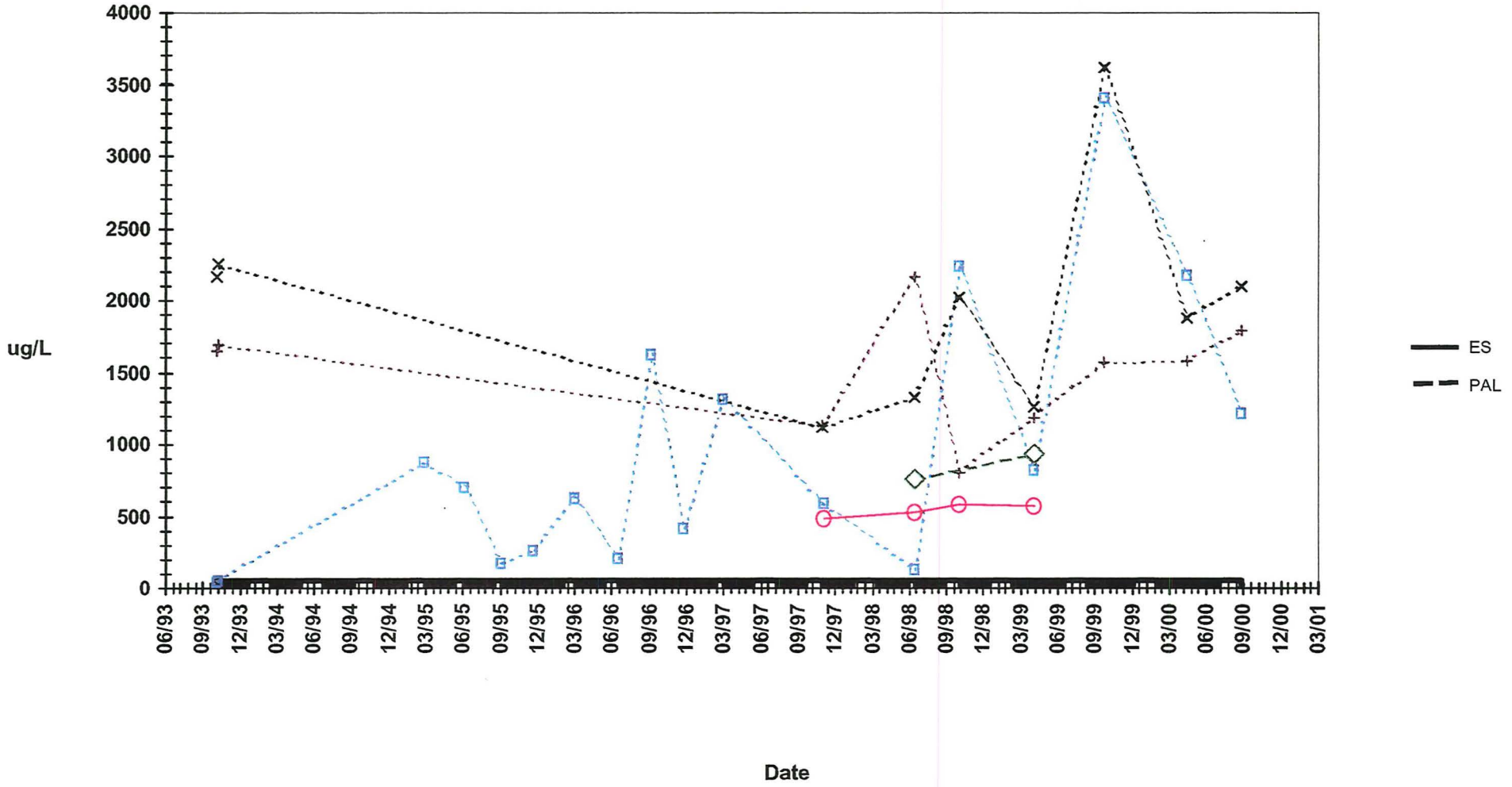
Manganese



Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S - Detects Only

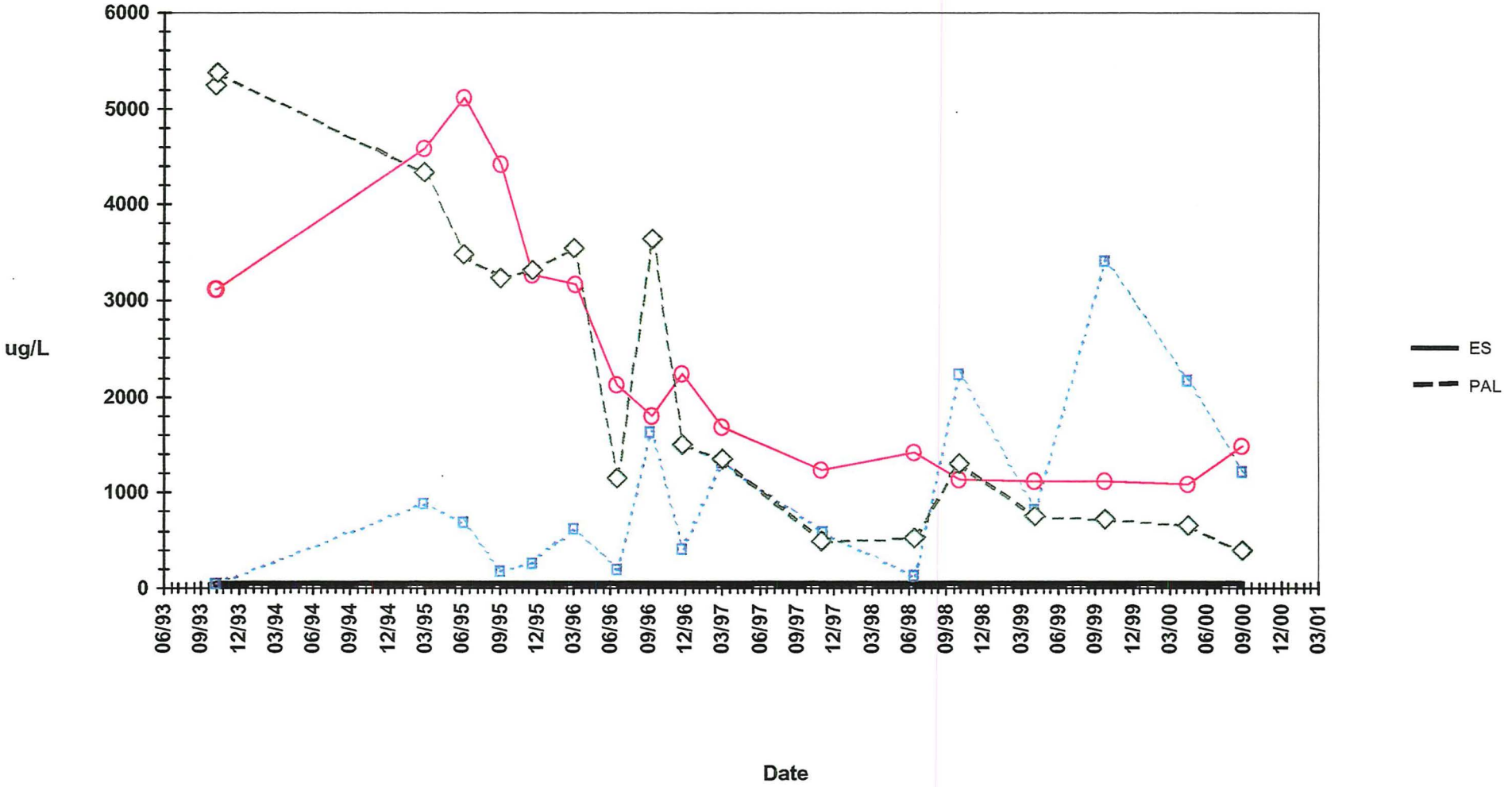
Manganese



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

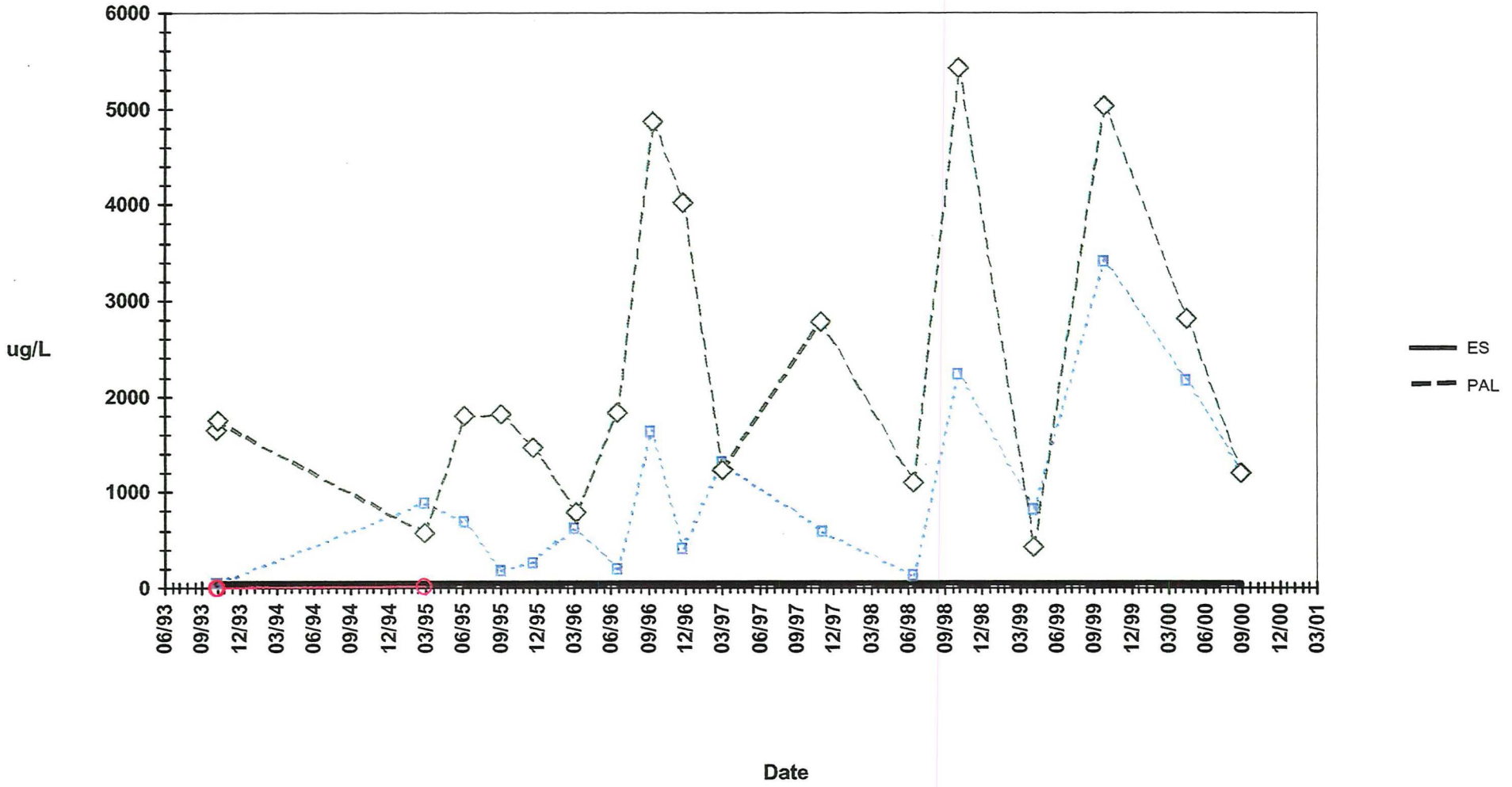
Manganese



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

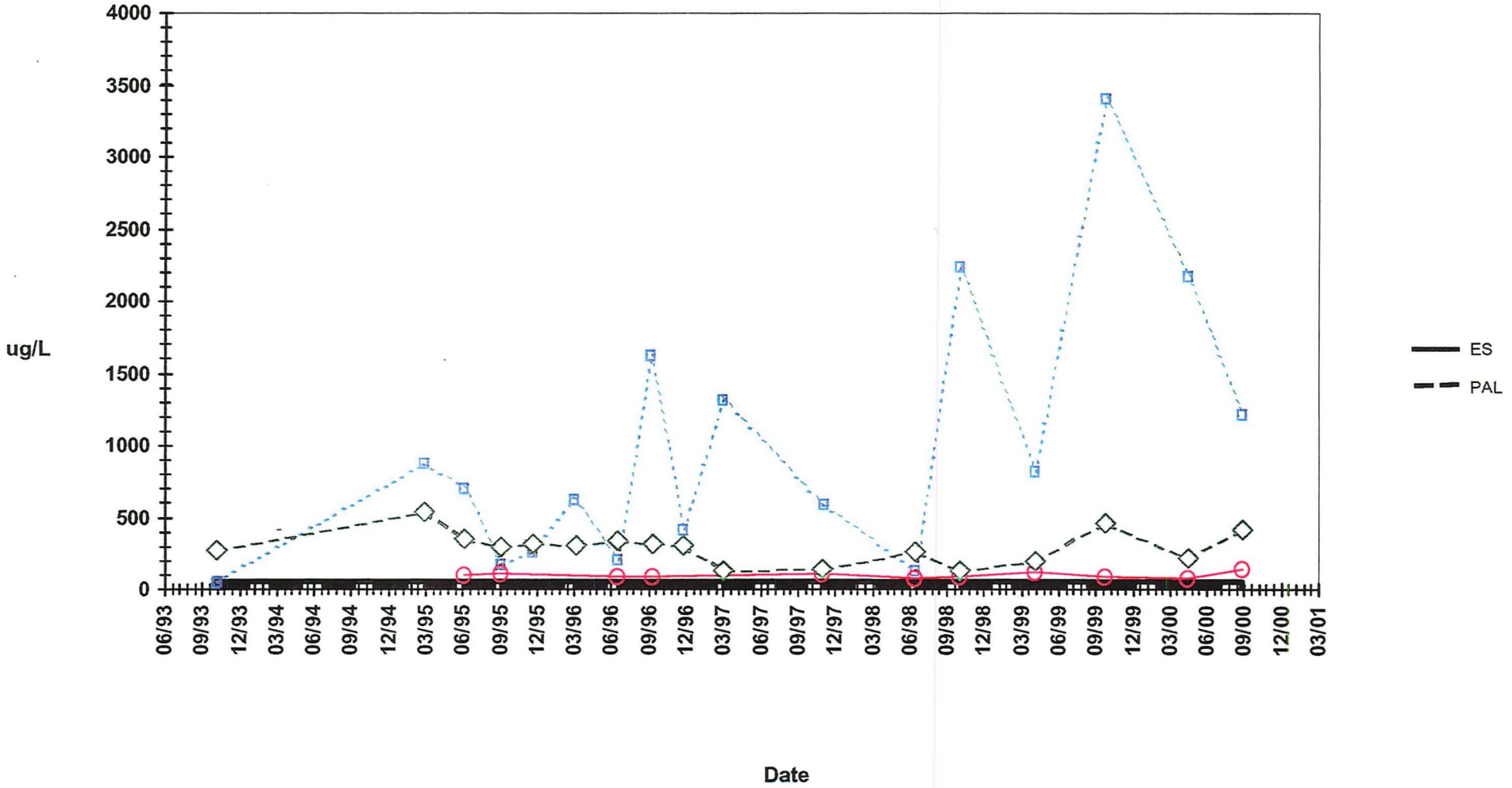
Manganese



Onalaska Municipal Landfill

Residential Wells - Detects Only

