Monitoring Well Installation Project Report

August 1993

Prepared by
RH2 Engineering P.S. and
Pacific Groundwater Group

94100535

Monitoring Well Installation Project Report

August 1993

WQFA Grant No. TAX90220

This project was partially funded by the Washington State Department of Ecology/Water Quality Financial Assistance Program under the Centennial Clean Water Fund.

Prepared by

RH2 Engineering, P.S.
8383 158th Avenue NE, Suite 200
Redmond, Washington 98052
(206) 869-1488

and

Pacific Groundwater Group
2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
(206) 329-0141

CITY OF RENTON
MONITORING WELL INSTALLATION PROJECT REPORT
TABLE OF CONTENTS

CHAPTER 5

APPENDICES

TABLES

FIGURES

CHAPTER 1
INTRODUCTION

A. PURPOSE

The purpose of this project was to install several additional monitoring wells at nine locations to support the continuing management goals of the City's Wellhead Protection (WHP) Program. It has been shown that a planned monitoring well network can contribute significantly to the success of a WHP program. The City has established a Wellhead Protection Area (WHPA), which is known to the City as the Aquifer Protection Area (APA). It was evident that the City had some gaps in its monitoring well network; therefore, additional monitoring wells were installed to expand this network in accordance with the City's wellhead protection goals.

B. AUTHORIZATION AND SCOPE OF WORK

On August 9, 1990, the City of Renton authorized RH2 Engineering to construct additional monitoring wells. Pacific Groundwater Group is a subconsultant to RH2 Engineering for this project. On October 9, 1990, the City of Renton executed a contract with the Washington State Department of Ecology to provide a 50 percent matching grant through the Centennial Clean Water Fund Program (FY90) under WQFA Grant No. TAX 90220.

The scope of work for this project included the following tasks:

1. Prepare a Work Plan and Quality Assurance Project Plan. This document was completed in March 1991.

2. Select a monitoring well drilling contractor through a competitive bidding process. Holt Drilling, Inc., was selected as the monitoring well drilling contractor in May 1991.

3. Construct and develop monitoring wells at nine locations. This task was completed in March 1992.

4. Collect and analyze water samples. This task was completed in September 1992.

5. Prepare a final report summarizing all collected data. This report summarizes the collected data.

C. PROJECT OBJECTIVES

This project involved the installation of 17 monitoring wells in nine boreholes within the Renton area. These monitoring wells were placed between potential sources of groundwater contamination and the City's water supply wells. The specific objectives of this project are listed below.

1. Expand the City's existing groundwater monitoring network in order to provide an early warning of aquifer contamination.

2. Study the flow of groundwater through the aquifer within the Renton area. This objective includes gathering geologic and hydrologic data during well drilling. A better understanding of the aquifer hydrology will permit the nature, pathway, and extent of a contaminant to be better determined.

3. Collect and analyze groundwater samples from each monitoring well. Results from this analysis will provide a baseline of groundwater quality for comparison with future analyses.

D. SUMMARY OF FINDINGS

This monitoring well installation project substantially improved our understanding of the geologic and hydrologic characteristics of the Cedar River aquifer system. First, six of the nine bore holes were drilled to the Tertiary bedrock which forms the regional aquiclude and defines the bottom of the regional aquifers. The middle aquifer located in the Maplewood area, also known as the Maplewood Production Aquifer, appears to extend northwest under the northern uplands which was evident in the drilling log for MW-34. Second, the thickness and characteristics of the unconsolidated material and the depth to bedrock within the Narrows supports the geologic model developed for the Cedar River Valley indicating a severe constriction within the alluvium aquifers. This constriction results in aquifer discharge zones east of the Narrows and aquifer recharge zones west of the Narrows. Third, the unconsolidated deposits for the Renton area aquifers were developed through recent glacial activities in the Puget Lowlands. This was evident through the composition and abundance of materials collected from the monitoring well boreholes that originated from sources located in the northern Cascades and British Columbia and were transported to the Renton area through the recent glacial activity.

The water quality of the monitoring well samples was typical of groundwater quality in the Renton area. The water quality data indicates no detection of any pesticides, PCB chemicals, or volatile organic chemicals. The various inorganics and metals measured in each monitoring well sample were below established primary or secondary maximum contamination levels with some exceptions.

E. RECOMMENDATIONS

With the installation of these additional monitoring wells, the City now has an extensive monitoring well network for the detection of contaminants within the groundwater which may threaten its water supply. However, groundwater contaminants cannot be identified unless a groundwater sampling and monitoring program is enacted. Therefore, the next phase in the City's WHP program is to establish a groundwater sampling plan. This plan would assess the needs and goals of the City's WHP program and would establish a sampling plan to meet those objectives. The sampling plan would identify sampling intervals for each monitoring well based on its proximity to potential sources of contamination, thus providing early warning of contamination migrating to the City's wellfields.

As part of its WHP program, the City also needs to improve the groundwater modeling of the Maplewood wellfield. This monitoring well installation project has collected significant geologic and hydrologic information regarding the aquifer within the Maplewood area. This information can now be used to develop a numeric groundwater model in order to assist the City in delineating a WHPA for the Maplewood wellfield. At the present time the City has contracted with Pacific Groundwater Group to develop such a model. Once completed, this model will be used to delineate a WHPA for the Maplewood wellfield as well as quantify the link between the Maplewood and Cedar River Delta wellfields.

CHAPTER 2
MONITORING WELL INSTALLATION

This monitoring well installation project resulted in construction of 17 new monitoring wells in nine different boreholes. Each monitoring well site was identified in the Monitoring Well Installation Work Plan (March 1992). The construction phase of the project began on July 17, 1991 and was completed on March 19, 1992. **Figure 2.1** shows an overall map of the Maplewood and Cedar River Delta well fields and identifies the location of the nine (9) monitoring well installation sites. Detailed vicinity maps of each monitoring well site are presented in **Appendix B**. Well logs for each monitoring well installation are presented in **Appendix C** The groundwater sampling program "Quality Assurance Project Plan" and QA/QC results are presented in **Appendix E**. Water quality data for each monitoring well are presented in a separate document entitled "City of Renton - Monitoring Well Installation Project, Groundwater Quality Data, AM Test Professional Analytical Services. The boreholes in this project were drilled by the cable tool method. A summary of monitoring well construction details is provided in **Table 2.1**. The following presents a detailed description of the drilling and installation of each monitoring well.

A. MONITORING WELL 30 (MW-30)

Monitoring Well 30 is located on the west side of Williams Avenue N between N 1st Street and the Cedar River channel. This monitoring well is located west of Renton's downtown wellfield on the western boundary of Zone 1 of the City's Aquifer Protection Area.

The well drilling began on March 10, 1992. The borehole was drilled to a depth of 114 feet using the cable-tool method with 8-inch diameter casing. The material encountered in the borehole consisted mainly of sand and gravel. A bluish-grey silt and clay alluvial deposit was encountered at a depth of 108 feet which indicated the bottom of the aquifer unit. No bedrock was encountered in this borehole. Two monitoring wells were installed in this borehole, each with a 10 foot screen. The bottom of the deep monitoring well was located at 94 feet and the bottom of the shallow monitoring well was located at 54 feet. The monitoring wells are considered to be screened within the upper and lower section of the same aquifer unit. The monitoring well installation was completed on March 19, 1992.

The monitoring wells were sampled on August 19, 1992. The depth to water on this date was 13.86 feet for the shallow monitoring well and 13.88 feet for the deep monitoring well as measured from the top of the monitoring well piezometer pipes.

B. MONITORING WELL 31 (MW-31)

Monitoring Well 31 is located in the City's Cedar River Park adjacent to the Stoneway Concrete property and METRO's Cedar River Sewer Interceptor. This monitoring well is located up gradient from the City's Production Well No. 8 and is within Zone 1 of the City's Aquifer Protection Area.

The well drilling began on October 7, 1991. The borehole was drilled to a depth of 112 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted mainly of sand and gravel. A bluish-grey silt and clay alluvial deposit was encountered at a depth of 93 feet which indicated the bottom of the aquifer unit. No bedrock was encountered in this borehole. Two monitoring wells were installed in this borehole, each with a 5 foot screen. The bottom of the deep monitoring well is located at 79 feet and the bottom of the shallow monitoring well is located at 43 feet. The monitoring wells are considered to be screened within the upper and lower section of the same aquifer unit. The monitoring well installation was completed on October 15, 1991.

The monitoring wells were sampled on March 10, 1992. The depth to water on this date was 22.02 feet for the shallow monitoring well and 22.06 feet for the deep monitoring well as measured from the top of the monitoring well piezometer pipes.

C. MONITORING WELL 32 (MW-32)

Monitoring Well 32 is located along the south side of the Cedar River in an area called the Narrows, which is the narrowest part of the Cedar River Valley. The well lies up gradient from the City of Renton's production well field, in Zone 1 of the City's Aquifer Protection Area.

Drilling for MW-32 started on February 24, 1992. The borehole was drilled to a depth of 58 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted mainly of sand and gravel. One monitoring well was installed in the borehole; the well extends to a depth of 45 feet, with a screen from 40 to 45 feet. Bedrock (gray silty sandstone) was encountered at 54.5 feet in MW-32. The monitoring well installation was completed on March 5, 1992.

Monitoring Well 32 was sampled on August 19, 1992. The depth to water on this date was 14.46 feet as measured from the top of the monitoring well piezometer pipe.

D. MONITORING WELL 33 (MW-33)

Monitoring Well 33 is also located along the south side of the Cedar River in the Narrows. The well lies up gradient from the City of Renton's Production Wellfield, in Zone 1 of the City's Aquifer Protection Area.

Drilling for MW-33 started on February 26, 1992. The borehole was drilled to a depth of 66 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted mainly of sand and gravel, with some silty interbeds. One monitoring well was installed in the borehole; the well extends to a depth of 50 feet, with a screen from 45 to 50 feet. Bedrock (gray sandy claystone) was encountered at 58.5 feet in MW-33. The monitoring well installation was completed on March 9, 1992.

Monitoring Well 33 was sampled on August 19, 1992. The depth to water on this date was 24.83 feet as measured from the top of the monitoring well piezometer pipe.

E. MONITORING WELL 34 (MW-34)

Monitoring Well 34 is located 100 yards southwest of the refuse transfer station, which is owned and operated by King County Solid Waste Department. This monitoring well is located down gradient from this transfer station and is within Zone 2 of the City's Aquifer Protection Area.

The well drilling began on September 16, 1991. The borehole was initially drilled using the cable-tool method to a depth of 318 feet with 12-inch diameter casing and was continued to a depth of 544 feet with 8-inch diameter casing. Bedrock was encountered at a depth of 543 feet. During the drilling several aquitards were encountered with interbedded layers of sand and gravel. Three monitoring wells were installed in this borehole, each with a 10 foot screen. The bottom of the shallowest monitoring well (MW-34S) is located at a depth of 50 feet, just above the first aquitard. This location was selected in order to see if perched groundwater occurred within this sand and gravel unit. However, no seasonally high groundwater table was observed in this monitoring well. The bottom of the medium depth monitoring well (MW-34M) was located at a depth of 276 feet and the bottom of the deep monitoring well (MW-34D) was located at a depth of 529 feet. This monitoring well installation was completed on November 7, 1991.

The monitoring wells were sampled on August 19, 1992. The depth to water on this date was 183.38 feet in MW-34M and 190.89 feet in MW-34D as measured from the top of the monitoring well piezometer pipes.

F. MONITORING WELL 35 (MW-35)

Monitoring Well 35 is located on an easement at the south end of Union Avenue SE, adjacent to a water transmission control facility for the Seattle Water Department. This monitoring well site is located within Zone 2 of the City's Aquifer Protection Area.

The well drilling began on November 22, 1991. The borehole was drilled using the cable-tool method to a depth of 338 feet with 16-inch diameter casing and was extended to a depth of 560 feet with 12-inch diameter casing. Bedrock was encountered at a depth of 559 feet. Two monitoring wells were installed in this borehole, each with a 10 foot screen. The bottom of the deep monitoring well was located at 520 feet and the bottom of the shallow monitoring well was located at 340 feet. This monitoring well installation was completed on March 10, 1992.

The monitoring wells were sampled on September 14, 1992. We were unable to measure the depth to water in these monitoring wells through the piezometer pipes.

G. MONITORING WELL 36 (MW-36)

Monitoring Well 36 is located along the western boundary of the Maplewood Golf Course, down gradient from City of Renton Production Wells 11 and 17. The well is within Zone 2 of the City's Aquifer Protection Area.