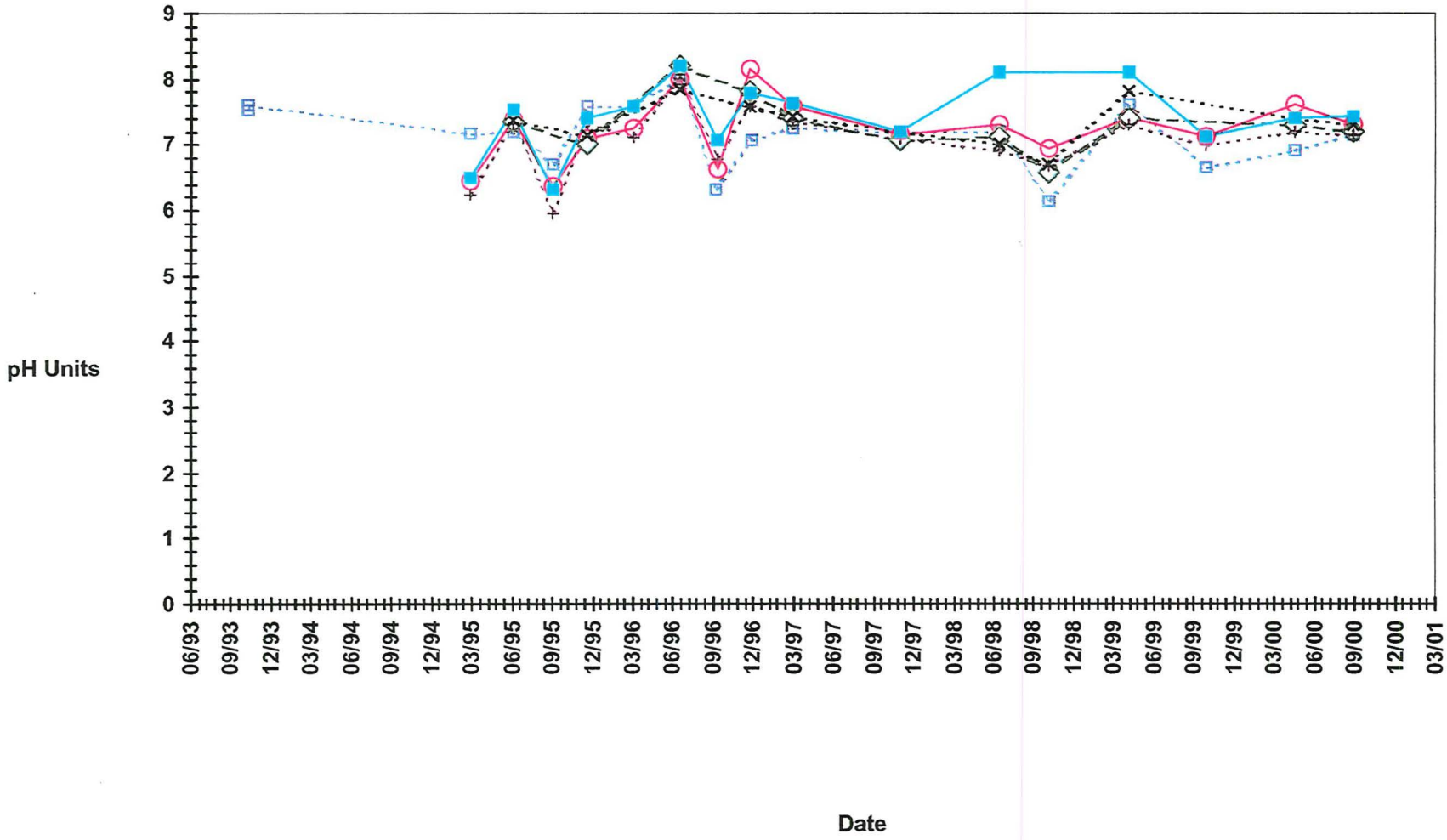
Manganese



Onalaska Municipal Landfill

Extraction Wells

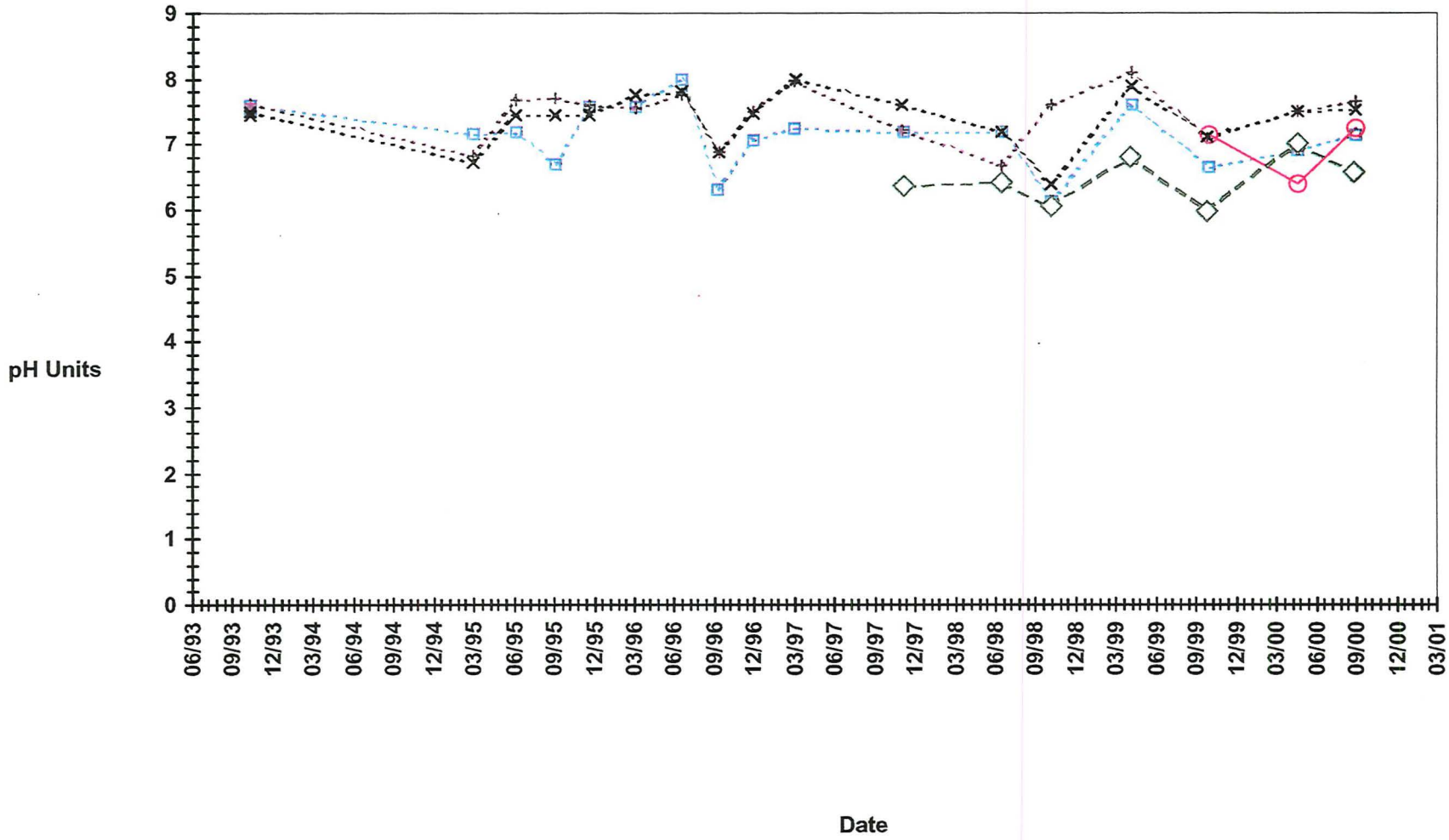
pH



Onalaska Municipal Landfill

Medium Depth Wells

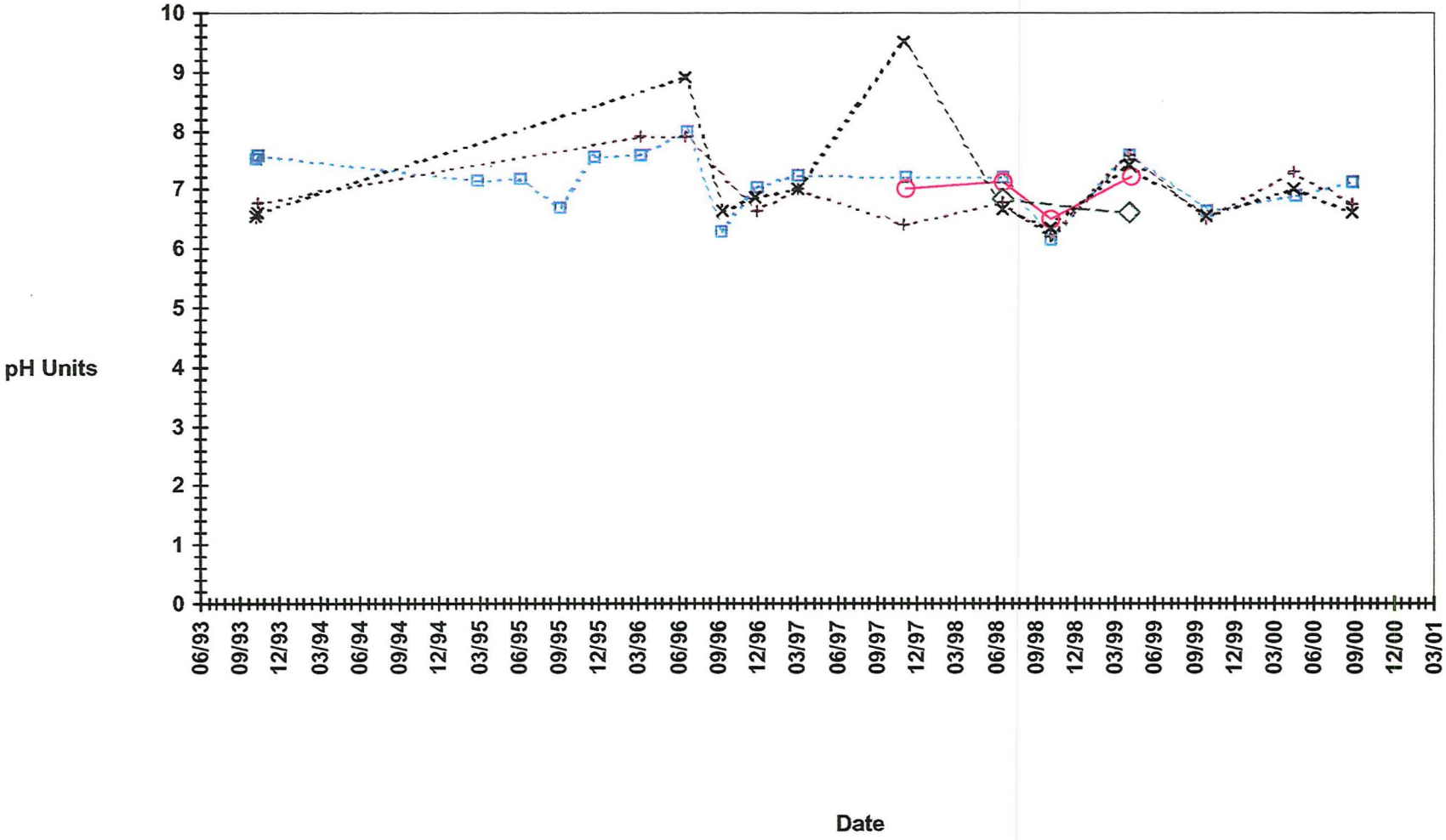
pH



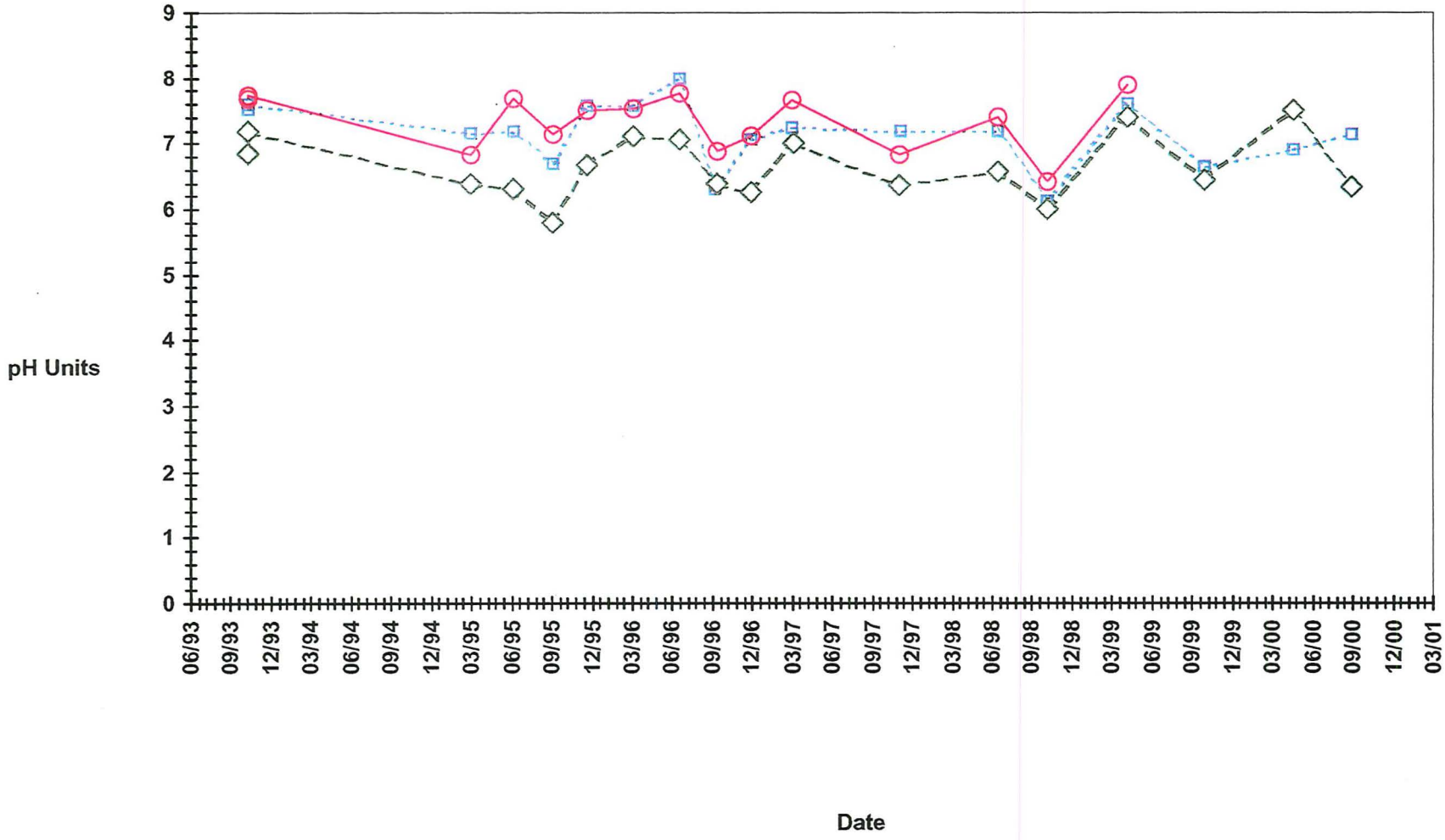
Onalaska Municipal Landfill

MW-02, MW-04S, MW-05S

pH



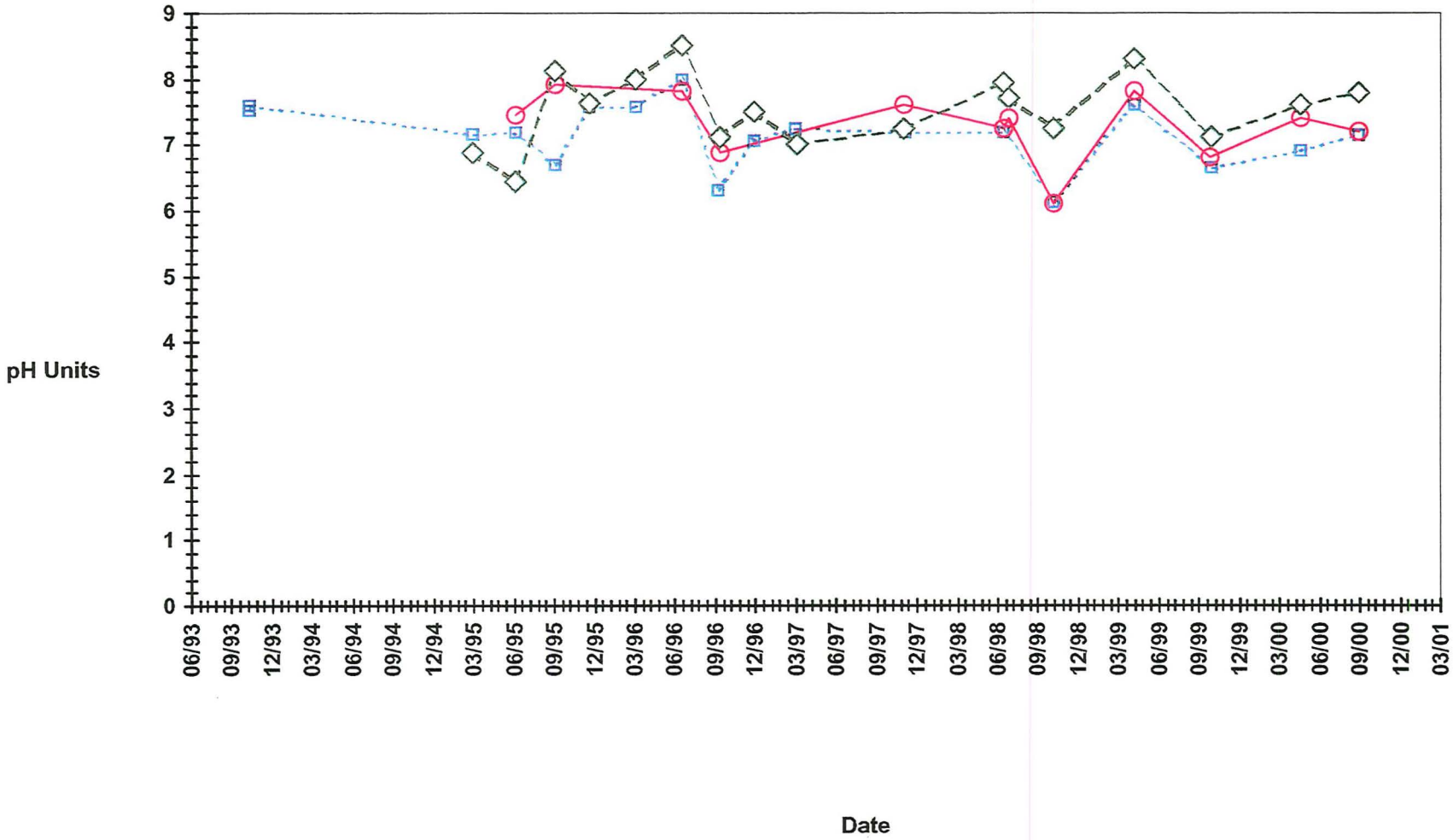
Onalaska Municipal Landfill
MW-12S and MW-14S
pH