Drilling for MW-36 started on July 17, 1991. The borehole was drilled to a depth of 354 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted

mainly of silty, fine-grained sands, with occasional thin interbeds of coarser-grained sand and gravel. Significant sand and gravel deposits were present from about 22 to 42 feet and below about 292 feet. Two monitoring wells were installed in the borehole. The shallow well extends to a depth of 42 feet, with a screen from 35 to 40 feet in the upper sand and gravel unit. The deep well extends to 343 feet, with a screen from 346 to 351 feet in a relatively silt-free portion of the lower gravel unit. Bedrock was not encountered at MW-36. The monitoring well installation was completed on August 15, 1992.

The monitoring wells were sampled on March 11, 1992. The depth to water on this date was 13.53 feet in the shallow well and 10.54 feet in the deep monitoring well as measured from the top of the monitoring well piezometer pipes.

H. MONITORING WELL 37 (MW-37)

Monitoring Well 37 is located in the central portion of the Maplewood Golf Course, in the vicinity of City of Renton Production Wells 11 and 17. The well is within Zone 2 of the City's Aquifer Protection Area.

Drilling for MW-37 started on November 4, 1991. The borehole was drilled to a depth of 337 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted of interbedded sandy silts, silty sands, and sandy or siltbound gravels. A poorly-permeable sequence of sandy silt/silty sand encountered from about 58 feet to 171 feet comprises the major aquitard at the MW-37 site. Two monitoring wells were installed in the borehole; the wells were screened in sand and gravel units which are separated by the major aquitard. The shallow well extends to a depth of 47 feet, with a screen from 40 to 45 feet. The deep well extends to 232 feet, with a screen from 225 to 230 feet. Bedrock was not encountered at MW-37. The monitoring well installation was completed on December 5, 1992.

The monitoring wells were sampled on March 11, 1992. The depth to water on this date was 24.29 feet in the shallow monitoring well and 23.54 feet in the deep monitoring well as measured from the top of the monitoring well piezometer pipes.

I. MONITORING WELL 38 (MW-38)

Monitoring Well 38 is located in a City right-of-way along SE 10th Place, near its intersection with Sheldon Avenue SE. The well is in the vicinity of City of Renton Production Wells 11 and 17, in Zone 2 of the City's Aquifer Protection Area.

Drilling for MW-38 started on August 19, 1991. The borehole was drilled to a depth of 239.5 feet using the cable-tool method with 8-inch diameter casing. The materials encountered in the borehole consisted of silty fine- to medium-grained sands with occasional gravelly layers, and sandy or siltbound gravels. The sequence between about 45 and 180 feet contains less gravel and is generally finer grained than overlying and underlying sections. Two monitoring wells were installed in the borehole; the wells were screened in sand and gravel units which are separated by the finer-grained facies. The shallow well extends to a depth of 42 feet, with a screen from 35 to 42 feet. The deep well extends to 207 feet, with a screen from 202 to 207 feet. Bedrock was encountered at about 235 feet in MW-38. The monitoring well installation was completed on September 12, 1992.

The monitoring wells were sampled on March 10, 1992. The depth to water on this date was 11.40 feet in the shallow monitoring well and 9.52 feet in the deep monitoring well as measured from the top of the monitoring well piezometer pipes.

Table 2.1: Monitoring Well Installation Summary

Monitoring Well No.	Location	Borehole Depth	No. of Monitoring Wells	Screened Interval	Pump Settings	
					Pump Depth	Riser Material
MW-30	NW1/4 of NW1/4 Section 17	114	2	44 - 54 84 - 94	32 32	PVC PVC
MW-31	NW1/4 of SE1/4 Section 17	112	2	33 - 43 69 - 79	32 42	PVC PVC
MW-32	SW1/4 of SW1/4 Section 16	54	1	30 - 40	32	PVC
MW-33	SW1/4 of SW1/4 Section 16	66	1	40 - 50	42	PVC
MW-34	SE1/4 of NW1/4 Section 16	544	3	40 - 50 266 - 276 519 - 529	Bailer 230	 SS
MW-35	NE1/4 of SE1/4 Section 16	560	2	330 - 340 510 - 520	290 290	SS SS
MW-36	NE1/4 of NE1/4 Section 21	354	2	40 - 50 300 - 350	32 32	PVC PVC
MW-37	NE1/4 of NE1/4 Section 21	337	2	40 - 50 300 - 350	42 42	PVC PVC
MW-38	NE1/4 of NE1/4 Section 21	240	2	35 - 40 202 - 207	32 32	PVC PVC

FIGURE 2.1
MONITORING WELL LOCATIONS AND
POTENTIAL CONTAMINATION SOURCES

FIGURE 2.1
CITY OF RENTON
MONITORING WELL LOCATIONS AND POTENTIAL CONTAMINATION SOURCES

LEGEND

- CEMETERY
- SPRAY AND FERTILIZER APPLICATION AREA
- COMMERCIAL OPERATIONS INVOLVING HAZARDOUS CHEMICALS
- TRANSPORTAION CORRIDOR
- SEPTIC TANK AREA
- METRO SEWER INTERCEPTOR
- OLYMPIC PETROLEUM PIPELINE
- RENTON CITY LIMITS
- APA ZONE 1
- APA ZONE 2
- PRODUCTION WELL
- MONITORING WELL
- PACCAR MONITORING WELL
- NEW MONITORING WELL

SCALE: 1" = 800'

0' 400' 800' 1600'

REVISION DATE: AUGUST 19, 1993

RH2 ENGINEERS PLANNERS SCIENTISTS

LAKE WASHINGTON
BOEING RENTON PLANT
RENTON AIRPORT
CEDAR RIVER
STADIUM
RENTON HS
LIBERTY PARK
CEDAR RIVER PARK
RENTON SHOPPING CENTER
Park & Ride
GREENWOOD CEMETERY
MT. OLIVET CEMETERY
RENTON TECH. INST.
MAPLEWOOD GOLF COURSE
CEDAR RIVER PARK
RIVER PARK
APA ZONE 1
APA ZONE 2
MW-30
MW-31
MW-32
MW-33
MW-34
MW-35
MW-36
MW-37
MW-38
PW-3
PW-8
PW-11 & 17
RW-12 & 13
FILE: MON-WELLSNG

CHAPTER 3
REGIONAL GEOLOGY

Geologic well logs obtained during the drilling of the monitoring wells substantially improved our understanding of the distribution of the geologic materials that control the groundwater hydrology in the vicinity of Renton's production wells.

First, in the Maplewood area, the thickness of the unconsolidated (water-bearing) sediments was determined because wells were drilled to the Tertiary bedrock that forms the regional aquiclude.

Second, the distribution and relative abundances of clay, silt, sand, and gravel in the layers of unconsolidated sediments are much better known. This knowledge improves our understanding of the size, storage capacity, and vulnerability to contamination of aquifers supplying Renton's production wells.

Third, the composition and distribution of the unconsolidated deposits in the Narrows support a geologic model for the development of the Cedar River Valley due to catastrophic postglacial (about 13,000 - 14,000 years Before Present) erosion of the valley.

Fourth, careful examination of the composition of pebbles and rock fragments from the wells, and comparison of the abundance of pebbles of certain compositions with the frequency of pebbles of similar composition in gravel bars of the present day Cedar River provides solid evidence for the origin of Renton's aquifers. Even gravels from the bottoms of the deepest wells, where gravel directly overlies bedrock, contain a distinct population of pebbles that could only come from source regions in the North Cascades or Canada. Glaciers or glacially dammed rivers carried these pebbles and other rock fragments from the north to the Renton area. Thus, all of the unconsolidated deposits intercepted in Renton's production and monitoring well borings were deposited during a period of geologic time (the last 2 million years) when the advance and retreat of glaciers through the Puget Lowland dominated the development of the region's landscape. All of the sands and gravels from which Renton withdraws its water (its aquifers) were deposited in close proximity to glaciers or are predominantly composed of eroded and redeposited glacial drift.

Given this information, the geologic model for the deposition of Renton's aquifers can be refined from that presented in the Work Plan.

A. STUDY AREA

The Work Plan identified four physiographic areas in need of exploration so that groundwater flow paths to the water supply wells could be better understood. These areas were defined based on the geomorphology or shape of the land surface and previous geologic and hydrologic studies. This monitoring well installation project established that the shallow aquifer of the Maplewood area extends through the Narrows and merges with the Delta Aquifer. The sands and gravels of the shallow aquifer were deposited during a single catastrophic episode of postglacial river erosion and deposition. However, wells in the Maplewood and North Upland areas penetrated older, unconsolidated sediments (including the "middle aquifers") that were deposited by distinctly different geologic processes.

B. REGIONAL GEOLOGIC MODEL

Both the bedrock and unconsolidated sediments underlying the study area were predominantly deposited by rivers or in lakes and swamps. However, the 40-50 million year old river sediments that have consolidated to form the local bedrock (the Renton Formation), were deposited during a time of warm climate and for millions of years the space (pores) between the grains of sand and pebbles have disappeared as the sediment became rock. All of the younger unconsolidated sediments were deposited during a time of colder climate when the distribution of sediments was largely controlled by glaciers. However, the actual volume of these unconsolidated sediments deposited directly by glaciers (till) is small compared to the volume of sediment deposited in water moving around or dammed by glaciers.

1. Tertiary Bedrock

As mentioned above, some of the monitoring wells were drilled to bedrock. In those wells, samples were obtained of sedimentary rocks, like those typical of the Renton Formation, in which the pore space between grains was filled with natural cements. Somewhat surprisingly, this bedrock was not deeply weathered. Thus the land surface that was buried during the first advance of the Puget lobe glacier over the Renton area may have been 1) actively eroding so that deep weathering profiles were not forming, 2) scoured by the action of glacial outwash rivers surging ahead of the glacier, or 3) scoured by an earlier glacial advance. However, the apparent absence of till directly on the bedrock surface appears to rule out No. 3 and to indicate that erosion and sedimentation were active in front of the glacier immediately before the landscape was inundated by slowly southward moving ice.

The well cemented nature of the bedrock samples (no pore space) confirms that the Puget Group sediments are a regional aquiclude. Thus hills and valleys in the ancient bedrock landscape that existed prior to the glaciation and the deposition of the unconsolidated deposits set definite limits on the size and shape of Renton's aquifers. By drilling wells to bedrock at several locations, it was verified that the Maplewood area is underlain by an ancient bedrock landscape that broadly slopes down to the north and locally eastward (down the side of a north trending ancient valley, **Figure 3.1**). In the Narrows, bedrock crops out in road cuts at altitudes of up to 100 feet MSL (above Mean Sea Level). These outcrops are part of a buried bedrock ridge that trends roughly north/south (**Figure 3.2**). East of the Narrows bedrock was encountered at altitudes of -170 to -290 feet (**Figure 3.3**). Farther to the east, a deep exploration well failed to intercept bedrock even at an altitude of about -600 feet.

2. Tertiary Erosion

The depths to bedrock measured during the monitoring drilling program confirm that the ancient landscape that existed prior to Quaternary glaciation had substantial relief (**Figure 3.4**). This relief may have been caused by erosion by north-northwest trending rivers or by faulting. If Tertiary rivers cut the ancient valleys in the bedrock, then these valleys must continue to get deeper to the north so that the rivers would drain to an ancient shoreline. Because it is known that the depth to bedrock beneath Seattle is greater than 3,000 feet below the present land surface, it is possible that a north-northwest trending paleovalley extends from Maplewood northward, beneath Mercer Island, and then

toward Seattle. Alternatively, movement of bedrock due to folding or faulting (earthquakes) may have been much more active during the late Tertiary than it is today. A block of the Earth's crust (a graben) or a downwarping of the crust (syncline) may have created a depression in the bedrock that extends northward from the Maplewood area.

The bedrock paleovalley or basin that contains Renton's middle aquifers is four miles across measured east west from the Narrows to Indian. Although it is uncertain how this bedrock valley formed and what its shape and depth are farther north and east, the paleovalley's existence and side slopes are better understood as a result of the monitoring well installation project. It is also now known that the bedrock basin is filled with thick sequences of unconsolidated sediments that are of Quaternary age. Within the Quaternary section are lenses or ribbons of gravelly sediments that are locally very favorable for storage and transmission of groundwater.

3. Late Tertiary Sediments

Although the Hammer Bluff Formation (unconsolidated sediments of late Tertiary age) is found in the nearby Green River Valley and sediments of similar appearance were found in a cliff along the Cedar River near the Maplewood Golf Course, this Formation was not encountered in any of the monitoring wells. Indeed, re-examination of the cliffs on the Cedar River after they were freshly exposed by erosion during the 1990 floods, indicates that the cliff sediments are all of Quaternary age.

4. Quaternary Sediments

The steep north and south walls of the Cedar River Valley provide numerous exposures of glacial drift typical of those found elsewhere in the Puget lowland. However, many of these sections, like the well log from Well MW-35 are dominated by fine-grained sediments typical of glacial lakes or the deltas of the silt-laden rivers that flow out of glaciers. Clean glacial outwash and river gravels, and the direct deposits of glaciers (till), are less abundant than the fine-grained sediments. Although these fine-grained sediments have the capacity to store very large volumes of water, this water generally does not move rapidly through such fine-grained material into production wells. Thus, Renton's highly productive aquifers must have substantial areal extent, possibly as sequences of elongate lenticular deposits associated with an aggrading fluvial environment.

CITY OF RENTON

MONITORING WELL INSTALLATION PROJECT

FIGURE 3.1

GEOLOGIC FEATURES

CROSS SECTION 1
CROSS SECTION 2
CROSS SECTION 3
BEDROCK CONTOURS

BEDROCK
100 BEDROCK ALTITUDE MSL (FT)

SCALE: 1" = 3000'
0 1500 3000

RH2 ENGINEERS PLANNERS SCIENTISTS

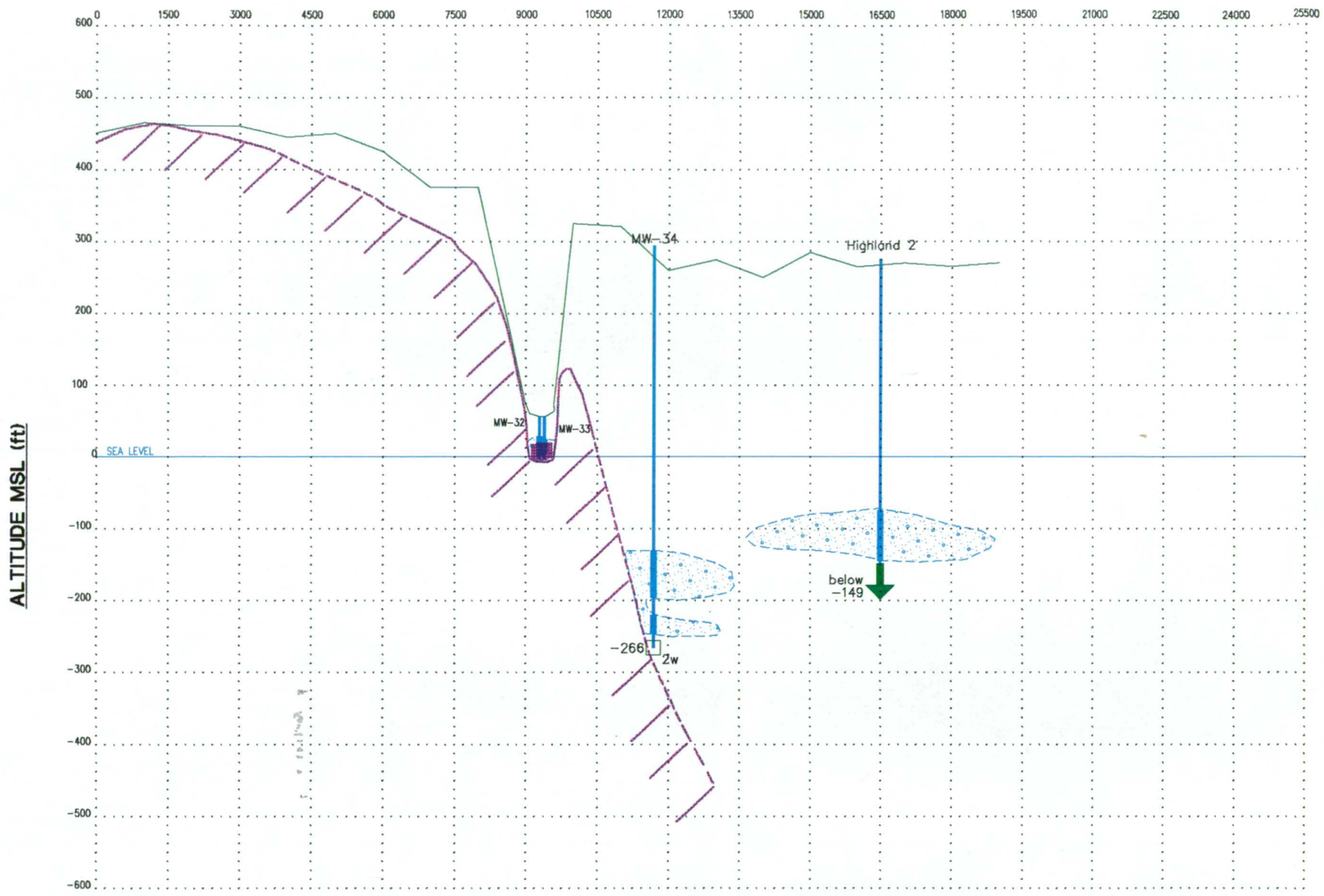
FILE: MWCROSGF.DWG
REVISED: AUGUST 23, 1993

Port Quendall
LAKE WASHINGTON
Highland School
BM 359
BM 451
Lake Youngs
25000'
Below -300
Below -350
Below -650
Below 250
Below 150
Below 50
Below 340
Below 380
Below 540

S

DISTANCE ALONG CROSS SECTION (ft)

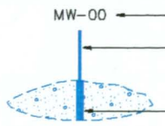
N



SCALE: 1V = 15H

LEGEND

- Measured bedrock surface
- Inferred bedrock surface
- Well terminated in bedrock (Well on cross section)
- Well terminated in bedrock (Well not on cross section)
- Well terminated an unknown distance above bedrock (Well on cross section)
- Well terminated an unknown distance above bedrock (Well not on cross section)



- MW-00 — Well Identification
- Well Depth (Most are projected onto the ground surface profile of the cross section)
- Water bearing sands or gravels.
- 3e — Distance and direction of well from cross section.
  No number = on cross section
  1 = 200' to 1000' from cross section
  2 = 1000' to 2000' from cross section
  3 = 2000' to 3000' from cross section
  4 = 3000' to 4000' from cross section
  e = east, w = west, n = north, s = south

FIGURE 3.2
CROSS SECTION NO. 1

CITY OF RENTON MONITORING WELL INSTALLATION PROJECT

RH2 ENGINEERS PLANNERS SCIENTISTS

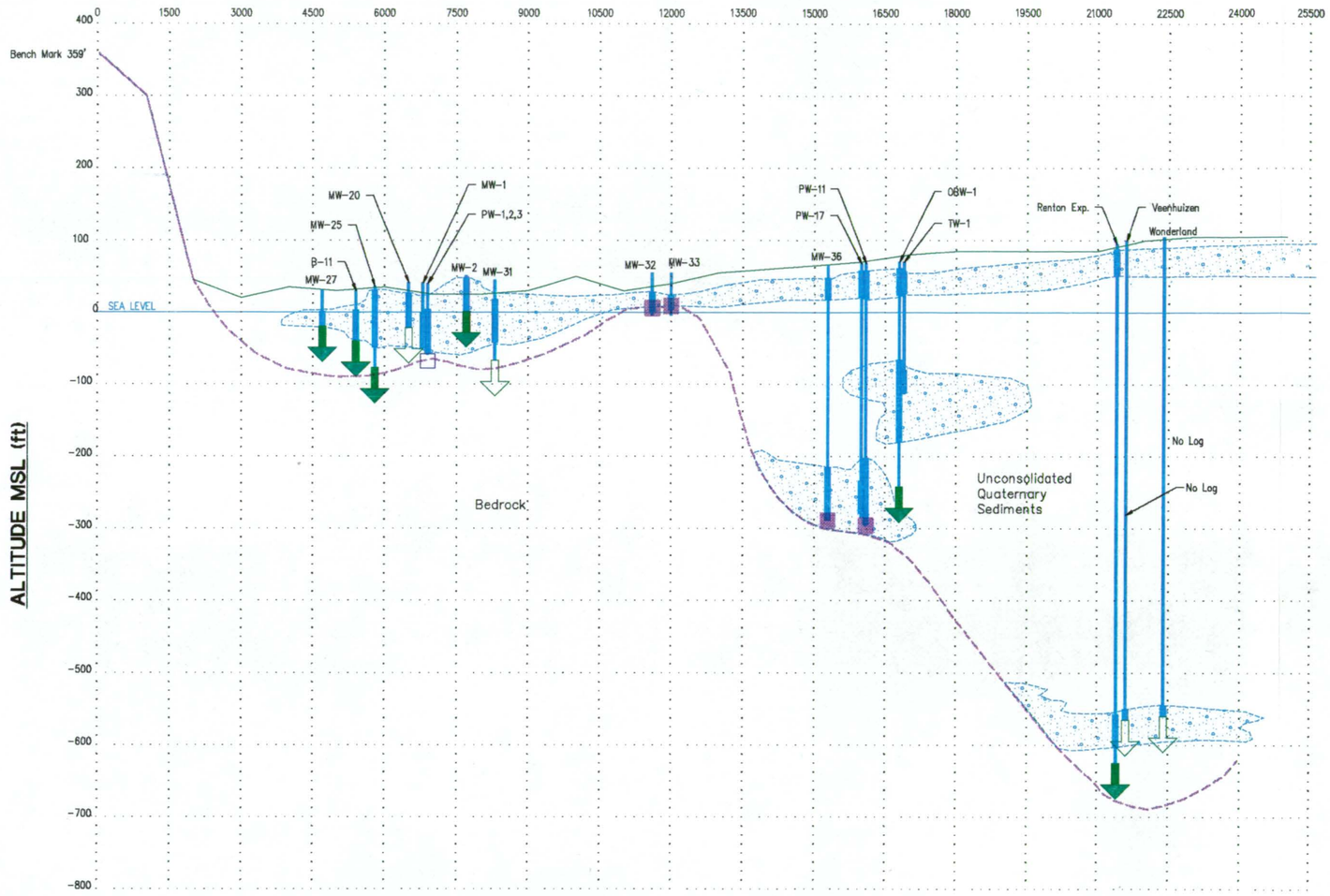
REVISED: MARCH 23, 1993

FILE: MWCROSS3.DWG

WNW

DISTANCE ALONG CROSS SECTION (ft)

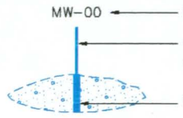
ESE



SCALE: 1V = 15H

LEGEND

- Measured bedrock surface
- Inferred bedrock surface
- Well terminated in bedrock (Well on cross section)
- Well terminated in bedrock (Well not on cross section)
- Well terminated an unknown distance above bedrock (Well on cross section)
- Well terminated an unknown distance above bedrock (Well not on cross section)



- MW-00 — Well Identification
- Well Depth (Most are projected onto the ground surface profile of the cross section)
- Water bearing sands or gravels.
- 3e — Distance and direction of well from cross section.
  No number = on cross section
  1 = 200' to 1000' from cross section
  2 = 1000' to 2000' from cross section
  3 = 2000' to 3000' from cross section
  4 = 3000' to 4000' from cross section
  e = east, w = west, n = north, s = south

FIGURE 3.3
CROSS SECTION NO. 2

CITY OF RENTON MONITORING WELL INSTALLATION PROJECT

RH2 ENGINEERS PLANNERS SCIENTISTS

REVISED: AUGUST 23, 1993

FILE: MWCROSS2.DWG

SSE

NNW

DISTANCE ALONG CROSS SECTION (ft)

0 1500 3000 4500 6000 7500 9000 10500 12000 13500 15000 16500 18000 19500 21000 22500 24000 25500 27000 28500 30000 31500 33000 34500 36000 37500 39000 40500 42000 43500

ALTITUDE MSL (ft)

600 500 400 300 200 100 0 −100 −200 −300 −400 −500 −600 −700 −800

SEA LEVEL

Lake Youngs

Coal ?

Coal ?

Coal ?

Coal ?

Benchmark 492

470 3e

No Log

290 2e

No Log

below 50 3w

160 ft.

No Log

below −136 1e

Bedrock

Inferred depth to bedrock along cross section 1

Renton Exp.

Veenhuizen

Wonderland

No Log

No Log

below −550 4e 3e

below −625 3e

outcrop 2w

OBW-1 Test

Cedar River

MW-38

PW-11

PW-17

MW-35

MW-37

MW-36

−171 1w

−242

−296 1w

−289 1w

−198 1e

outcrop 3w

MW-34

−266 2w

Unconsolidated Quaternary Sediments

Bedrock

Highland 2

below −149

Ground surface profile for cross section 1

Well 5

below −172

Lake Washington 12ft.