Onalaska Municipal Landfill

Residential Wells

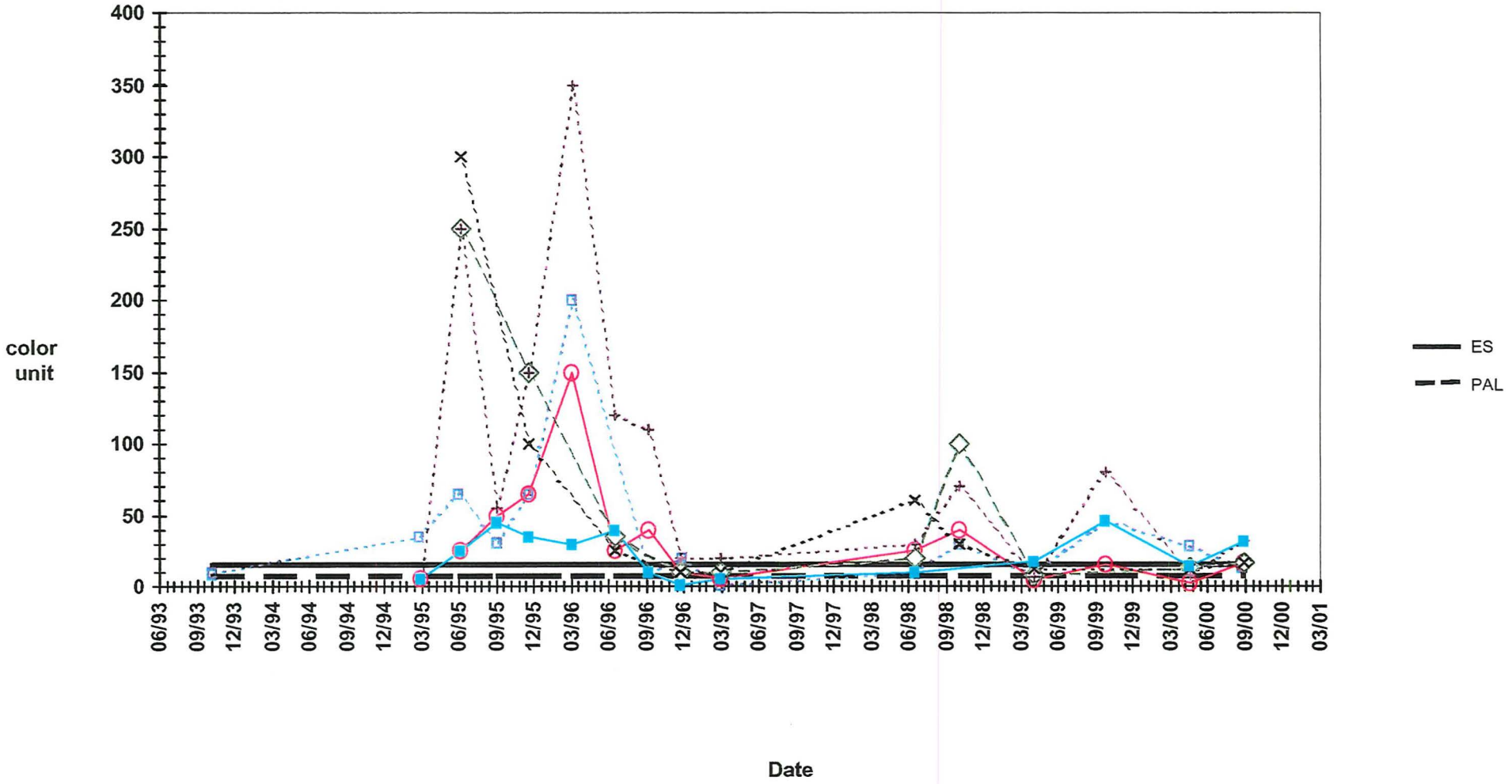
pH



Onalaska Municipal Landfill

Extraction Wells - Detects Only

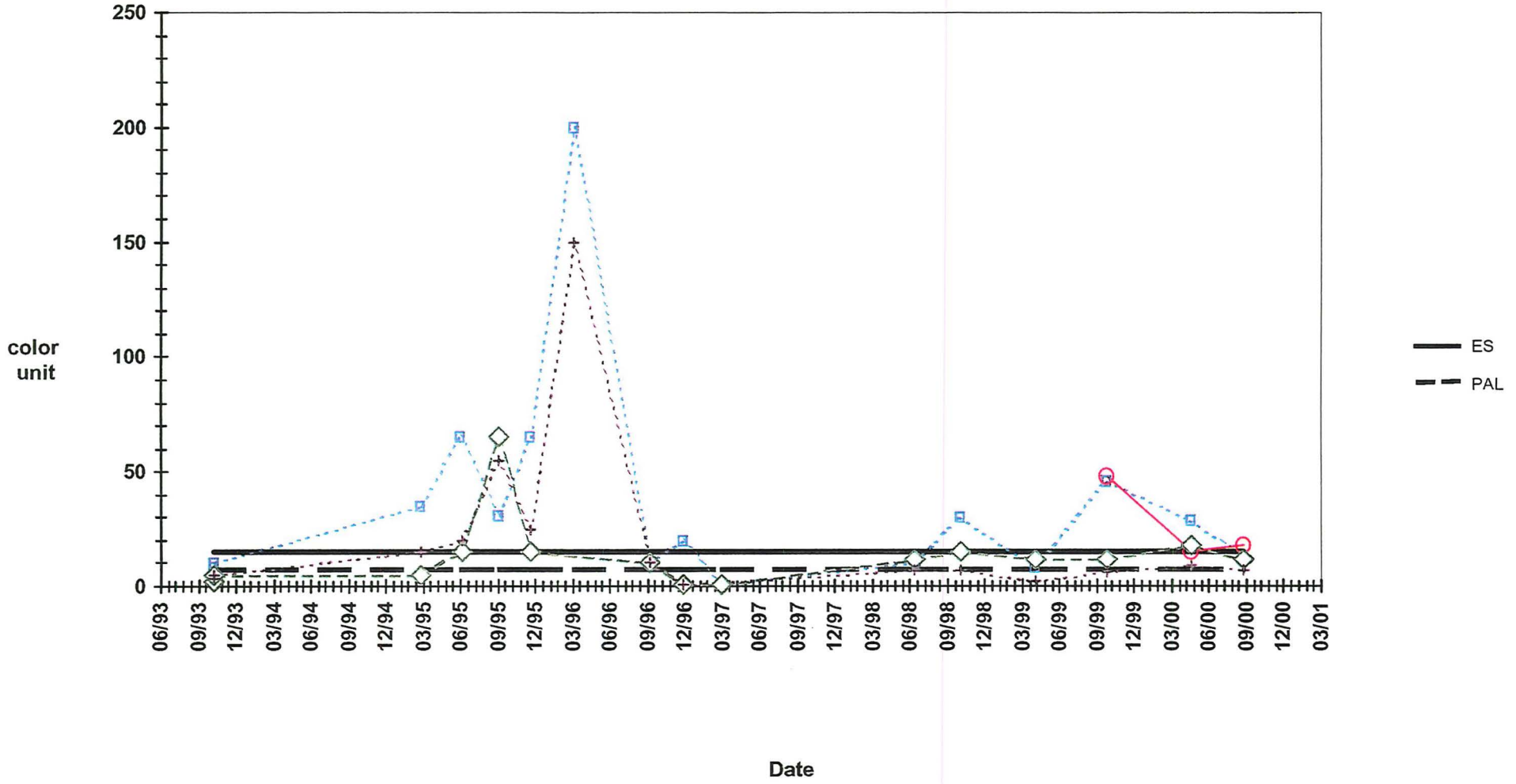
Color



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

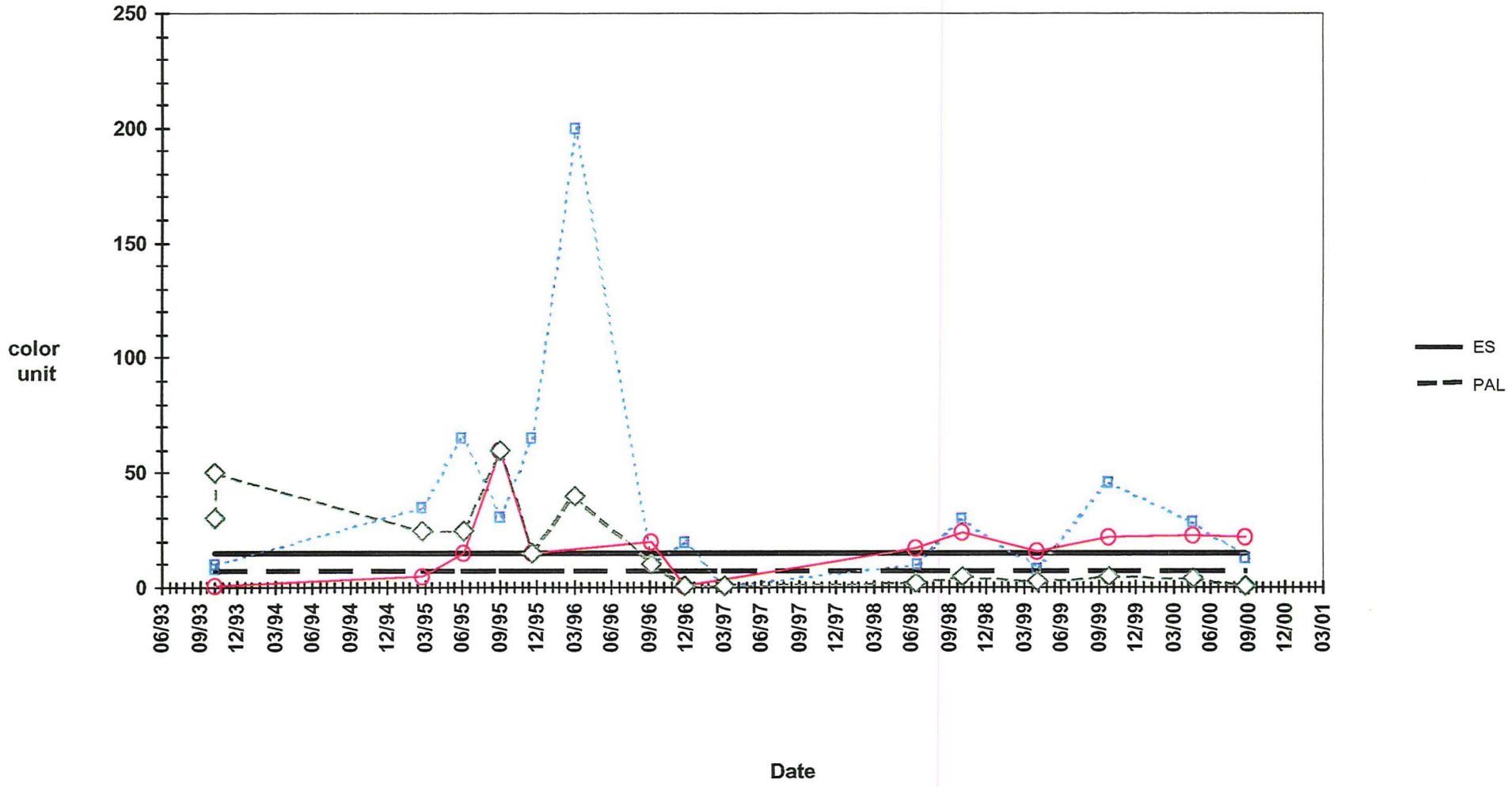
Color



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

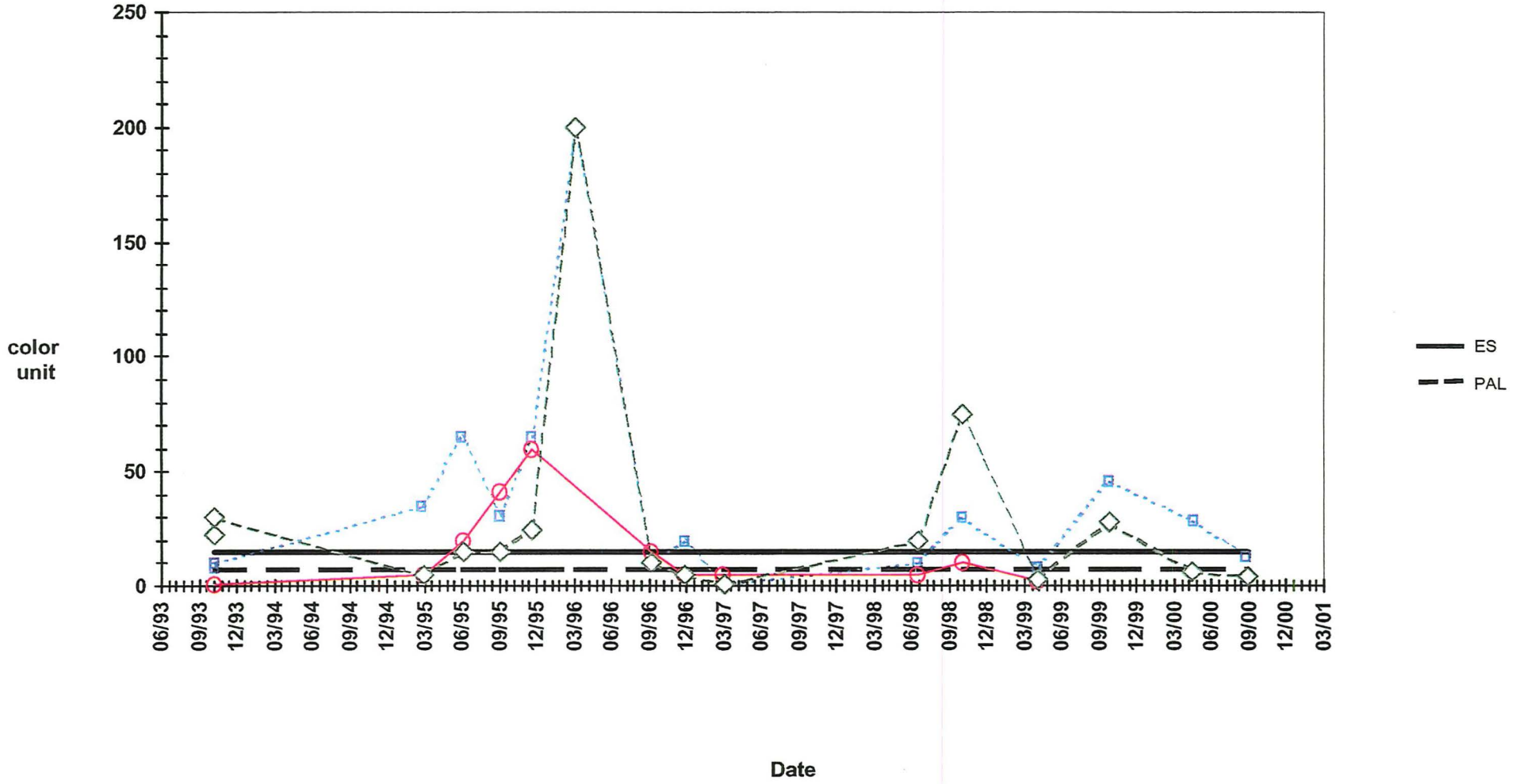
Color



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