SCALE: 1V = 15H

LEGEND

- Measured bedrock surface
- Inferred bedrock surface
- Well terminated in bedrock (Well on cross section)
- Well terminated in bedrock (Well not on cross section)
- Well terminated an unknown distance above bedrock (Well on cross section)
- Well terminated an unknown distance above bedrock (Well not on cross section)

MW-00 ← Well Identification

Well Depth (Most are projected onto the ground surface profile of the cross section)

Water bearing sands or gravels.

3e ← Distance and direction of well from cross section.
No number = on cross section
1 = 200' to 1000' from cross section
2 = 1000' to 2000' from cross section
3 = 2000' to 3000' from cross section
4 = 3000' to 4000' from cross section
e = east, w = west, n = north, s = south

FIGURE 3.4
CROSS SECTION NO. 3

CITY OF RENTON MONITORING WELL INSTALLATION PROJECT

RH2 ENGINEERS PLANNERS SCIENTISTS

REVISED: AUGUST 23, 1993

FILE: MWCROSS1.DWG

CHAPTER 4
GROUNDWATER HYDROLOGY

During drilling of the monitoring well boreholes, a considerable amount of geologic and hydrogeologic information was obtained. This chapter discusses the hydrogeologic information that was collected during this project and its correlation with existing hydrogeologic information obtained from previous studies.

Several borehole pump tests and slug tests were performed during this project. The results of these tests are presented in **Appendix D.**

A. AQUIFER DESCRIPTIONS

The newly installed monitoring wells are completed in four aquifers beneath the City of Renton's service area. The Delta Aquifer, located at the lower end of the Cedar Valley, is bounded by fine grained sediments to the northwest, a bedrock hill to the west, bedrock uplands to the south, and glacial uplands to the northeast. The Delta Aquifer is connected in an easterly direction to the Cedar Valley Alluvial Aquifer by a constricted bedrock narrows ("The Narrows"). The Cedar Valley Alluvial Aquifer is comprised of sediments deposited by the Cedar River, and occurs only within the Cedar Valley between bedrock and glacial upland valley walls to the south and north, respectively. A stratified aquifer system occurs within the glacial uplands, and is exposed above the valley floor in the steep vertical wall on the north side of Maple Valley. Springs emanate from the valley wall where the aquifers crop out. In addition, two deeper aquifers occur beneath the Cedar Valley Alluvial Aquifer. The "Maplewood Production Aquifer", likely of glacial origin, has been encountered in wells at the Maplewood Golf Course and beneath the North Uplands. A still deeper aquifer (i.e. 650-700 feet deep) has been documented farther east (up-valley). New monitoring wells were not installed within this "Deep Aquifer". An existing deep exploration well however, flows under artesian pressure.

The City of Renton derives most of its water supply from the Delta Aquifer. Five production wells currently tap the aquifer with a productive capacity of up to 16 million gallons per day. The aquifer lies close to land surface and has a maximum thickness of 70 to 90 feet. It was formed by deposition of alluvial material at the mouth of the Cedar River where it emanates from the valley into the Lake Washington basin. The shallow soils overlying the aquifer are comprised of silt, sand and gravels. The aquifer itself is comprised of coarser, very permeable sandy gravel. Depths to water within the Delta Aquifer are typically less than 25 feet below land surface. Recharge is believed to occur from precipitation on the land surface, seepage from the Cedar River, groundwater discharge from adjacent uplands, and groundwater subflow through the bedrock narrows. Areal recharge is minimal in the highly industrialized area of Renton because land coverage by impermeable surfaces is high.

The Cedar Valley Alluvial Aquifer, present along the Cedar River east of the bedrock narrows, is an alluvial aquifer which is in hydraulic continuity with the Delta Aquifer via groundwater sub-flow through The Narrows. The aquifer provides a water source for an irrigation well located at the Maplewood Golf Course and domestic water supply well located in Wasmeta Park. The aquifer bottom occurs at a depth of about 50 feet below land surface. Measured depths to groundwater are generally within 15 feet of the land surface. Some degree of hydraulic continuity with the Cedar River is likely, but was not investigated as a part of this study.

The Maplewood Production Aquifer has been well documented in several test and production wells in the Maplewood Golf Course area, and is believed to extend northward into hydrostratigraphically correlated zones beneath the North Uplands. The aquifer is targeted as the City's next major source of water. Two recently completed production wells yield a combined flow of 4000 gpm. Two additional wells are scheduled for construction in the near future. The aquifer is encountered at elevations ranging from approximately -40 to -220 feet mean sea level (MSL) beneath the golf course, and -160 to -220 feet MSL beneath the North Uplands. Its thickness varies from approximately 50 feet beneath the golf course to 150 feet beneath the North Uplands. Testing of PW-11 and 17 has shown it to be confined and leaky. The aquifer does not extend to the south and west due to the presence of bedrock. The aquifer does not exist one mile east of the Maplewood production wells based on the log of the deep exploration well. Aquifer recharge is believed to occur predominantly from the North Uplands. Aquifer discharge occurs in the Cedar Valley via upward flow to the Alluvial Aquifer east of The Narrows and through the subsurface to the northwest. Other recharge and discharge point(s) may exist, but have not been documented.

The North Uplands aquifer system consists of a stratified series of glacially deposited aquifers. The uppermost of these aquifers occurs in the Vashon recessional outwash deposits which cover the top of the uplands. Other permeable glacial deposits alternate with low permeability deposits beneath the recessional outwash. The aquifers are currently not used for water supply due to their limited thicknesses, available drawdown, and permeabilities (relative to other aquifers). Recharge to the upland aquifer system occurs from rainfall and septic drainage from residential development atop the uplands. The aquifer system discharges to the Cedar Valley Alluvial Aquifer via springs emanating from the valley wall and infiltrating into the valley floor, and possibly to the Maplewood Production Aquifer via downward flow.

B. AQUIFER PROPERTIES

Existing literature and technical reports provide good definition of aquifer properties in the Delta Aquifer; moderate definition in the Maplewood Production Aquifer, and relatively poor definition in the Cedar Valley Alluvial Aquifer. Aquifer properties include thickness (b), hydraulic conductivity (K), transmissivity (T), and storage coefficient (S). Testing was performed during installation of the new monitoring wells to augment existing aquifer/aquitard property data. A constant-rate pumping test was performed to assess the transmissivity of the Alluvial Aquifer in the vicinity of The Narrows, and slug tests were performed in aquitard materials separating the Alluvial Aquifer and the Maplewood Production Aquifer. This section summarizes both existing and recently obtained hydraulic data.

Properties of the Delta Aquifer have been characterized with constant-rate pumping tests performed on individual wells, a multi-well pumping test, and numerical model calibration. Aquifer transmissivity in the downtown (Renton wellfield) area is estimated to range from about 1 to 2.3 million gallons/day-foot (gpd/ft). Assuming an average aquifer thickness of 70 feet and transmissivity of 1.3 million gpd/ft, the corresponding hydraulic conductivity is approximately 4,350 ft/day. Hydraulic conductivity diminishes with distance from the mouth of the Cedar River valley due to lower energy depositional environments occurring away from the delta source. Hydraulic conductivity was estimated at the PACCAR site, just south of Lake Washington, at 0.4 ft/day (Hart Crowser, 1987a). Storage coefficient varies based on location in the aquifer. The downtown portion of the aquifer tends to exhibit semi-confined conditions, and is typically characterized by S values on the order of 0.02 to 0.03 (Hart Crowser, 1987b). East of I-405, where permeable sediments extend above the top of the water table, model calibration indicates that the aquifer responds to pumping with a storage coefficient of about 0.25 (EES, 1992).

Documented tests of the Alluvial Aquifer to estimate aquifer properties are relatively limited. Hydraulic conductivity in the Maplewood area was calculated to be 460 feet/day based on testing a shallow well (GeoEngineers Inc, 1986). The aquifer appears to be unconfined in Maplewood and the storage coefficient should be correspondingly large. A pumping test at MW-33 was conducted as part of this project.

1. Testing of MW-33

A constant-rate pumping test was conducted at MW-33 on March 5, 1992 prior to installation of the 2-inch monitoring well. The purpose of the test was to measure the transmissivity of the alluvial aquifer at the Narrows. The test was 4 hours in length as planned in the scope of work. A longer pumping time would have allowed the cone of depression to intersect either a discharge boundary (bedrock) or a recharge boundary (river) (or both) which would have affected the drawdown measurements. Since the goal of the test was simply to determine the transmissivity of the aquifer, the four-hour pumping time was considered adequate. A longer pumping time might also have allowed consideration of delayed yield. In this case, the delayed yield would primarily affect the storage coefficient due to a change in flow from instantaneous release from storage to the free draining of the pore spaces. Since estimation of the storage coefficient was not an objective of this test, a longer pumping time was not considered useful.

The test was conducted using the 8-inch borehole and a temporarily installed screen which was open to the aquifer from 46 feet to 55 feet depth. The static water level in the well was about 24 feet below ground at the time of testing. Drawdown was measured only in MW-33 during the test. Recovery occurred too quickly (within 1 minute) to enable collection of meaningful measurements after the pump was shut off. A plot of the data is presented in **Appendix D** (Figure D.1).

The analysis of MW-33 pumping test data considered both the effects of pumping an unconfined aquifer and the effects of a partially penetrating well. The transmissivity based on these corrections is 59,000 gpd/ft which corresponds to a hydraulic conductivity of 225 ft/day, given an aquifer thickness of 35 feet. Figure D.1 depicts both the measured drawdown values and corrected drawdown values. Table D.1 documents both measured drawdown data and corrected drawdown data. Drawdown was measured using an electric well sounder. Discharge was measured by timing the flow into a 55 gallon drum.

The methods of drawdown correction are documented in Walton (1962).

The data was first corrected for partial penetration using the following equation:

$$s = s_1 * C_{pp}.$$

where:

s = drawdown for fully penetrating conditions, in feet,
s_1 = drawdown corrected for water table conditions, in feet,
C_{pp} = partial penetration correction factor. This value is derived from tables presented in Walton (1962), page 8.

A transmissivity (T) was calculated using the resultant data curve. This T was then used to calculate the well loss by determining the theoretical drawdown just outside the well. Well loss was calculated for each data point. The average well loss value (12.5 feet) was then subtracted from each measured value to calculate the theoretical drawdown. These data are plotted on Figure D.1. The data corrected for well loss were then corrected for water table conditions using the following equation:

$$s_1 = s_m - s_m^2 / 2m.$$

where:

s_1 = drawdown that would occur in an equivalent nonleaky artisian aquifer, in feet,
s_m = theoretically calculated aquifer drawdown, in feet,
m = initial saturated thickness of aquifer, in feet.

These data are also plotted on Figure D.1. Finally, data corrected for water table conditions were corrected for partial penetration. These data, plotted on Figure D.1, were used in the transmissivity calculation.

Aquifer properties have been characterized in the Maplewood Production Aquifer based on constant-rate testing of Production Wells 17 and 11. Transmissivities estimated for these wells range from 49,000 to 67,000 gpd/ft, and corresponding hydraulic conductivities range from 94 to 128 ft/day (aquifer thickness 70 feet). Storage coefficient was estimated to be approximately 0.0005. A leaky aquifer response was observed, however leakage analysis was inconclusive (Pacific Groundwater Group, 1990). Recent attempts to measure the transmissivity of the laterally contiguous sediments beneath the North Uplands were unsuccessful due to the inability to sufficiently stress the aquifer.

Aquifer properties have not been documented for the Vashon recessional aquifer and other related Vashon drift deposits. Transmissivity and storage coefficients for the "deep aquifer" encountered in the exploration well east of the Maplewood Golf Course have been estimated to be 19,500 gpd/ft and 0.00024, respectively (Golder, 1991).

Hydraulic properties were estimated for the aquitard which overlies the Maplewood Production Aquifer and underlies the Alluvial Aquifer. The purpose of these tests was to determine

permeability of the aquitard between the two aquifers. "Slug" tests were performed upon MW-37 and MW-38 during the drilling operation. The tests were performed by withdrawing a slug of water from the borehole and monitoring the recovery. Water level measurements were conducted using transducer data acquisition equipment.

The tests were analyzed with the method of Horvslev (1951). The analysis assumed that vertical conductivity is one-tenth that of horizontal conductivity. Plots of aquifer response and a summary table of analyses are included in **Appendix D**. Estimated values of horizontal hydraulic conductivity ranged from approximately 0.14 to 10 feet/day ($5X10^{-5}$ to $4X10^{-3}$ cm/sec).

2. Testing of MW-38

Displacement type slug test was performed after the well had been drilled and during the monitoring well construction. This test was conducted on September 11, 1991 in a temporarily installed 2-inch well. The temporary well was screened in a gravelly, silty, fine sand. Three separate tests were conducted using a displacement rod to create the slug of water within the well. Three positive displacement tests and two negative displacement tests were conducted. The results of these displacement tests are tabulated in Table D.1. Data plots are presented in Figures D.2, D.3, D.4, and D.5.

Testing of MW-38 was also completed in the borehole, during well drilling on August 29, 1991. The test was performed at a depth of 154.5 feet in a gray, silty, fine to medium sand. The results for each test are tabulated in Table D.1. Data plots are presented in Figures D.6.

3. Testing of MW-37

Testing of MW-37 was conducted over a two day period in early November, 1991. Tests 1, 2, and 3 were performed at depths of 90, 104, and 129.5 feet, respectively. The material tested for tests 1 and 3 is gray, silty to very silty, fine sand. Test 2 was conducted in gray, slightly sandy, clayey silt. The results for each test are tabulated in Table D.1. Data plots are presented in Figures D.7, D.8, and D.9.

C. GROUNDWATER ELEVATIONS, GRADIENTS, AND FLOW PATTERNS

Water levels were measured in selected City of Renton monitoring wells on August 20-21, 1992 and January 22, 1993. Potentiometric elevations were calculated for all monitoring wells visited. The calculated and approximated potentiometric elevations are shown on **Table 4.1** and **Figure 4.1**, a potentiometric elevation contour map.

1. Horizontal Gradients

A sufficient number of monitoring wells exist to describe the horizontal component of groundwater gradients in the Delta Aquifer, Cedar Valley Alluvial Aquifer, and Maplewood Production Aquifer.

Horizontal gradients in the Delta Aquifer and Cedar Valley Alluvial Aquifer can be evaluated together, because these surficial aquifers are hydraulically coupled through The Narrows. **Figure 4.1** shows potentiometric contours for the shallow Alluvial Aquifers. The figure shows that horizontal gradients occur in a down-valley direction. The contours are shown to bend up gradient along the river east of The Narrows - based partly on knowledge of gaining conditions along this stretch of the river (GeoEngineers, 1986) and partly on similar contour geometry approximated in the golf course vicinity. The 25-foot contour is inferred to bulge slightly down gradient along the river based on likely losing conditions associated with increased aquifer extent. A 20-foot contour was not drawn in the Delta Aquifer because water-level data were insufficient to characterize the flow pattern in this major wellfield vicinity. The inferred steeper gradient in the vicinity of The Narrows is qualitative and based on the decreased cross-sectional area available for groundwater flow.

Horizontal gradients in the Maplewood Production Aquifer are relatively steep between wells completed in the laterally contiguous sediments beneath the North Uplands and wells completed in the sediments beneath the golf course. Assuming lateral continuity between the completion zones of MW-35D, MW-36D, and MW-37D, a south-southwestern gradient of approximately 0.024 exists. The horizontal gradient between wells completed in the Maplewood Production Aquifer beneath the golf course is less steep and directed more towards the west. The direction of the horizontal gradient component is down valley (west) with a magnitude of approximately 0.006.

2. Vertical Gradients

The vertical component of groundwater flow was assessed by comparing water levels in shallow and deep completions of nested monitoring wells. Multiple completion wells in which water levels were measured include MW-25, MW-30, MW-31, MW-34, MW-35, MW-36, MW-37 and MW-38. **Table 4.2** presents calculated vertical gradients for the wells listed above. The table shows that upward gradients ranging from approximately 0.007 to 0.01 predominate in the Maplewood area, whereas larger magnitude downward gradients are evident beneath the North Uplands. Vertical gradients within the Delta Aquifer are of lower magnitude (0.001-0.002) and vary in direction. These vertical gradients are believed to be transient and largely related to the effects of pumping. Upward vertical gradients are known to occur from the "deep aquifer" encountered east of the golf course, based on its flowing artesian condition.

The magnitude of upward vertical gradients in the golf course vicinity is fairly comparable in MW-36, MW-37, and MW-38. Vertical gradients, while consistently downward in Well MW-34 beneath the North Uplands, vary in magnitude between aquifers. MW-34 is completed in the Vashon recessional deposits and two zones within the sediments hydrostratigraphically correlated with the Maplewood Production Aquifer. The relatively large (0.62) downward gradient between MW-34S and MW-34I suggests that the Vashon recessional deposits (MW-34S) are effectively perched. Geologic information (a thick sequence of low permeability glacial sediments between the two completions) supports this theory. Potentiometric elevations in MW-34D show that the downward vertical gradient extends to the deeper (MW-34D) zone beneath the North Uplands. Vertical gradient information for MW-35 is currently unavailable, but also appears to have a downward vertical gradient.

Vertical gradients in the downtown Delta Aquifer are inconsistent, of relatively low magnitude, and seem to say little about three dimensional groundwater flow patterns. Vertical gradients in this area are believed to be transient and associated with pumping stresses. As water levels were measured

on different days in the multi-completion wells in the Delta Aquifer, a "snapshot" description of vertical gradients is not possible for this aquifer at this time.

3. Groundwater Flow Patterns

Groundwater flow in the shallow Alluvial Aquifer system is largely down valley (west-northwest) in the Cedar Valley Alluvial Aquifer and radial towards City of Renton pumping wells in the downtown Delta Aquifer. Dominantly horizontal flow is likely in the Alluvial Aquifer based on its relatively high permeability. East of The Narrows, where upward vertical gradients occur, the Alluvial Aquifer receives recharge from the Maplewood Production Aquifer and slight upward flow may exist within the lower portion of the Alluvial Aquifer itself. West of The Narrows, flow patterns in the Delta Aquifer are largely controlled by pumping of the City of Renton downtown wellfield. Both horizontal and vertical flow components vary with pumping schedules. Flow patterns in the vicinity of the production wells were not illustrated in **Figure 4.1**, but a cone of depression has been well documented associated with pumping in the downtown area (CH2MHill, 1988).

Groundwater flow within the Maplewood Production Aquifer beneath the golf course is likely to be dominantly horizontal. Although the horizontal gradient within the aquifer (0.006) is only slightly smaller than the upward vertical gradient across the overlying aquitard (0.01), the horizontal aquifer hydraulic conductivity (94-128 ft/day) is much larger that the vertical aquitard hydraulic conductivity (0.014-1.0 ft/day). The role of upward vertical groundwater flow as a discharge pathway may be significant however, considering the areal extent of the Alluvial Aquifer into which upward flow can occur. Upward vertical flow may also play a greater role closer to the bedrock narrows west of the golf course. In this vicinity, bedrock boundaries are encountered to the west at The Narrows and to the south at the uplands; higher heads are encountered in the laterally contiguous sediments to the north and northeast; and the aquifer pinches out to the east. Horizontal groundwater flow may occur to the northwest within sediments hydrostratigraphically correlated to the Maplewood Production Aquifer. This northwest flow would occur along the bedrock boundary of the glacial sediments. Sufficient water level data are not available to distinguish the gradient that would indicate this additional discharge mechanism. However, the sharply curved potentiometeric surface contours of the Maplewood Production Aquifer on **Figure 4.1** indicates this type of flow near the bedrock boundary in the Maplewood area..

Groundwater flow in the stratified glacial aquifer system beneath the North Uplands may have both horizontal and vertical components. Springs along the northern Cedar Valley wall indicate a horizontal component of flow within the stratified aquifer system, but water level data are insufficient to quantify the horizontal component. High downward vertical gradient components indicate that downward recharge is occurring to the beneath the North Uplands. The upward vertical flow documented beneath the Maplewood golf course suggests a hydraulic circulation pattern with recharge to the laterally contiguous sediments beneath the North Uplands flowing into the Maplewood Production Aquifer and discharging upward within the Cedar Valley. In this case, groundwater discharge occurs from the Maplewood Production Aquifer to the overlying Alluvial Aquifer and eventually the Cedar River.

Table 4.1 - Water Levels and Potentiometric Surface Elevations

Monitoring Well Identification	MP Elevation in Feet (NGVD 1929)	Well Depth (feet)	Hole Depth (feet)	Screen Depth (feet)	Depth to Water (ft.) 1/22/93	Potentiometric Elevation (ft.) 1/22/93	Depth to Water (feet)	Potentiometric Elevation (ft.) 8/92
RENTON MW-1	* 40.24	50	58	38 - 48	21.83	18.41	23.25	16.99
RENTON MW-3	35.50	53	53	38.5 - 48.5	16.16	19.34	16.89	18.61
RENTON MW-6	38.83	50	50	35 - 45	N/M	N/M	20.07	18.76
RENTON MW-7	* 46.31	50	50	35 - 45	N/M	N/M	22.79	23.52
RENTON MW-10	34.12	37.5	37.5	22 - 32	N/M	N/M	15.40	18.72
RENTON MW-11	32.24	40	40	25 - 35	12.88	19.36	13.61	18.63
RENTON MW-25S	35.46	50	113	35 - 45	16.81	18.65	17.44	18.02
RENTON MW-25D	35.54	85	113	75 - 80	16.91	18.63	17.52	18.02
RENTON MW-26	33.74	50	50	35 - 45	16.31	17.43	16.83	16.91
RENTON MW-27	30.83	48	50	35 - 45	12.49	18.34	13.02	17.81
RENTON MW-30S	29.78	54	114	44 - 54	N/M	N/M	13.80	15.98
RENTON MW-30D	29.76	94	114	84 - 94	N/M	N/M	13.84	15.92
RENTON MW-31S	47.18	43	112	33 - 43	22.75	24.43	23.69	23.49
RENTON MW-31D	47.22	79	112	69 - 79	22.75	24.47	23.64	23.58
RENTON MW-32	51.06	45	59	40 - 45	13.41	37.65	14.39	36.67
RENTON MW-33	61.06	50	66	45 - 50	21.93	39.13	22.77	38.29
RENTON MW-34S	262.89	47	544	40 - 50	44.37	218.52	43.95	218.94
RENTON MW-34I	262.98	276	544	266 - 276	184.20	78.78	183.95	79.03
RENTON MW-34D	263.13	529	544	519 - 529	190.74	72.39	191.12	72.01
RENTON MW-35S	357.79	347	560	340 - 350	265.04	92.75	265.84	91.95
RENTON MW-35D	357.78	518	560	510 - 520	N/M	N/M	N/M	N/M
RENTON MW-36S	64.61	42	354	35 - 40	13.50	51.11	14.36	50.25
RENTON MW-36D	64.64	343	354	336 - 341	10.57	54.07	11.35	53.29
RENTON MW-37S	85.64	47	337	40 - 45	25.27	60.37	26.12	59.52
RENTON MW-37D	85.59	232	337	226 - 231	24.36	61.23	24.74	60.85
RENTON MW-38S	67.69	42	240	35 - 40	11.27	56.42	12.06	55.63
RENTON MW-38D	67.71	209	240	202 - 207	9.62	58.09	10.40	57.31
RENTON OBW-1S	71.89	48	312	35 - 45	9.64	62.25	10.93	54.2
RENTON OBW-1D	71.87	180	312	170 - 180	9.90?	61.97 ?	10.74 ?	54.3 ?
OLY PIPE MW-2	63.77	29.5	27.1	12.1 - 27.1	20.97	42.80	N/M	N/M
OLY PIPE MW-9	63.16	24.5	23	8 - 23	17.17	45.99	N/M	N/M
OLY PIPE MW-15	60.79	20.5	19	4 - 19	12.78	48.01	N/M	N/M
OLY PIPE MW-16	60.87	19.5	18.5	3.5 - 18.5	12.86	48.01	N/M	N/M
OLY PIPE MW-30	60.10	19.5	18	9 - 18	13.25	46.85	N/M	N/M
OLY PIPE MW-32	61.91	19.5	18.5	3.5 - 18.5	11.43	50.48	N/M	N/M

Notes: All measuring point (MP) elevations are reported to the same accuracy as survey accuracy.
MP elevations for MW-36,37,38 and OBW-1 based on a closed-loop survey performed by RH2 (1/12/93).
MP elevations for Olympic Pipeline MW's reported by GeoEngineers to City of Renton datum.
Survey tie-in between Renton and Olympic Pipeline wells performed by RH2. Estimated elevation of Olympic Pipeline wells to be 0.06 feet lower than reported.
N/A = water level not available; N/M = water level not measured.
* New MP elevation - wellhead was modified during the summer of 1990.
Depth to water in OBW-1D is questionable because the well may have lost continuity with the aquifer.