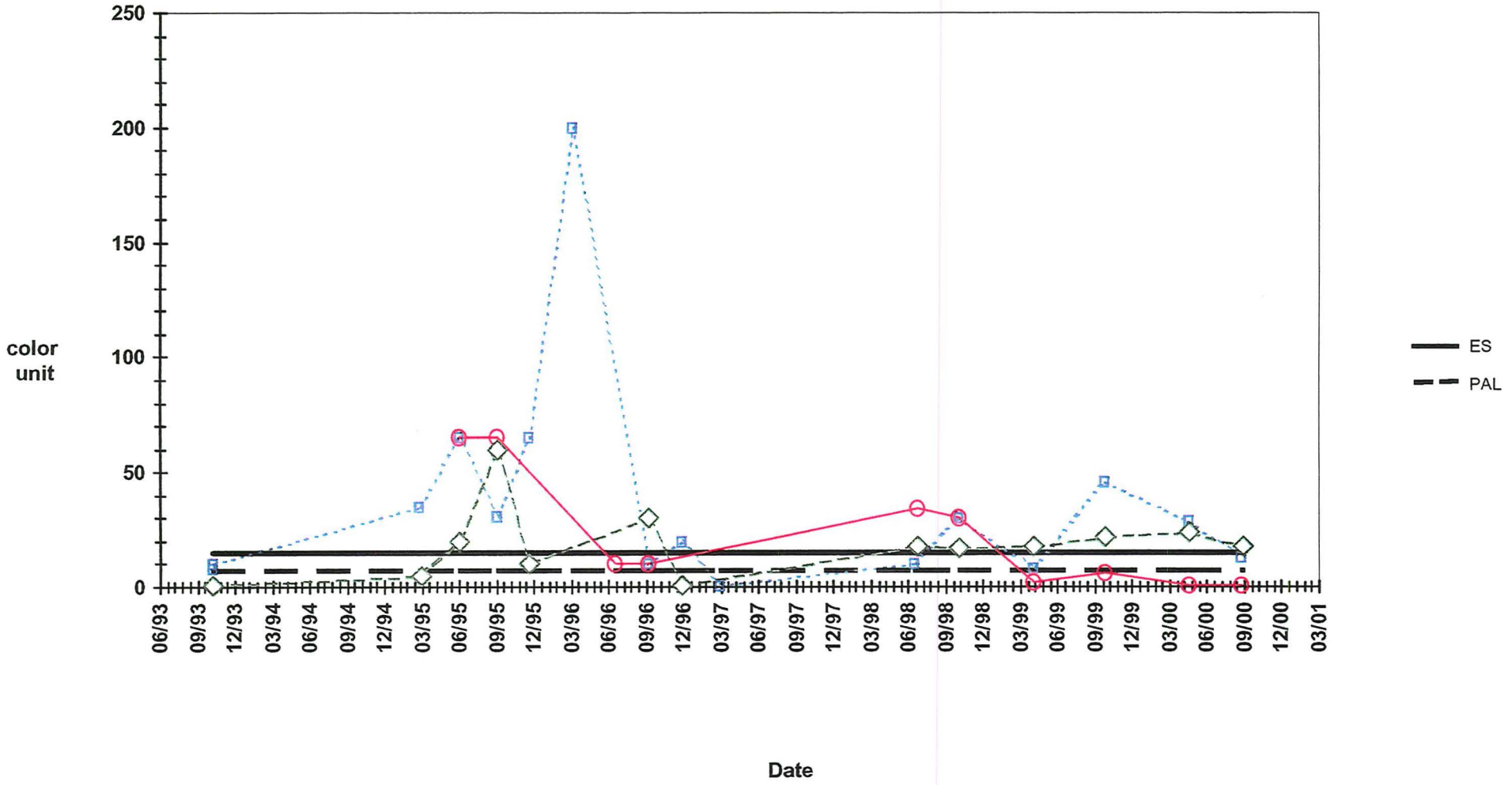
Color



Onalaska Municipal Landfill

Residential Wells - Detects Only

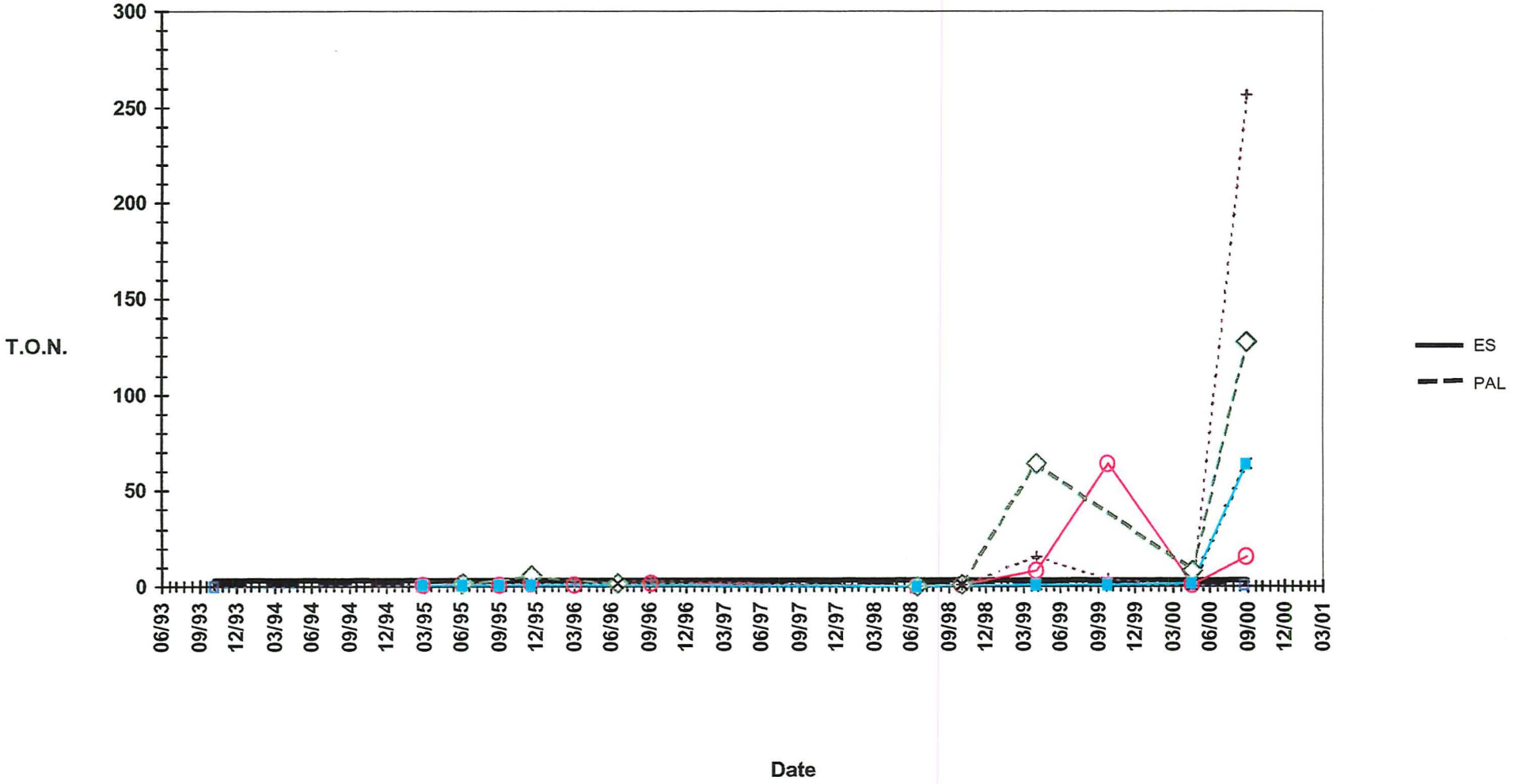
Color



Onalaska Municipal Landfill

Extraction Wells - Detects Only

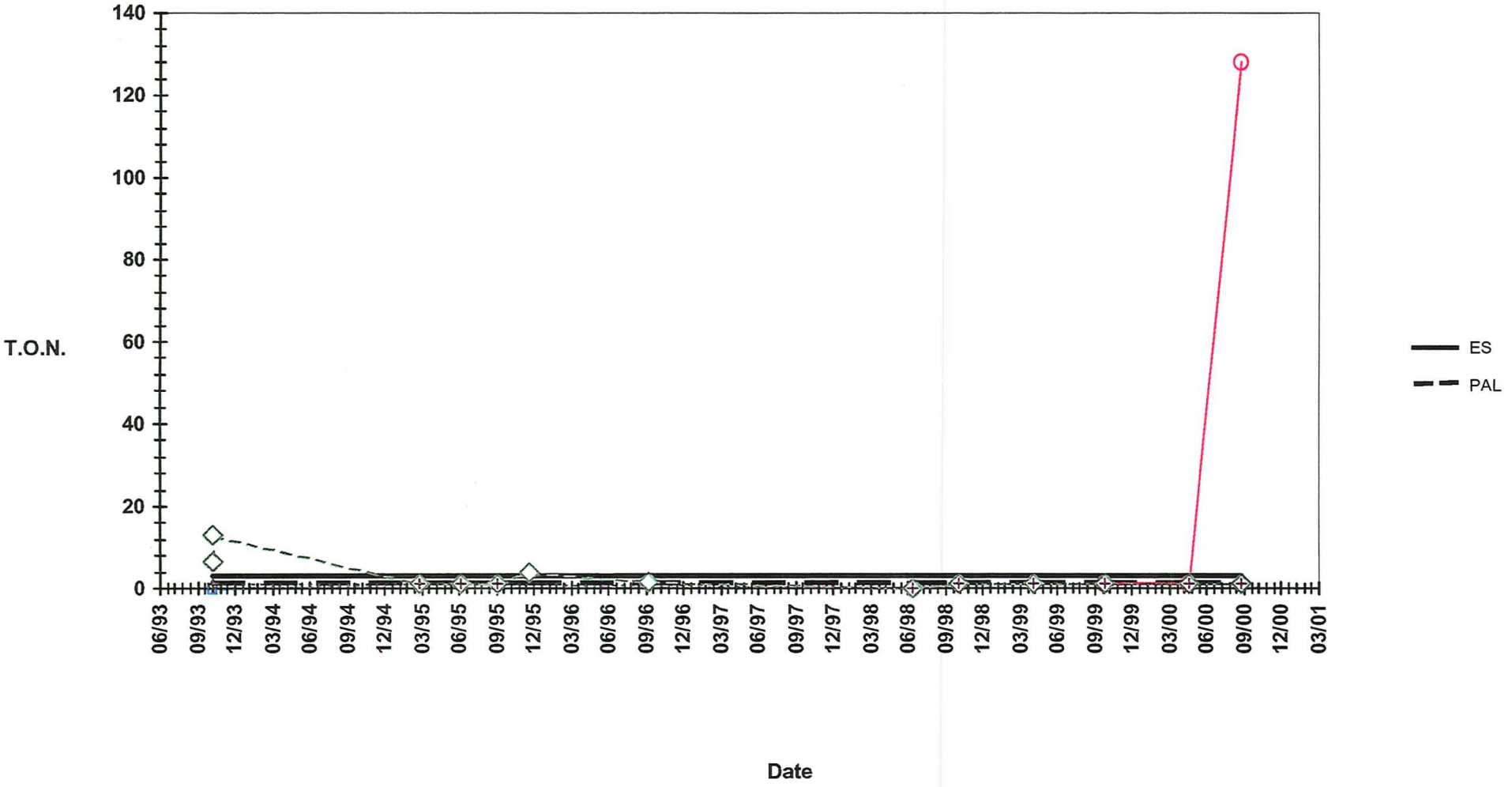
Odor



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

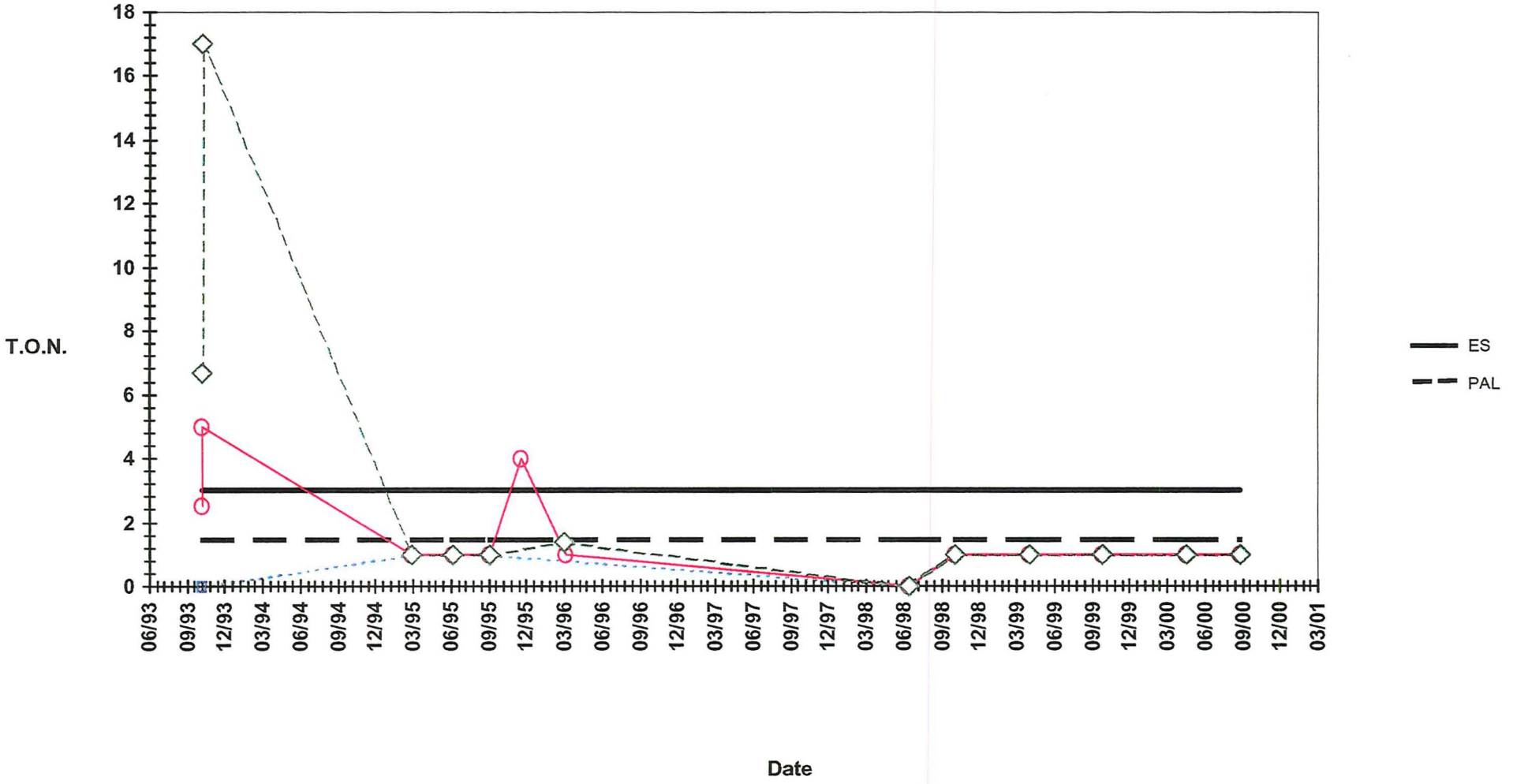
Odor



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

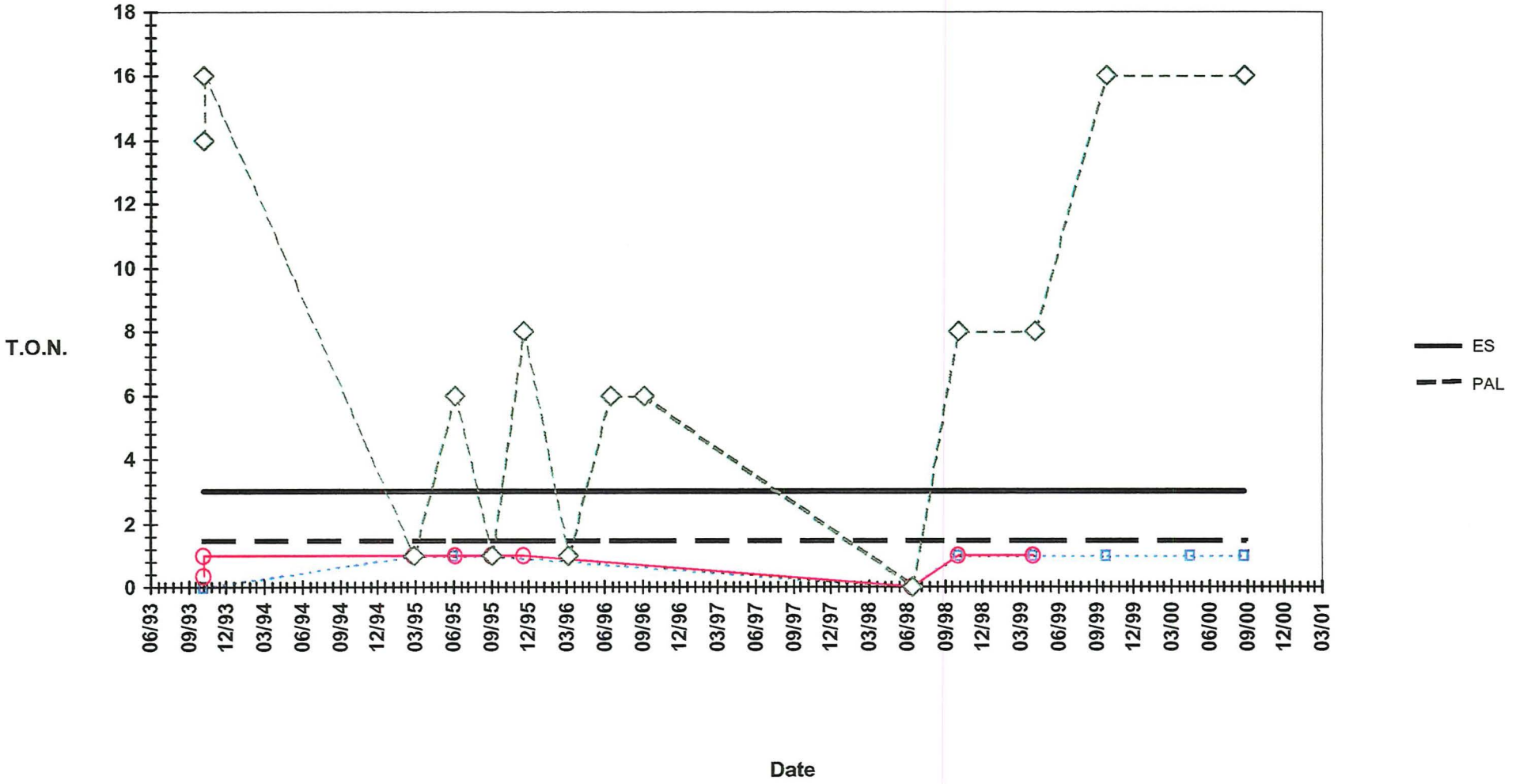