Table 4.2 - Vertical Gradients in Nested Piezometers

Monitoring Well Identification	MP Elevation in Feet (NGVD 1929)	Screen Top Depth (feet)	Screen Bot. Depth (feet)	Depth to Water 1/93	Vertical Gradient 1/93	Depth to Water 8/92	Vertical Gradient 8/92
RENTON MW-25S	35.46	35	45	16.81	0.00	17.44	0.00
RENTON MW-25D	35.54	75	80	16.91		17.52	
RENTON MW-30S	29.78	44	54	N/M	N/M	13.80	0.00
RENTON MW-30D	29.76	84	94	N/M		13.84	
RENTON MW-31S	47.18	33	43	22.75	0.00	23.69	0.00
RENTON MW-31D	47.22	69	79	22.75		23.64	
RENTON MW-34S	262.89	40	50	44.37	-0.62	43.95	-0.62
RENTON MW-34I	262.98	266	276	184.2	-0.03	183.95	-0.03
RENTON MW-34D	263.13	519	529	190.74		191.12	
RENTON MW-35S	357.79	340	350	265.04	N/A	265.84	N/A
RENTON MW-35D	357.78	510	520	N/M		N/M	
RENTON MW-36S	64.61	35	40	13.5	0.01	14.36	0.01
RENTON MW-36D	64.64	336	341	10.57		11.35	
RENTON MW-37S	85.64	40	45	25.27	0.00	26.12	0.01
RENTON MW-37D	85.59	226	231	24.36		24.74	
RENTON MW-38S	67.69	35	40	11.27	0.01	12.06	0.01
RENTON MW-38D	67.71	202	207	9.62		10.40	
RENTON OBW-1S	71.89	35	45	9.64	-0.0021 ?	10.93	0.0013 ?
RENTON OBW-1D	71.87	170	180	9.90?		10.74 ?	

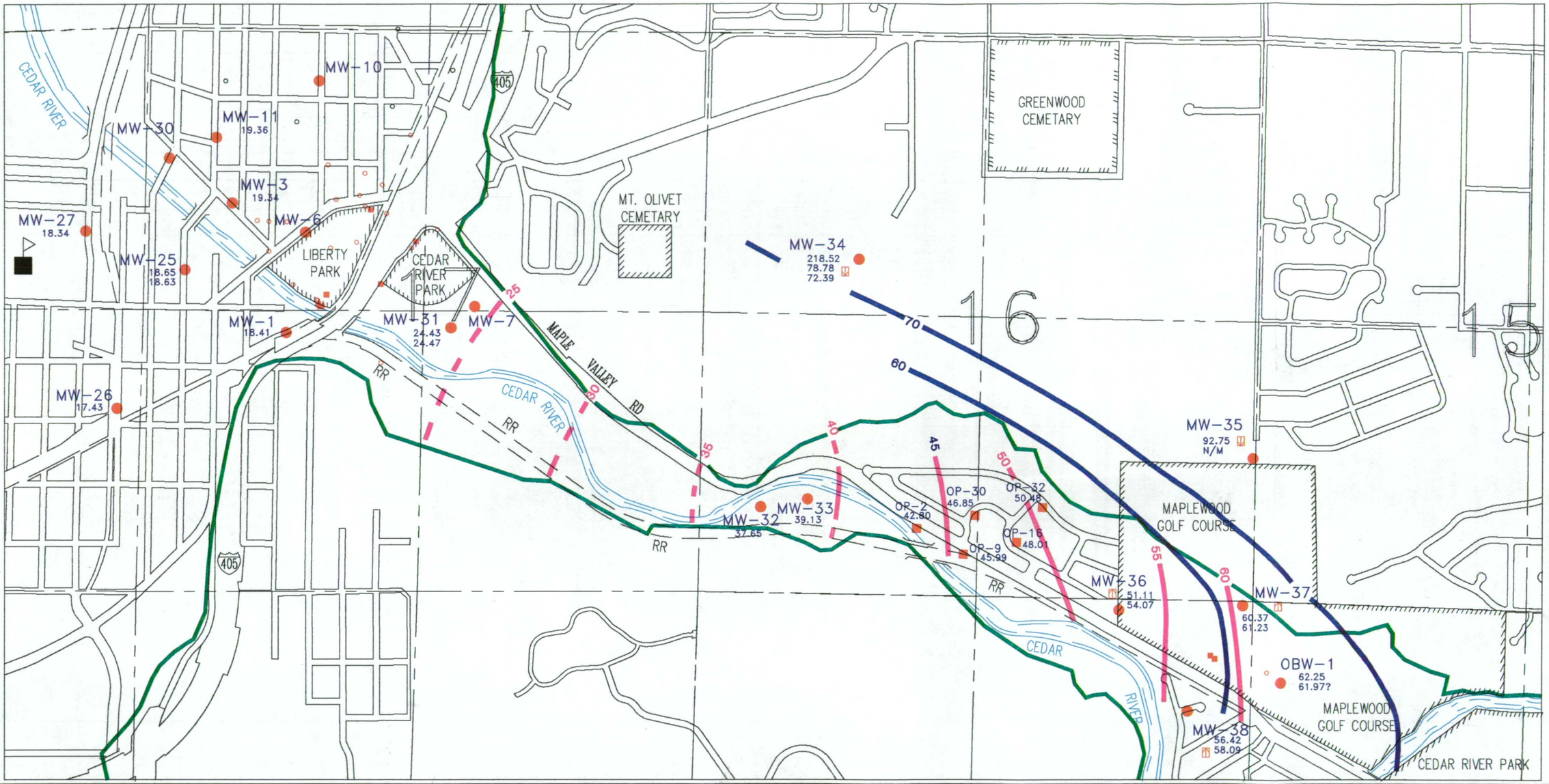
Notes:

Positive vertical gradients indicate upward flow, negative vertical gradient indicate downward flow.

N/A = water level/calculated gradient not available; N/M = water level not measured.

MP elevations for MW-36,37,38 and OBW-1 based on a closed-loop survey performed by RH2 (1/12/93).

Depth to water in OBW-1D is questionable because the well may have lost continuity with aquifer.



BOUNDARY OF SHALLOW ALLUVIAL (VALLEY WALL OR BEDROCK OUTCROP)

0 500 1000 2000
SCALE IN FEET (1"=1000')

MW-36 — MONITORING WELL ID
50.40 / 53.38 — POTENTIOMETRIC ELEVATIONS (IN SUCCESIVELY DEEPER COMPLETIONS)
MONITORING WELL
OLYMPIC PIPELINE MONITORING WELL
MONITORING WELL (NOT VISITED)
PRODUCTION WELL (NOT VISITED)

55 — POTENTIOMETRIC ELEVATION CONTOUR FOR ALLUVIAL AND DELTAIC AQUIFERS (DASHED WHERE INFERRED; CONTOUR INTERVAL 5 FT)
60 — POTENTIOMETRIC ELEVATION CONTOUR FOR MAPLEWOOD PRODUCTION (AND ADJACENT) AQUIFER (DASHED WHERE INFERRED; CONTOUR INTERVAL 10 FT)
UPWARD VERTICAL GRADIENT
DOWNWARD VERTICAL GRADIENT

NOTES:
OLYMPIC PIPELINE (OP) MONITORING WELL LOCATIONS ARE APPROXIMATE.
WELL OBW-1D MAY NOT BE IN HYDRAULIC COMMUNICATION WITH COMPLETION AQUIFER - WATER LEVEL IS UNCERTAIN
VERTICAL GRADIENTS SHOWN ONLY FOR NESTED PIEZOMETERS COMPLETED IN MORE THAN ONE AQUIFER

FIGURE 4.1
POTENTIOMETRIC ELEVATIONS AND VERTICAL GRADIENTS IN SELECTED WELLS (1/93)

CITY OF RENTON
MONITORING WELL INSTALLATION REPORT

REVISED: AUGUST 23, 1993

Pacific Groundwater Group

RH2 ENGINEERS PLANNERS SCIENTISTS

FILE: MWPEVG.DWG

CHAPTER 5
WATER QUALITY ANALYSIS

This chapter discusses the water quality analysis performed on groundwater samples for each monitoring well. The procedures for collection, analysis, and evaluation of the water quality were performed in accordance with the Quality Assurance Project Plan which was approved by the Department of Ecology and is presented in **Appendix E**. After the installation of the monitoring well sampling pumps, groundwater samples were collected by Mark Semrau of RH2 Engineering with the assistance of Cliff Nelson from the City of Renton Maintenance Department. AM Test, located in Redmond, Washington, performed the laboratory analytical analyses for the groundwater samples. Janet Knox from the Pacific Groundwater Group provided data quality assessment for the water quality results from the laboratory.

A. SAMPLING PROCEDURES

Before taking any groundwater samples, the depth to groundwater was measured in each monitoring well. Groundwater levels were measured using a Solinst Water Level Indicator Model No. 101. Water levels were measured to the nearest 0.01 feet. Next, the monitoring well was purged at a rate between 2 and 2.5 gpm using the groundwater sampling pump. Approximately 3 casing volumes were removed during the purge process, during which the temperature and conductivity were measured.

After the monitoring well casing was purged, the groundwater sampling pump rate was reduced to approximately 1.0 gpm. Samples were collected through a teflon sampling hose which has been dedicated to each monitoring well. The samples were collected in the following order: 1) volatile organic compounds, 2) other organic chemicals, 3) inorganic chemicals, and 4) metals. All sampling containers were prepared with the proper preservatives by AM Test. Once the samples were collected, they were placed on ice in an ice chest for storage and delivery to the laboratory. Field analytical tests, which included pH, conductivity, temperature, turbidity, fluoride, iron, and orthophosphate, were performed immediately after collection using portable field testing equipment. The equipment used for the field analytical measurements is listed in **Table 4.1**. Field analytical procedures for fluoride, iron, and orthophosphate are presented in **Table 4.2**.

B. DATA ASSESSMENT

The water quality data assessment was performed by Janet Knox of Pacific Groundwater Group and Mark Semrau of RH2 Engineering. Laboratory water quality analyses were performed by AM Test located in Redmond, Washington. The groundwater sampling program QA/QC results are presented in **Appendix E**. The laboratory results from AM Test are presented in **Appendix F**.

Water quality measurements taken in the field during the monitoring well sampling are presented in **Table 4.3**. A comparison of field and laboratory measurements for pH, conductivity, fluoride, iron, and orthophosphate are also presented in **Table 4.3**. The relative standard error and the absolute difference were calculated for these water quality parameters. The pH of the groundwater samples was fairly consistent between the field and laboratory measurements. The relative standard error between the field

and laboratory pH measurements ranged from 1 to 13 percent. The conductivity measurement taken in the field was consistently lower than the conductivity measured in the laboratory. The relative standard error between the field and laboratory conductivity measurements ranged from 2 to 26 percent.

The relative standard error for fluoride, iron, and orthophosphate varied considerably, however, the absolute difference in the field and laboratory measurements for these water quality parameters were, for the most part, very small, since their concentrations were relatively low. One exception to this was iron since the field measurements were consistently lower than laboratory measurements. In addition, if the groundwater sample had high turbidity, the laboratory measurement for iron was several orders of magnitude larger than the field measurement. This is most likely due to particulate iron which will be dissolved into the sample by the addition of acid prior to analysis. The field measurement of iron using colorimetric methods would not detect particulate iron within the groundwater sample. More comparable results may be achieved if the groundwater samples were filtered prior to performing analytical analyses.

Other data assessment procedures included: performing an cation-anion balance, calculating the ratio of the measured to calculated total dissolved solids (TDS), and calculating the ratio of the calculated TDS to the electrical conductivity (EC). We were unable to perform these analyses for samples collected at MW-31, 36, 37, and 38 because the laboratory did not measure the calcium or TDS concentrations for these samples. The results for MW-30, 32, 33, 34, and 35 are presented in **Table 4.4**.

Groundwater samples with high turbidity had high measurements of silica and iron, resulting in a poor ion balance. For the most part anions had a higher total concentration than the cations. The calculated TDS was always higher than the measured TDS in the laboratory. Again this may be contributed by the high silica concentrations in the unfiltered samples. High turbidity samples also had higher than normal ratios for the calculated TDS to EC.

Duplicate samples were collected and analyzed for MW-30S, 36S, and 38D. The comparison of duplicates is presented in **Table 4.5**. The absolute difference, relative standard error, and precision have been calculated for water quality parameters and are also presented in **Table 4.5**. For the most part, the analytical results are within the precision values listed for duplicate samples presented in Standard Methods. One water quality parameter, nitrate nitrogen, had poor duplicate precision in all three groundwater samples.