Odor



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

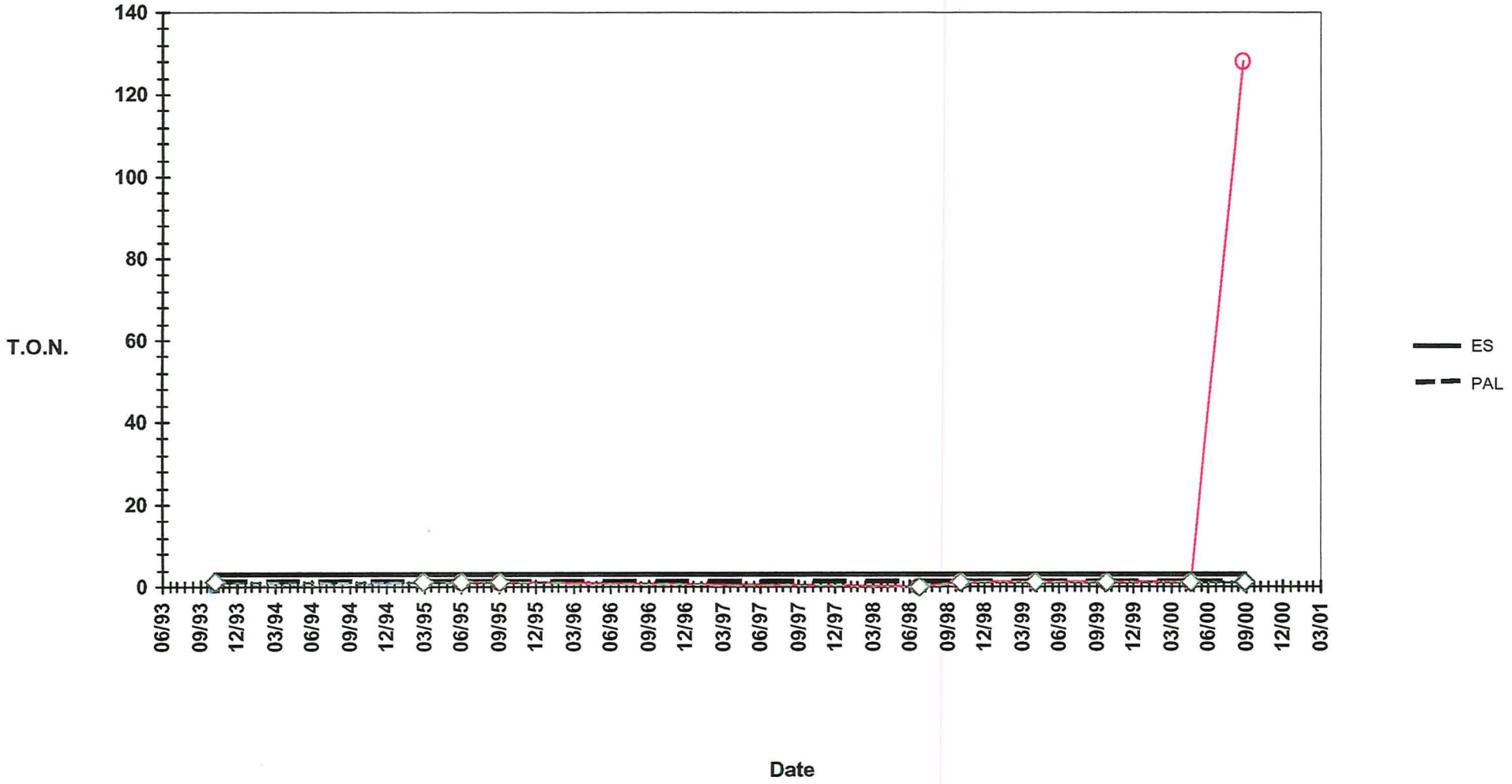
Odor



Onalaska Municipal Landfill

Residential Wells - Detects Only

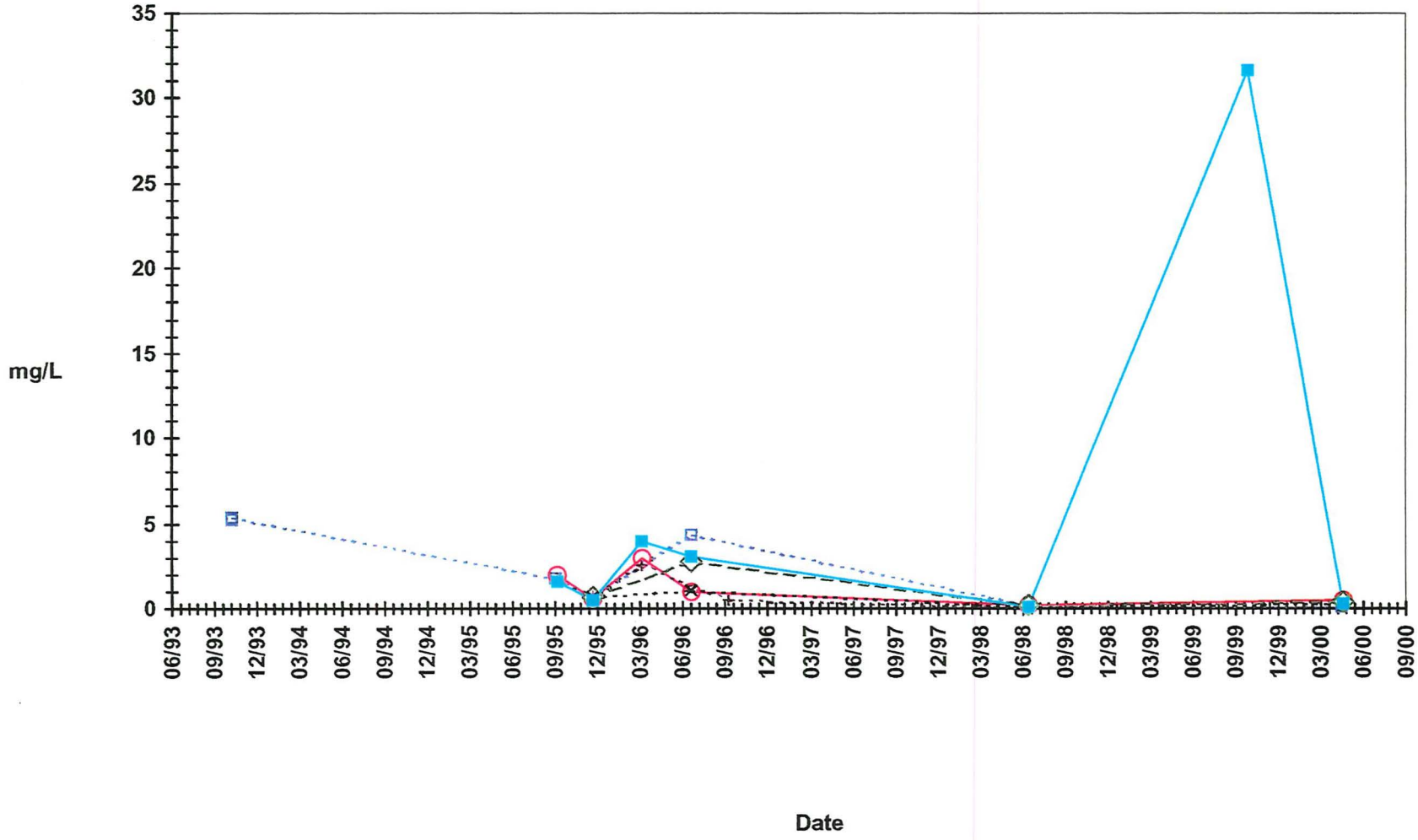
Odor



Onalaska Municipal Landfill

Extraction Wells - Detects Only

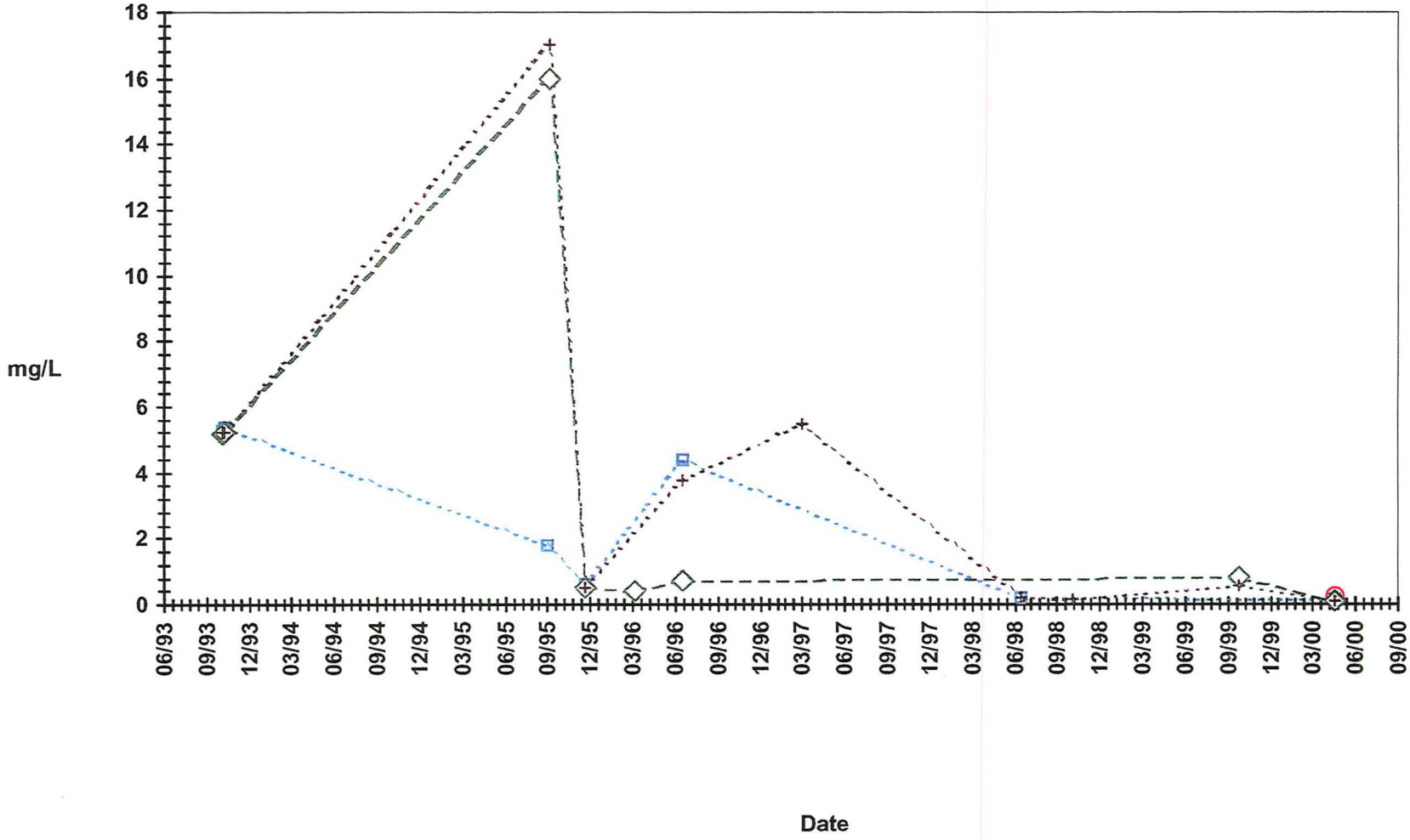
Oil & Grease, Total Rec



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

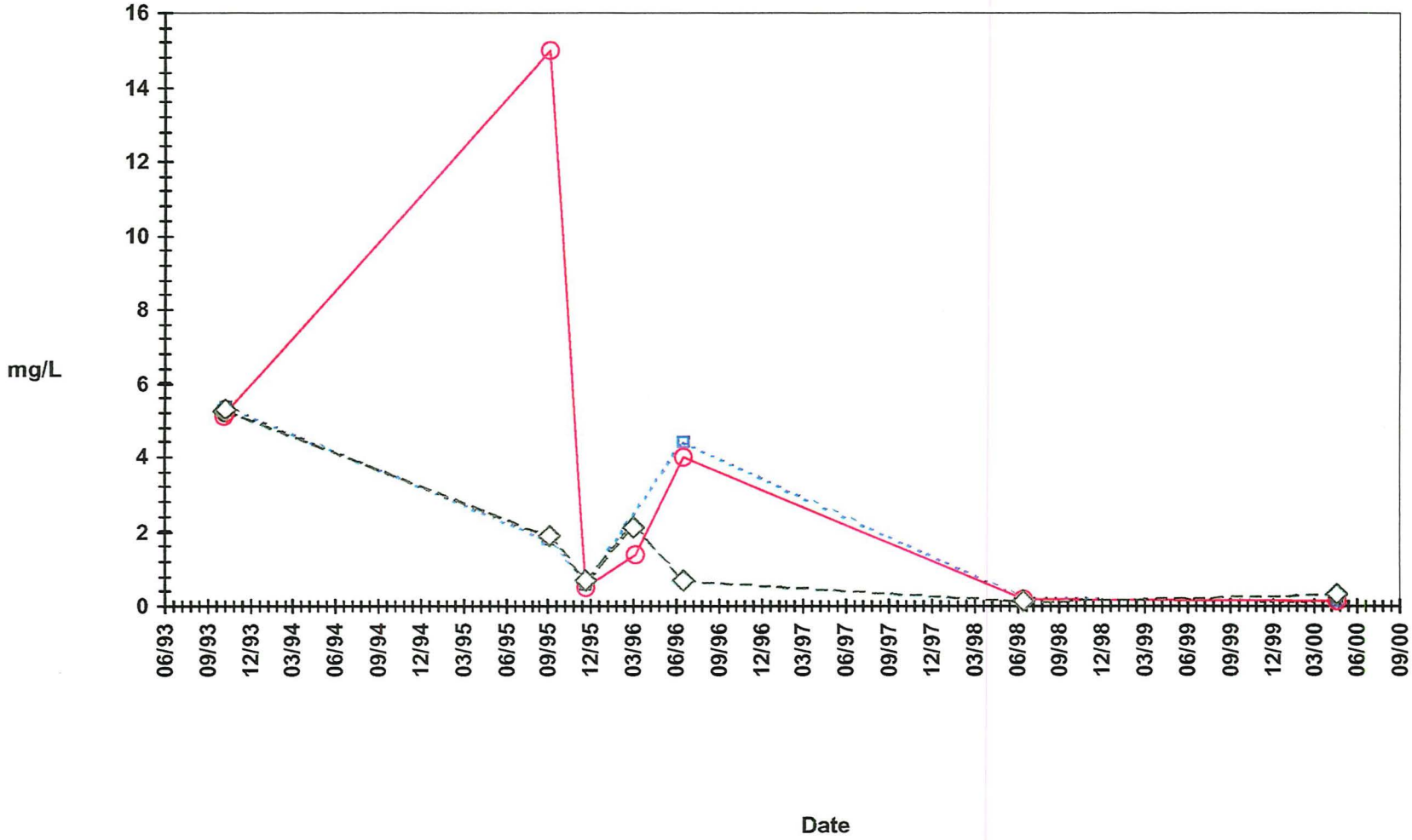