C. WATER QUALITY

The water quality within the monitoring well samples were typical of groundwater quality in the Renton area. Primary concern to the City is the contamination of groundwater by pesticides, PCBs, and volatile organic chemicals. The water quality data indicates that there was no detection of any pesticides and PCB chemicals as measured by EPA Method 608 or volatile organic chemicals as measured by EPA Method 624.

Various inorganics and metals were detected in each monitoring well sample. For the most part, these chemicals were below any established primary or secondary maximum contamination levels (MCL). The exceptions are noted below:

1. Total Coliforms

Total coliform was measured using the most probable number (MPN) method. The maximum contamination level for total coliform is less than 2 per 100 ml. Coliform bacteria were detected in MW-35D, 36S, 37S, and 37D.

2. Iron and Manganese

Iron and manganese are common chemicals found in groundwater. The secondary MCL for iron and manganese is 0.30 mg/l and 0.05 mg/l, respectively. Iron levels in groundwater samples exceeding the secondary MCL were detected in MW-30S, 30D, 31S, 31D, 34D, 35D, 36S, 37S, 37D, and 38D. Manganese levels in groundwater samples exceeding the secondary MCL were detected in MW-30D, 31D, 34D, 36S, 37S, and 37D.

3. Sulfide

Sulfide in water supplies creates odor problems due to the formation of hydrogen sulfide. Sulfide is often detected in groundwater samples due to the anaerobic nature of the subsurface environment. There is no primary or secondary MCL for sulfide. However, this chemical was detected in groundwater samples from MW-31S, 31D, 36S, 36D, 37S, 37D, 38S, and 38D.

4. Chromium

Chromium was detected in groundwater samples from MW-34D at a level of 0.38 mg/l. The primary MCL for chromium is set at 0.05 mg/l. This measurement may indicate chromium contaminations in the groundwater in this area. One sample result is not sufficient to verify if chromium in the groundwater near MW-34D is a problem at this time. The City should analyze a second groundwater sample to verify the chromium measurement as well as other metals.

5. Selenium

Selenium was detected in groundwater samples from MW-35D at a level of 0.011 mg/l. The primary MCL for selenium is set at 0.01/mg/l. This measurement may indicate selenium concentrations in the groundwater in this area. One sample result is not sufficient to verify if selenium in the groundwater near MW-35D is a problem at this time. The City should analyze a second groundwater sample to verify the selenium measurement as well as other metals.

Table 5.1: Field Analytical Equipment

Parameter	Analytical Instrument	Precision	Sample Locations
pH	Hach Portable pH and Conductivity Meter	± 0.1	MW-31, 36, 37, and 38
	Hach One Portable pH Meter	± 0.01	MW-30, 32, 33, 34, and 35
Conductivity	Hach Portable pH and Conductivity Meter	± 1 umhos/cm	MW-31, 36, 37, and 38
	Portable Hach Model 44600 Conductivity, TDS, and Temperature Meter	± 1 umhos/cm	MW-30, 32, 33, 34, and 35
Temperature	Thermometer	± 1 °C	MW-31, 36, 37, and 38
	Portable Hach Model 44600 Conductivity, TDS, and Temperature Meter	± 0.1 °C	MW-30, 32, 33, 34, and 35
Turbidity	Hach Model 2100A Turbidimeter	± 2% of full scale	MW-31, 36, 37, and 38
	Hach Model DR/2000 Spectrophotometer	± 1 NTU	MW-30, 32, 33, 34, and 35
Fluoride	Hach Model DR/100 Spectrophotometer	± 2% of full scale	MW-31, 36, 37, and 38
	Hach Model DR/2000 Spectrophotometer	± 0.01 mg/L	MW-30, 32, 33, 34, and 35
Iron	Hach Model DR/2000 Spectrophotometer	± 0.01 mg/L	All monitoring wells
Orthophosphate	Hach Model DR/2000 Spectrophotometer	± 0.01 mg/L	All monitoring wells

Table 5.2: Field Analytical Procedures

Parameter	Analytical Procedure	Measurement Method	Sample Locations
Fluoride	Hach SPADNS Reagent Solution Method	Colorimetric	All monitoring wells
Iron	Hach FerroVer Method	Colorimetric	All monitoring wells
Orthophosphate	Hach PhosVer 3 (Ascorbic Acid) Method	Colorimetric	All monitoring wells

Note: All three methods listed above have been approved by the US EPA for reporting purposes.

Table 5.3A: Water Quality Analyses for MW-30

Monitoring Well:	MW-30S	*Sampling Time:*	10:50 AM
General Location:	Cedar River and Williams Ave N.	*Sampling Date:*	8/19/92
Depth to Groundwater:	13.86 ft	*Water Table Elevation:*	15.92 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.74	*Fluoride:*	0.09 mg/L
Conductivity:	80 umhos/cm	*Iron:*	0.25 mg/L
Temperature:	13.1 °C	*Orthophosphate:*	0.01 mg/L
Turbidity:	14 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.7	7.0	3%	0.3
Conductivity:	80 umhos/cm	100 umhos/cm	16%	20 umhos/cm
Fluoride:	0.09 mg/L	0.04 mg/L	54%	0.05 mg/L
Iron:	0.25 mg/L	0.65 mg/L	63%	0.40 mg/L
Orthophosphate:	0.01 mg/L	0.023 mg/L	56%	0.01 mg/L

Monitoring Well:	MW-30D	*Sampling Time:*	10:25 AM
General Location:	Cedar River and Williams Ave N.	*Sampling Date:*	8/19/92
Depth to Groundwater:	13.88 ft	*Water Table Elevation:*	15.88 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.91	*Fluoride:*	0.09 mg/L
Conductivity:	230 umhos/cm	*Iron:*	1.46 mg/L
Temperature:	13.0 °C	*Orthophosphate:*	0.09 mg/L
Turbidity:	406 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.9	7.3	4%	0.4
Conductivity:	230 umhos/cm	260 umhos/cm	9%	30 umhos/cm
Fluoride:	0.09 mg/L	0.07 mg/L	18%	0.02 mg/L
Iron:	1.46 mg/L	47.00 mg/L	133%	45.54 mg/L
Orthophosphate:	0.09 mg/L	0.073 mg/L	15%	0.02 mg/L

Table 5.3B: Water Quality Analyses for MW-31

Monitoring Well:	MW-31S	*Sampling Time:*	11:00 AM
General Location:	Cedar River Park	*Sampling Date:*	3/10/92
Depth to Groundwater:	22.02 ft	*Water Table Elevation:*	25.16 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.7	*Fluoride:*	0.1 mg/L
Conductivity:	110 umhos/cm	*Iron:*	0.04 mg/L
Temperature:	15 °C	*Orthophosphate:*	0.00 mg/L
Turbidity:	1.0 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.7	7.4	3%	0.3
Conductivity:	110 umhos/cm	130 umhos/cm	12%	20 umhos/cm
Fluoride:	0.1 mg/L	0.07 mg/L	25%	0.0 mg/L
Iron:	0.04 mg/L	0.71 mg/L	126%	0.67 mg/L
Orthophosphate:	0.00 mg/L	0.088 mg/L	141%	0.09 mg/L

Monitoring Well:	MW-31D	*Sampling Time:*	10:30 AM
General Location:	Cedar River Park	*Sampling Date:*	3/10/92
Depth to Groundwater:	22.06 ft	*Water Table Elevation:*	25.16 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.3	*Fluoride:*	0.2 mg/L
Conductivity:	530 umhos/cm	*Iron:*	0.39 mg/L
Temperature:	14 °C	*Orthophosphate:*	0.03 mg/L
Turbidity:	1.3 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.3	6.9	6%	0.6
Conductivity:	530 umhos/cm	580 umhos/cm	6%	50 umhos/cm
Fluoride:	0.2 mg/L	0.06 mg/L	76%	0.1 mg/L
Iron:	0.39 mg/L	0.43 mg/L	7%	0.04 mg/L
Orthophosphate:	0.03 mg/L	0.054 mg/L	40%	0.02 mg/L

Table 5.3C: Water Quality Analyses for MW-32 AND MW-33

Monitoring Well:	MW-32	*Sampling Time:*	12:50 PM
General Location:	Jordan - Larue Park Site	*Sampling Date:*	8/19/92
Depth to Groundwater:	14.46 ft	*Water Table Elevation:*	36.60 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.31	*Fluoride:*	0.55 mg/L
Conductivity:	180 umhos/cm	*Iron:*	0.07 mg/L
Temperature:	10.0 °C	*Orthophosphate:*	0.00 mg/L
Turbidity:	1 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.3	7.0	3%	0.3
Conductivity:	180 umhos/cm	220 umhos/cm	14%	40 umhos/cm
Fluoride:	0.55 mg/L	0.08 mg/L	106%	0.47 mg/L
Iron:	0.07 mg/L	0.24 mg/L	78%	0.17 mg/L
Orthophosphate:	0.00 mg/L	0.006 mg/L	141%	0.01 mg/L

Monitoring Well:	MW-33	*Sampling Time:*	1:15 PM
General Location:	Jordan - Larue Park Site	*Sampling Date:*	8/19/92
Depth to Groundwater:	22.83 ft	*Water Table Elevation:*	38.23 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.18	*Fluoride:*	0.12 mg/L
Conductivity:	174 umhos/cm	*Iron:*	0.13 mg/L
Temperature:	10.0 °C	*Orthophosphate:*	0.05 mg/L
Turbidity:	5 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.2	6.9	3%	0.3
Conductivity:	174 umhos/cm	200 umhos/cm	10%	26 umhos/cm
Fluoride:	0.12 mg/L	0.07 mg/L	37%	0.05 mg/L
Iron:	0.13 mg/L	0.30 mg/L	56%	0.17 mg/L
Orthophosphate:	0.05 mg/L	0.065 mg/L	18%	0.02 mg/L

Table 5.3D: Water Quality Analyses for MW-34

Monitoring Well:	MW-34S	*Sampling Time:*	11:00 AM
General Location:	King County Transfer Station	*Sampling Date:*	9/30/92
Depth to Groundwater:	44.29 ft	*Water Table Elevation:*	218.60 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.1	*Fluoride:*	NA
Conductivity:	284 umhos/cm	*Iron:*	NA
Temperature:	11.0 °C	*Orthophosphate:*	NA
Turbidity:	NA		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.1	8.1	9%	1.0
Conductivity:	284 umhos/cm	330 umhos/cm	11%	46 umhos/cm
Fluoride:	NA	0.12 mg/L	NA	NA
Iron:	NA	110 mg/L	NA	NA
Orthophosphate:	NA	0.12 mg/L	NA	NA

Monitoring Well:	MW-34D	*Sampling Time:*	3:40 PM
General Location:	King County Transfer Station	*Sampling Date:*	8/19/92
Depth to Groundwater:	190.89 ft	*Water Table Elevation:*	72.24 ft

Physical Parameters		*Chemical Parameters*	
pH:	8.89	*Fluoride:*	0.10 mg/L
Conductivity:	165 umhos/cm	*Iron:*	1.67 mg/L
Temperature:	11.3 °C	*Orthophosphate:*	0.07 mg/L
Turbidity:	275 NTU	*Sulfide*	0.138 mg/L

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	8.9	8.3	5%	0.6
Conductivity:	165 umhos/cm	160 umhos/cm	2%	5 umhos/cm
Fluoride:	0.10 mg/L	0.12 mg/L	13%	0.02 mg/L
Iron:	1.67 mg/L	23.00 mg/L	122%	21.33 mg/L
Orthophosphate:	0.07 mg/L	0.068 mg/L	2%	0.00 mg/L

Table 5.3E: Water Quality Analyses for MW-35

Monitoring Well:	MW-35S	*Sampling Time:*	
General Location:	End of Union Ave SE	*Sampling Date:*	
Depth to Groundwater:		*Water Table Elevation:*	

Physical Parameters		*Chemical Parameters*	
pH:		*Fluoride:*	
Conductivity:		*Iron:*	
Temperature:		*Orthophosphate:*	
Turbidity:			

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	0.0			0.0
Conductivity:	0 umhos/cm			0 umhos/cm
Fluoride:	0.0 mg/L			0.0 mg/L
Iron:	0.00 mg/L			0.00 mg/L
Orthophosphate:	0.00 mg/L			0.00 mg/L

Monitoring Well:	MW-35D	*Sampling Time:*	9:45 AM
General Location:	End of Union Ave SE	*Sampling Date:*	9/14/92
Depth to Groundwater:	265.84 ft	*Water Table Elevation:*	91.94 ft