Oil & Grease, Total Rec



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

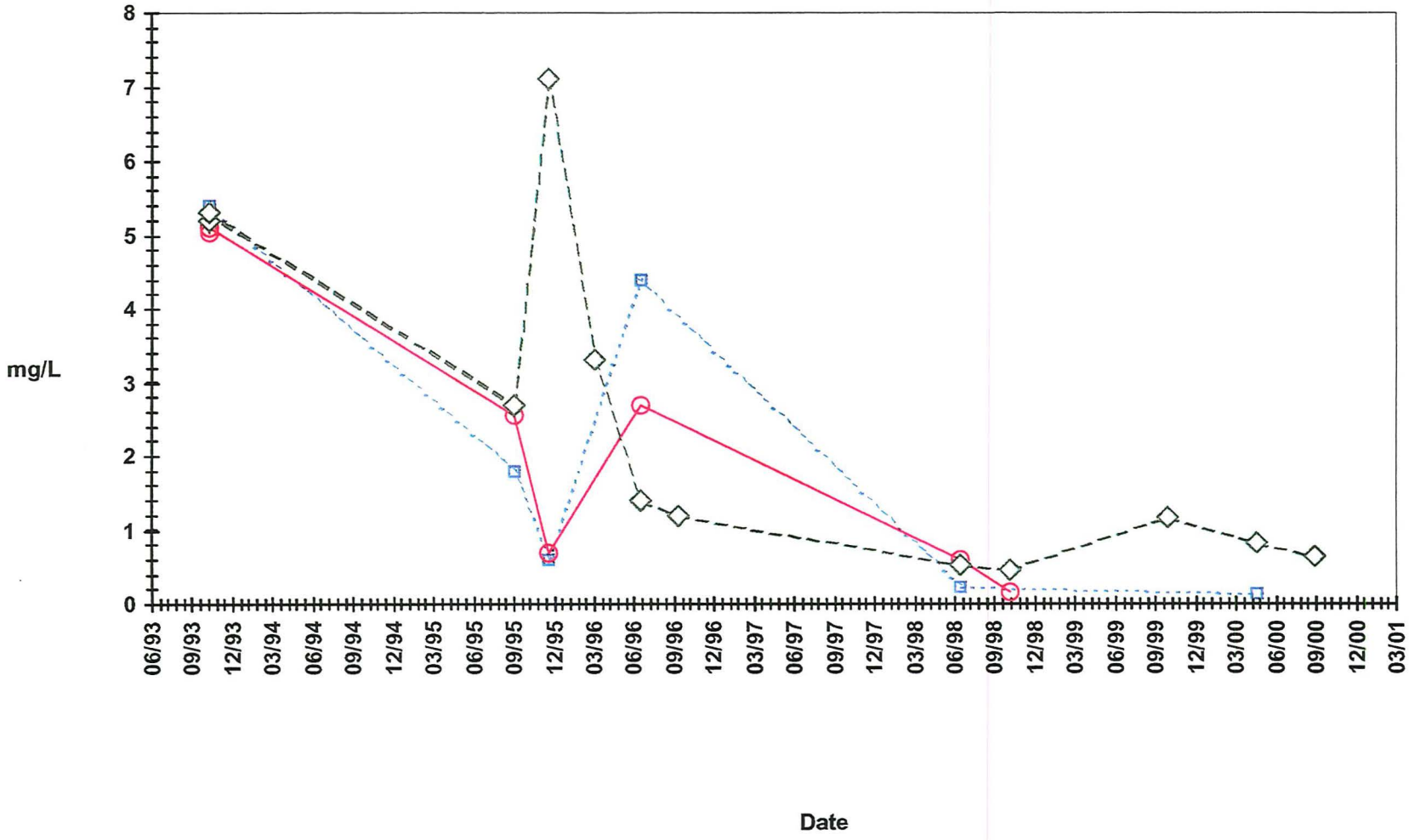
Oil & Grease, Total Rec



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

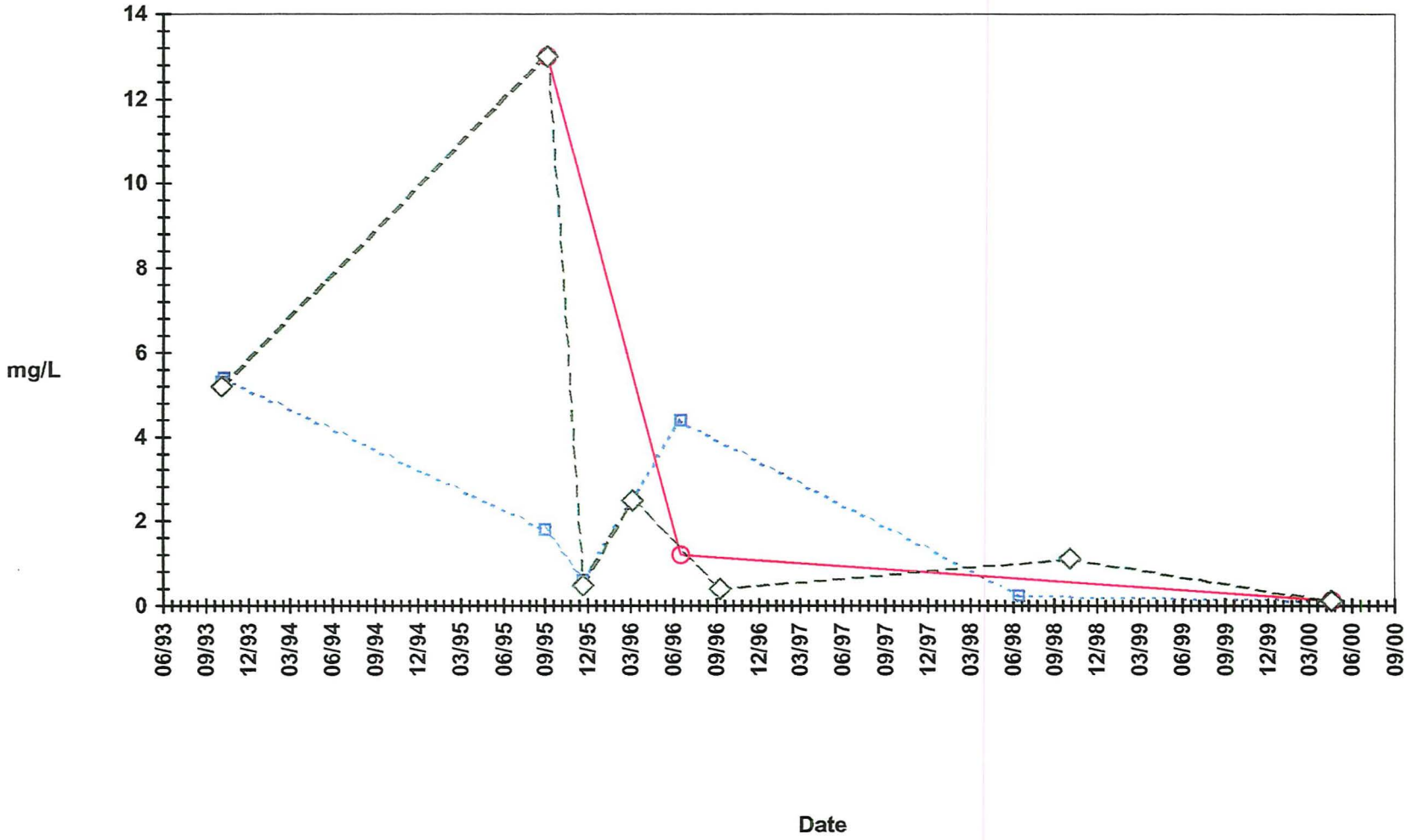
Oil & Grease, Total Rec



Onalaska Municipal Landfill

Residential Wells - Detects Only

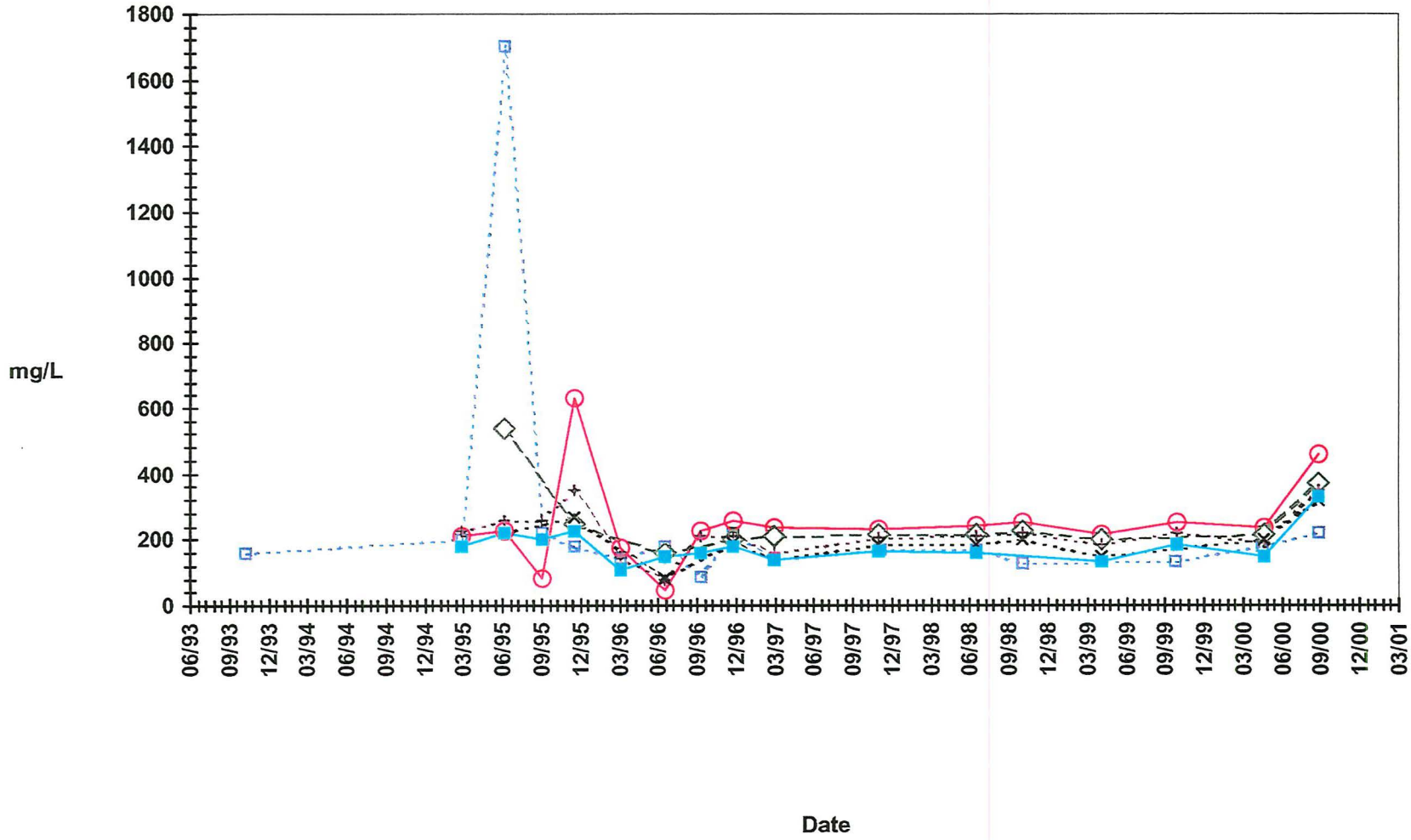
Oil & Grease, Total Rec



Onalaska Municipal Landfill

Extraction Wells

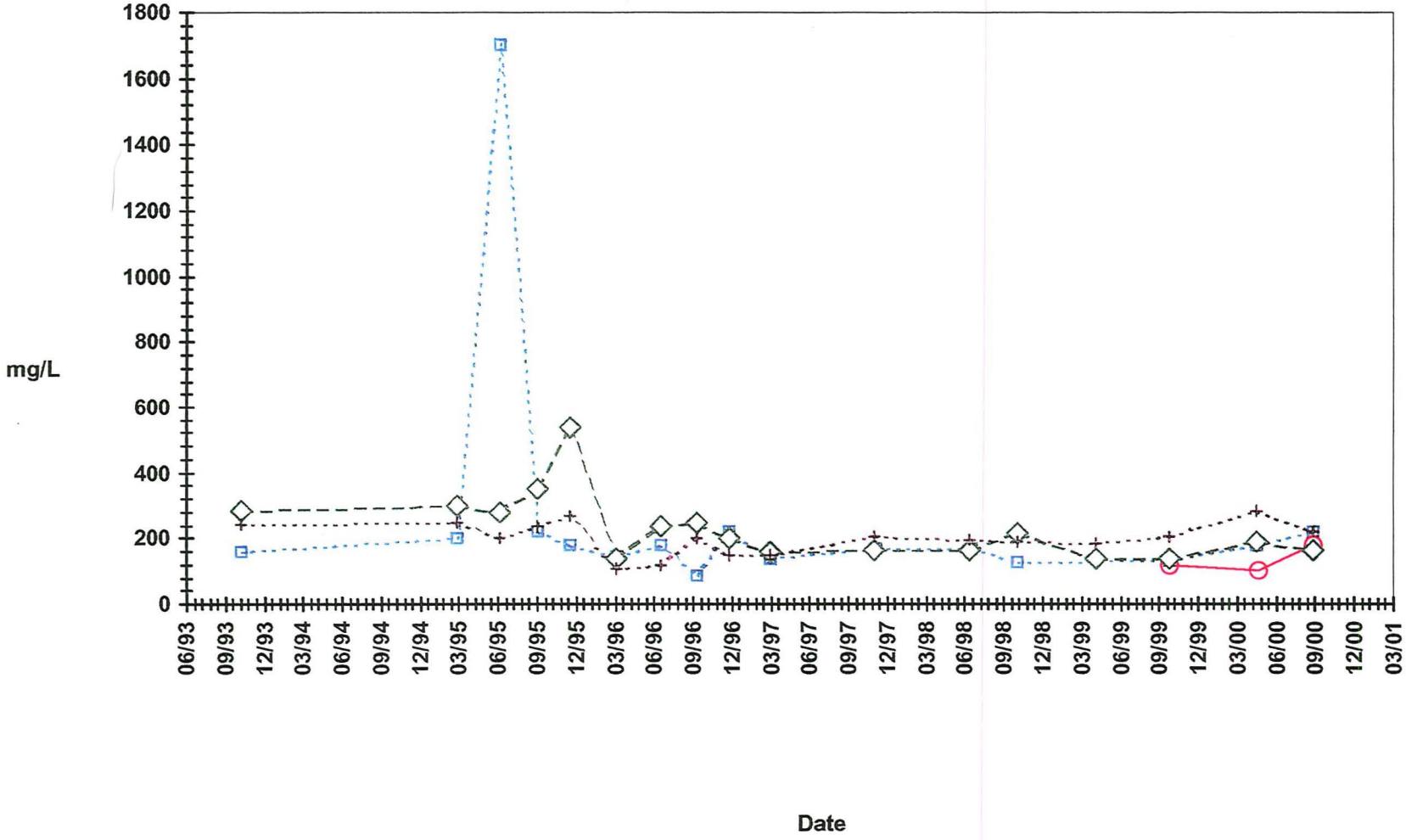
Total Dissolved Solids (Residue, Filterable)



Onalaska Municipal Landfill

Medium Depth Wells

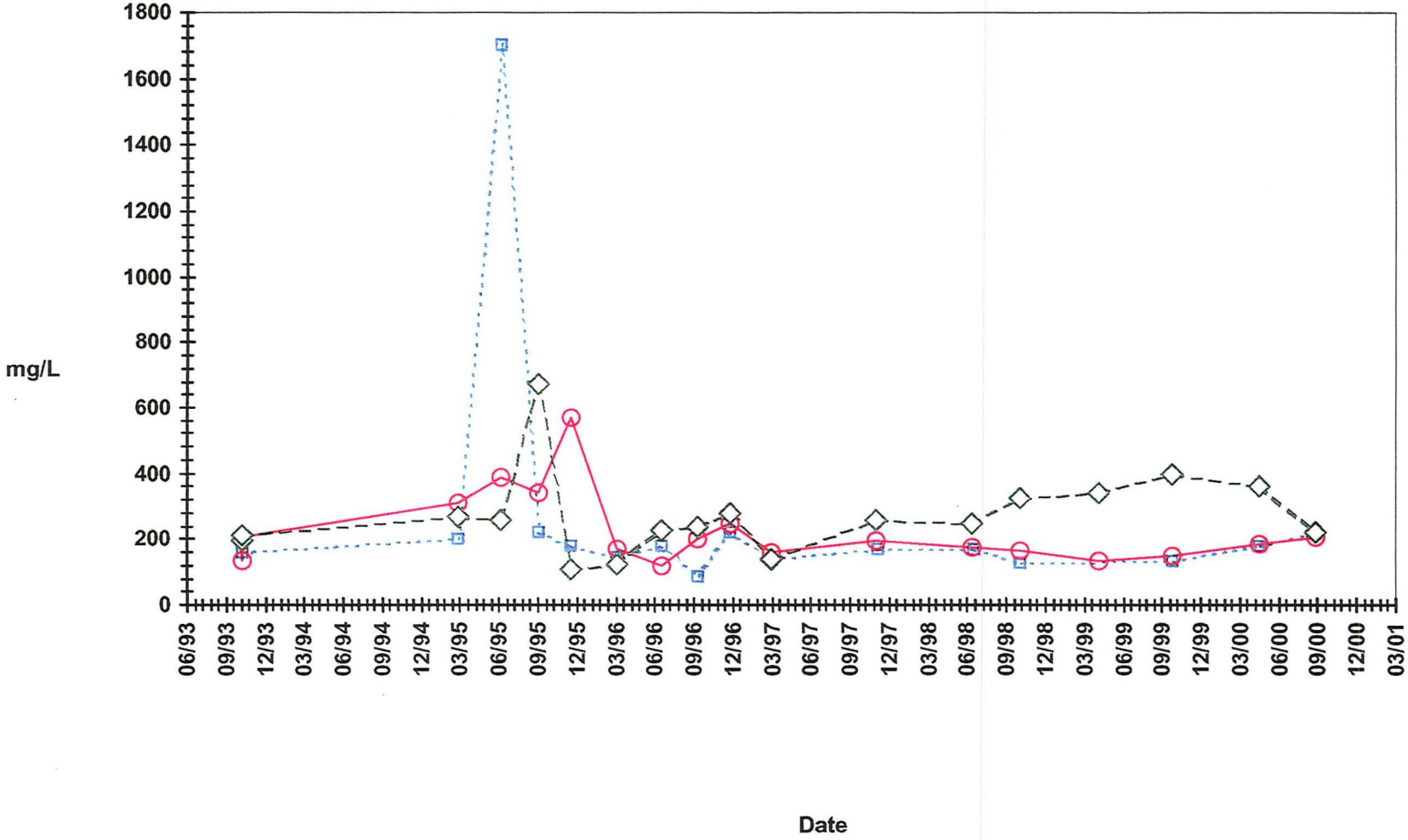
Total Dissolved Solids (Residue, Filterable)



Onalaska Municipal Landfill

MW-06S and MW-08S

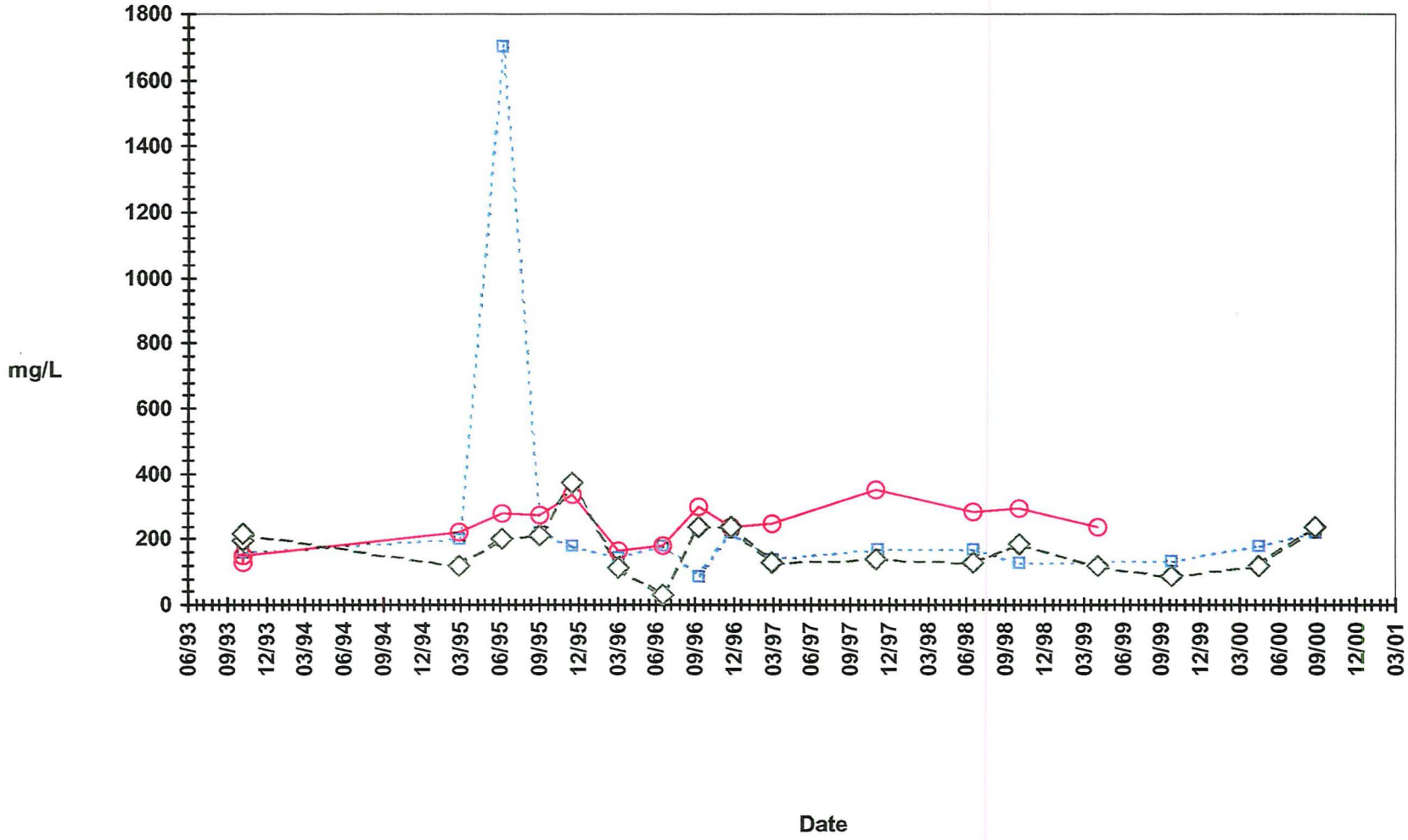
Total Dissolved Solids (Residue, Filterable)



Onalaska Municipal Landfill

MW-12S and MW-14S

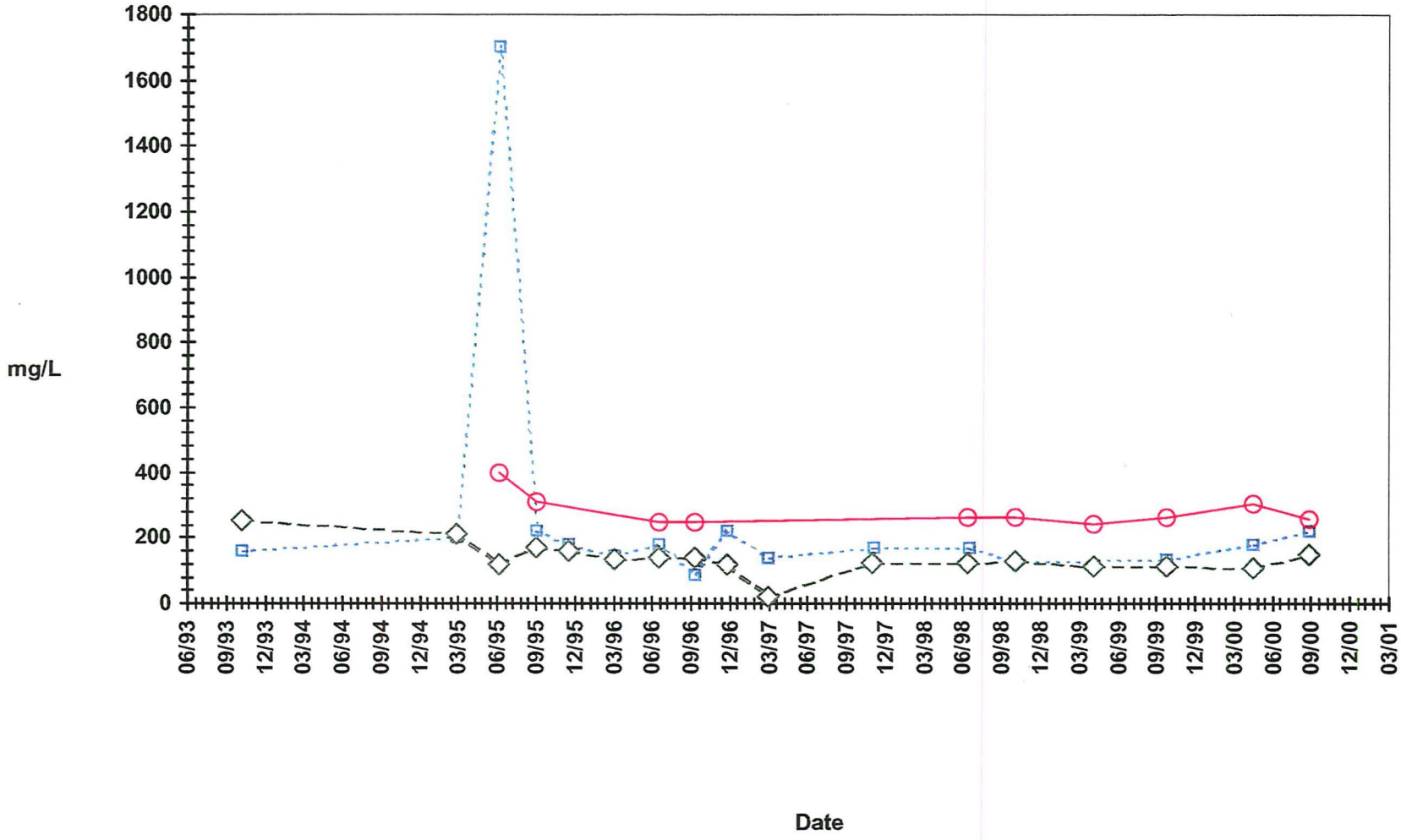
Total Dissolved Solids (Residue, Filterable)



Onalaska Municipal Landfill

Residential Wells

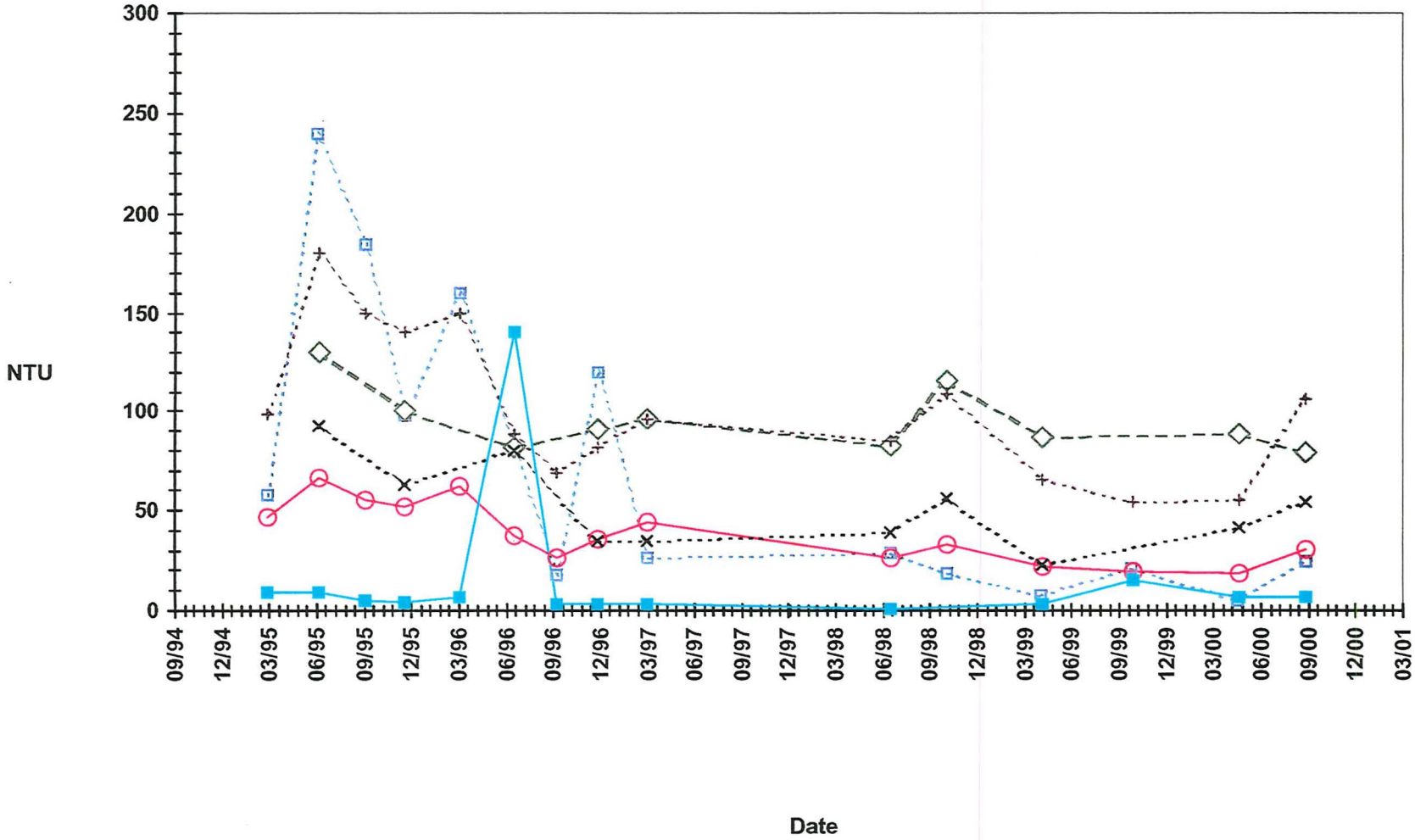
Total Dissolved Solids (Residue, Filterable)



Onalaska Municipal Landfill

Extraction Wells - Detects Only

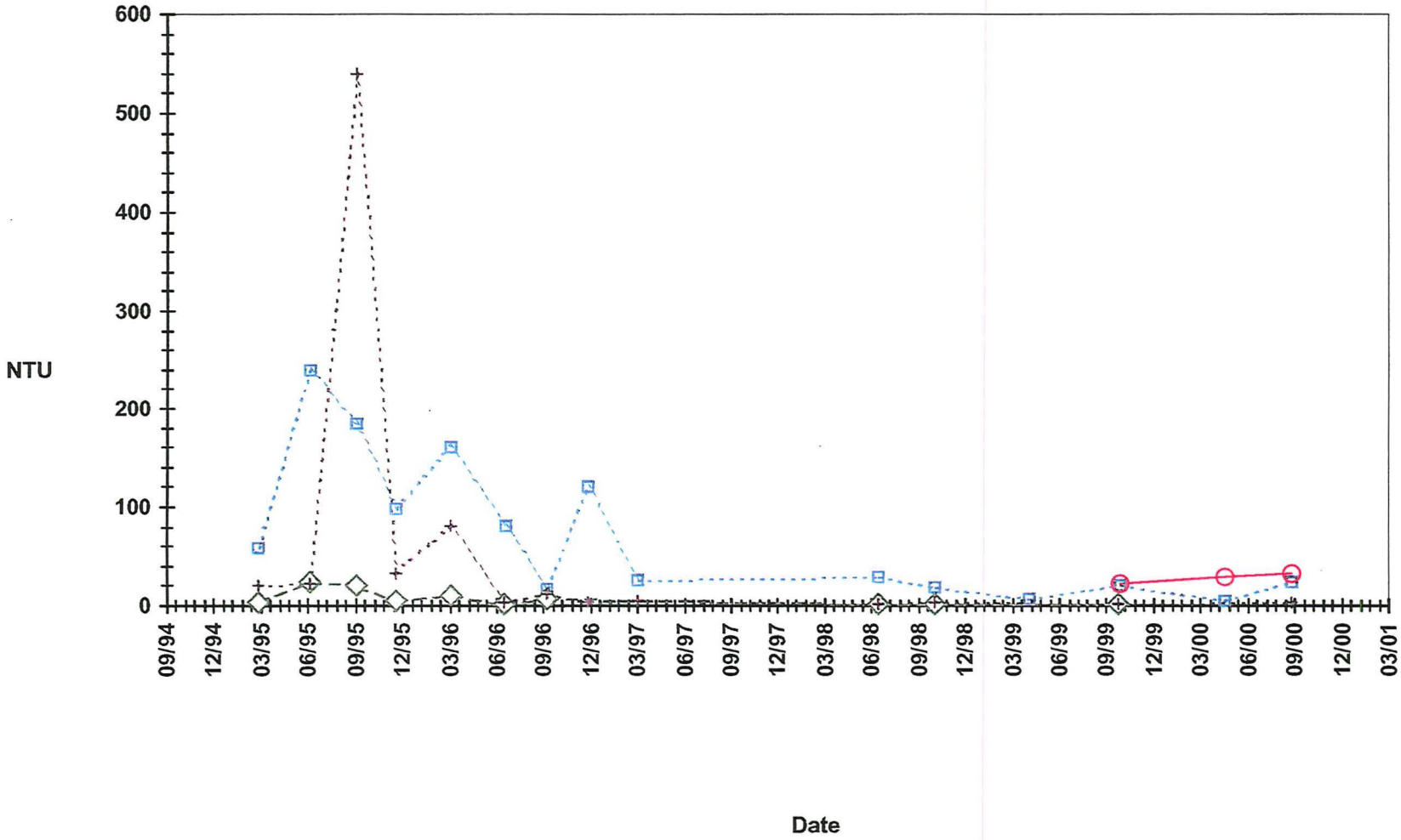
Turbidity



Onalaska Municipal Landfill

Medium Depth Wells - Detects Only

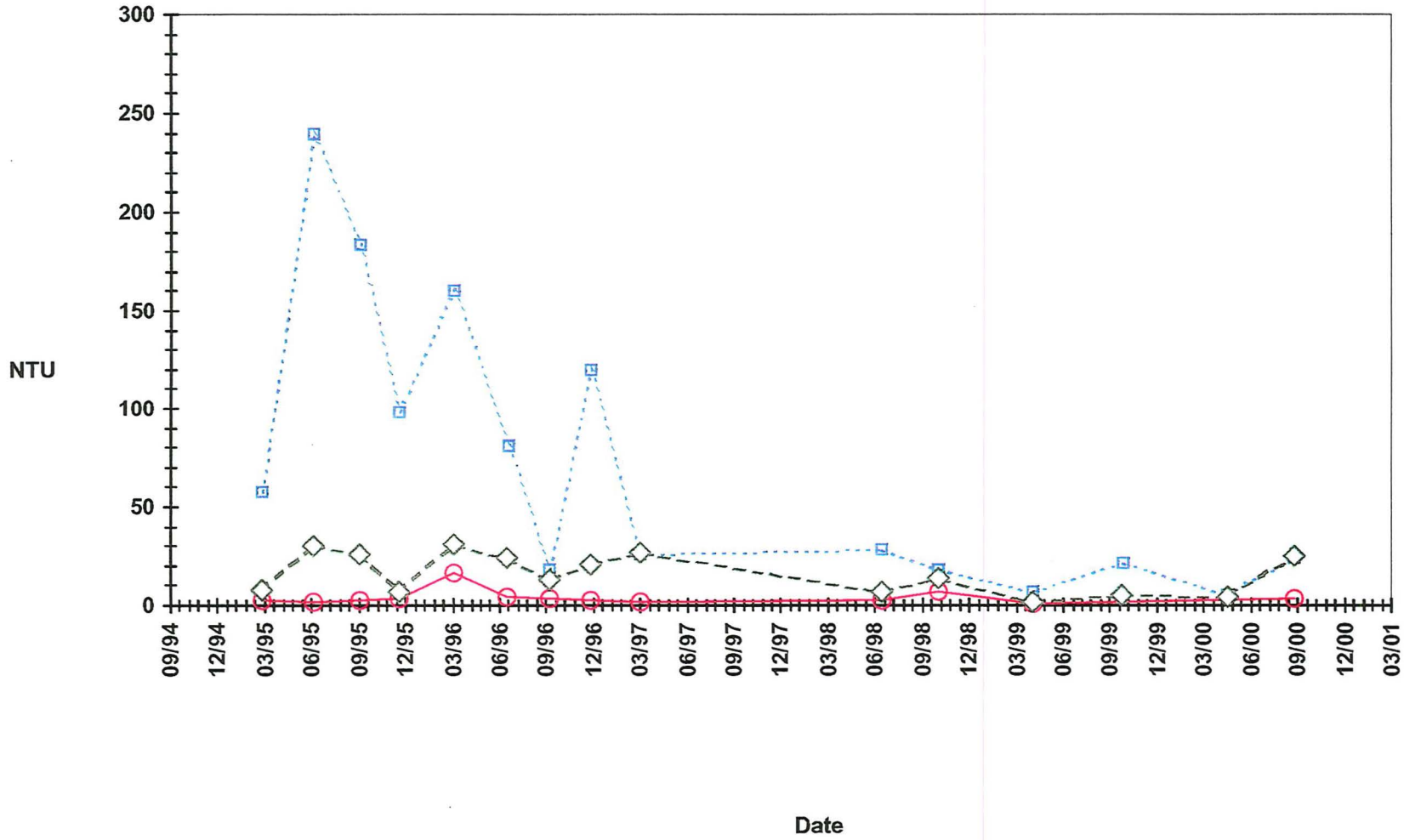
Turbidity



Onalaska Municipal Landfill

MW-06S and MW-08S - Detects Only

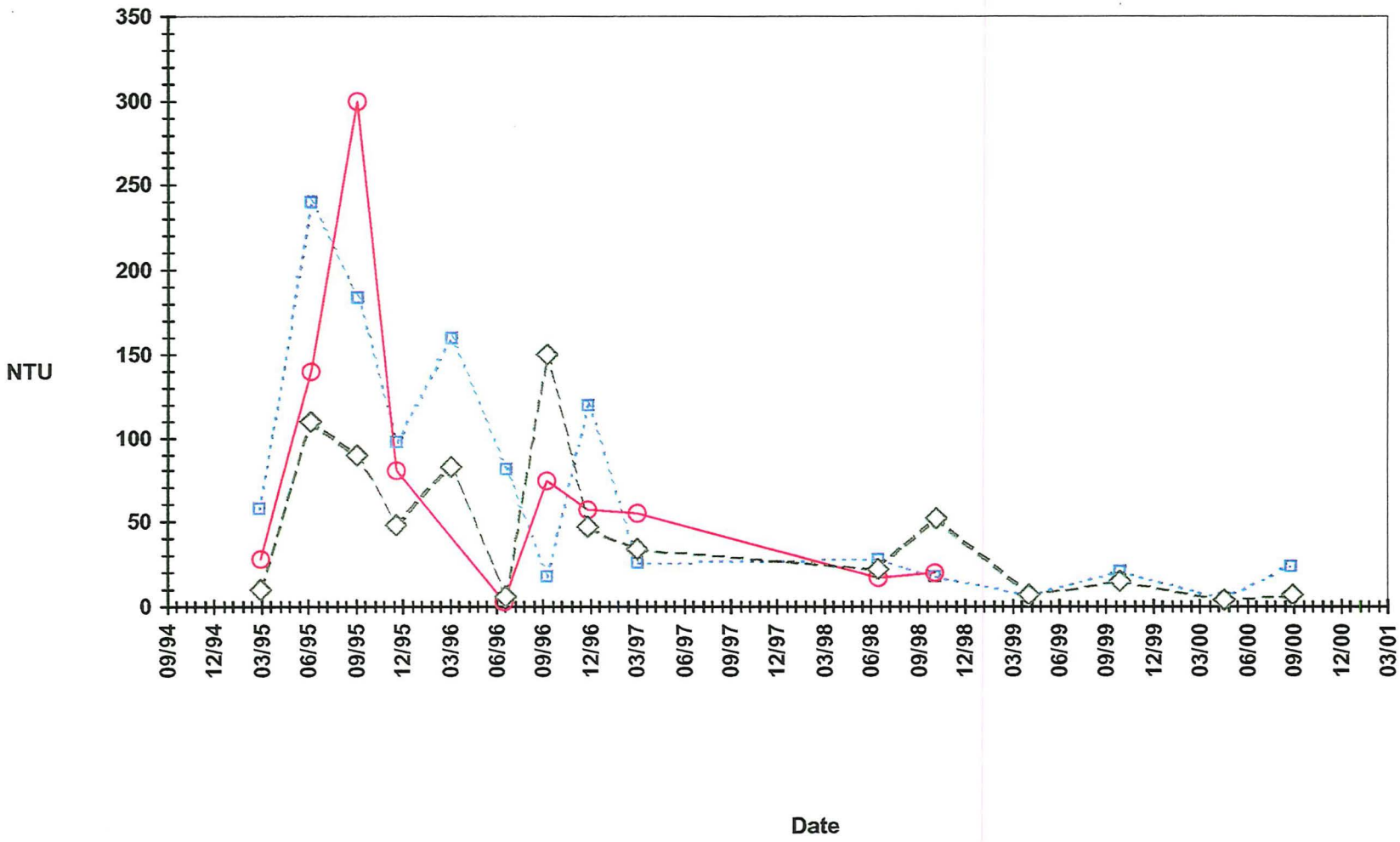
Turbidity



Onalaska Municipal Landfill

MW-12S and MW-14S - Detects Only

Turbidity



Onalaska Municipal Landfill

Residential Wells - Detects Only

Turbidity