Physical Parameters		*Chemical Parameters*	
pH:	8.13	*Fluoride:*	0.15 mg/L
Conductivity:	195 umhos/cm	*Iron:*	0.55 mg/L
Temperature:	10.4 °C	*Orthophosphate:*	0.86 mg/L
Turbidity:	7.0 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	8.1	8.1	0%	0.0
Conductivity:	195 umhos/cm	190 umhos/cm	2%	5 umhos/cm
Fluoride:	0.15 mg/L	0.11 mg/L	22%	0.04 mg/L
Iron:	0.55 mg/L	3.00 mg/L	98%	2.45 mg/L
Orthophosphate:	0.86 mg/L	0.17 mg/L	95%	0.69 mg/L

Table 5.3F: Water Quality Analyses for MW-36

Monitoring Well:	MW-36S	*Sampling Time:*	10:35 AM
General Location:	West End of Maplewood Golf Course	*Sampling Date:*	3/11/92
Depth to Groundwater:	13.53 ft	*Water Table Elevation:*	44.73 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.6	*Fluoride:*	0.15 mg/L
Conductivity:	119 umhos/cm	*Iron:*	0.33 mg/L
Temperature:	13 °C	*Orthophosphate:*	0.15 mg/L
Turbidity:	8.3 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.6	7.0	4%	0.4
Conductivity:	119 umhos/cm	160 umhos/cm	21%	41 umhos/cm
Fluoride:	0.15 mg/L	0.13 mg/L	10%	0.0 mg/L
Iron:	0.33 mg/L	1.50 mg/L	90%	1.17 mg/L
Orthophosphate:	0.15 mg/L	0.17 mg/L	9%	0.02 mg/L

Monitoring Well:	MW-36D	*Sampling Time:*	10:15 AM
General Location:	West End of Maplewood Golf Course	*Sampling Date:*	3/11/92
Depth to Groundwater:	10.54 ft	*Water Table Elevation:*	47.75 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.6	*Fluoride:*	0.1 mg/L
Conductivity:	203 umhos/cm	*Iron:*	0.03 mg/L
Temperature:	13 °C	*Orthophosphate:*	0.27 mg/L
Turbidity:	0.7 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.6	8.0	4%	0.4
Conductivity:	203 umhos/cm	250 umhos/cm	15%	47 umhos/cm
Fluoride:	0.1 mg/L	0.20 mg/L	47%	0.1 mg/L
Iron:	0.03 mg/L	0.08 mg/L	64%	0.05 mg/L
Orthophosphate:	0.27 mg/L	0.26 mg/L	3%	0.01 mg/L

Table 5.3G: Water Quality Analyses for MW-37

Monitoring Well:	MW-37S	*Sampling Time:*	2:45 PM
General Location:	Clubhouse at Maplewood Golf Course	*Sampling Date:*	3/11/92
Depth to Groundwater:	24.29 ft	*Water Table Elevation:*	54.55 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.5	*Fluoride:*	0.1 mg/L
Conductivity:	170 umhos/cm	*Iron:*	1.41 mg/L
Temperature:	15 °C	*Orthophosphate:*	0.01 mg/L
Turbidity:	26.0 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.5	6.7	2%	0.2
Conductivity:	170 umhos/cm	230 umhos/cm	21%	60 umhos/cm
Fluoride:	0.1 mg/L	0.17 mg/L	37%	0.1 mg/L
Iron:	1.41 mg/L	3.80 mg/L	65%	2.39 mg/L
Orthophosphate:	0.01 mg/L	0.16 mg/L	125%	0.15 mg/L

Monitoring Well:	MW-37D	*Sampling Time:*	2:25 PM
General Location:	Clubhouse at Maplewood Golf Course	*Sampling Date:*	3/11/92
Depth to Groundwater:	23.54 ft	*Water Table Elevation:*	55.27 ft

Physical Parameters		*Chemical Parameters*	
pH:	7.5	*Fluoride:*	0.1 mg/L
Conductivity:	115 umhos/cm	*Iron:*	NA
Temperature:	17 °C	*Orthophosphate:*	0.44 mg/L
Turbidity:	79.0 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	7.5	7.6	1%	0.1
Conductivity:	115 umhos/cm	150 umhos/cm	19%	35 umhos/cm
Fluoride:	0.1 mg/L	0.17 mg/L	37%	0.07 mg/L
Iron:	NA	30.00 mg/L	NA	NA
Orthophosphate:	0.44 mg/L	0.088 mg/L	94%	0.35 mg/L

Table 5.3H: Water Quality Analyses for MW-38

Monitoring Well:	MW-38S	*Sampling Time:*	2:50 PM
General Location:	SE 10th Place	*Sampling Date:*	3/10/92
Depth to Groundwater:	11.40 ft	*Water Table Elevation:*	56.31 ft

Physical Parameters		*Chemical Parameters*	
pH:	5.6	*Fluoride:*	0.1 mg/L
Conductivity:	61 umhos/cm	*Iron:*	0.01 mg/L
Temperature:	14 °C	*Orthophosphate:*	0.00 mg/L
Turbidity:	0.5 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	5.6	6.7	13%	1.1
Conductivity:	61 umhos/cm	88 umhos/cm	26%	27 umhos/cm
Fluoride:	0.1 mg/L	0.06 mg/L	35%	0.0 mg/L
Iron:	0.01 mg/L	0.01 mg/L	0%	0.00 mg/L
Orthophosphate:	0.00 mg/L	0.023 mg/L	141%	0.02 mg/L

Monitoring Well:	MW-38D	*Sampling Time:*	3:15 PM
General Location:	SE 10th Place	*Sampling Date:*	3/10/92
Depth to Groundwater:	9.52 ft	*Water Table Elevation:*	58.17 ft

Physical Parameters		*Chemical Parameters*	
pH:	6.9	*Fluoride:*	0.1 mg/L
Conductivity:	114 umhos/cm	*Iron:*	0.16 mg/L
Temperature:	13 °C	*Orthophosphate:*	0.26 mg/L
Turbidity:	5.4 NTU		

Water Quality Parameter	*Field Measurement*	*Laboratory Measurement*	*Relative Standard Error*	*Difference*
pH:	6.9	7.7	8%	0.8
Conductivity:	114 umhos/cm	160 umhos/cm	24%	46 umhos/cm
Fluoride:	0.1 mg/L	0.15 mg/L	28%	0.1 mg/L
Iron:	0.16 mg/L	0.41 mg/L	62%	0.25 mg/L
Orthophosphate:	0.26 mg/L	0.250 mg/L	3%	0.01 mg/L

Table 5.4A: Cation - Anion Balance for Monitoring Well MW-30S

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	ND	74.95 g	+ 3	ND
Boron	B	ND	10.81 g	+ 3	ND
Barium	Ba	0.007 mg/L	137.33 g	+ 2	0.00 meq/L
Cadmium	Cd	ND	112.41 g	+ 2	ND
Calcium	Ca	9.2 mg/L	40.08 g	+ 2	0.46 meq/L
Chromium	Cr	ND	52.00 g	+ 3	ND
Iron	Fe	0.65 mg/L	55.85 g	+ 2	0.02 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	ND	39.10 g	+ 1	ND
Magnesium	Mg	2.6 mg/L	24.31 g	+ 2	0.21 meq/L
Manganese	Mn	0.035 mg/L	54.94 g	+ 2	0.00 meq/L
Sodium	Na	4.1 mg/L	22.99 g	+ 1	0.18 meq/L
Lead	Pb	ND	207.20 g	+ 2	ND
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.035 mg/L	87.62 g	+ 2	0.00 meq/L
				Total Cations	**0.88 meq/L**
Anions					
Bicarbonate	CaCO3	35.0 mg/L	100.00 g	- 1	0.35 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	1.9 mg/L	35.45 g	- 1	0.05 meq/L
Fluoride	F	0.04 mg/L	19.00 g	- 1	0.00 meq/L
Nitrate	NO3	0.952 mg/L	62.00 g	- 1	0.02 meq/L
Nitrite	NO2	0.016 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.071 mg/L	94.97 g	- 3	0.00 meq/L
Silicon	SiO3	23.8 mg/L	76.08 g	- 2	0.63 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	7.7 mg/L	96.06 g	- 2	0.16 meq/L
				Total Anions	**1.21 meq/L**
Percent Difference		**16%**		**Total difference**	**0.33 meq/L**

Calculated TDS / Electrical Conductivity

Measured Total Dissolved Solids [TDS]	68 mg/L	
Calculated Total Dissolved Solids [TDS]	71 mg/L	
Ratio of Measured to Calculated TDS	0.96	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	100 umhos/cm	
Ratio of Calculated TDS to EC	0.71	(Should be 0.55 - 0.70)

Table 5.4B: Cation - Anion Balance for Monitoring Well MW-30D

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	0.020 mg/L	74.95 g	+ 3	0.00 meq/L
Boron	B	ND	10.81 g	+ 3	ND
Barium	Ba	0.027 mg/L	137.33 g	+ 2	0.00 meq/L
Cadmium	Cd	ND	112.41 g	+ 2	ND
Calcium	Ca	29.0 mg/L	40.08 g	+ 2	1.45 meq/L
Chromium	Cr	0.066 mg/L	52.00 g	+ 3	0.00 meq/L
Iron	Fe	47.00 mg/L	55.85 g	+ 2	1.68 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	5.7 mg/L	39.10 g	+ 1	0.15 meq/L
Magnesium	Mg	17.0 mg/L	24.31 g	+ 2	1.40 meq/L
Manganese	Mn	1.600 mg/L	54.94 g	+ 2	0.06 meq/L
Sodium	Na	18.0 mg/L	22.99 g	+ 1	0.78 meq/L
Lead	Pb	0.010 mg/L	207.20 g	+ 2	0.00 meq/L
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.220 mg/L	87.62 g	+ 2	0.01 meq/L
				Total Cations	**5.53 meq/L**
Anions					
Bicarbonate	CaCO3	66.0 mg/L	100.00 g	- 1	0.66 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	3.4 mg/L	35.45 g	- 1	0.10 meq/L
Fluoride	F	0.07 mg/L	19.00 g	- 1	0.00 meq/L
Nitrate	NO3	0.851 mg/L	62.00 g	- 1	0.01 meq/L
Nitrite	NO2	0.059 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.224 mg/L	94.97 g	- 3	0.01 meq/L
Silicon	SiO3	187.0 mg/L	76.08 g	- 2	4.92 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	35.0 mg/L	96.06 g	- 2	0.73 meq/L
				Total Anions	**6.43 meq/L**
Percent Difference		**8%**		**Total difference**	**0.90 meq/L**

Calculated TDS / Electrical Conductivity

Measured Total Dissolved Solids [TDS]	140 mg/L	
Calculated Total Dissolved Solids [TDS]	335 mg/L	
Ratio of Measured to Calculated TDS	0.42	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	260 umhos/cm	
Ratio of Calculated TDS to EC	1.29	(Should be 0.55 - 0.70)

Table 5.4C: Cation - Anion Balance for Monitoring Well MW-32

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	ND	74.95 g	+ 3	ND
Boron	B	ND	10.81 g	+ 3	ND
Barium	Ba	ND	137.33 g	+ 2	ND
Cadmium	Cd	ND	112.41 g	+ 2	ND
Calcium	Ca	15 mg/L	40.08 g	+ 2	0.75 meq/L
Chromium	Cr	ND	52.00 g	+ 3	ND
Iron	Fe	0.24 mg/L	55.85 g	+ 2	0.01 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	ND	39.10 g	+ 1	ND
Magnesium	Mg	7.1 mg/L	24.31 g	+ 2	0.58 meq/L
Manganese	Mn	0.003 mg/L	54.94 g	+ 2	0.00 meq/L
Sodium	Na	11.0 mg/L	22.99 g	+ 1	0.48 meq/L
Lead	Pb	ND	207.20 g	+ 2	ND
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.053 mg/L	87.62 g	+ 2	0.00 meq/L
				Total Cations	**1.82 meq/L**
Anions					
Bicarbonate	CaCO3	72.0 mg/L	100.00 g	- 1	0.72 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	3.1 mg/L	35.45 g	- 1	0.09 meq/L
Fluoride	F	0.08 mg/L	19.00 g	- 1	0.00 meq/L
Nitrate	NO3	0.873 mg/L	62.00 g	- 1	0.01 meq/L
Nitrite	NO2	0.010 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.190 mg/L	94.97 g	- 3	0.01 meq/L
Silicon	SiO3	32.5 mg/L	76.08 g	- 2	0.85 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	9.7 mg/L	96.06 g	- 2	0.20 meq/L
				Total Anions	**1.89 meq/L**
Percent Difference		**2%**		**Total difference**	**0.07 meq/L**

Calculated TDS / Electrical Conductivity

Measured Total Dissolved Solids [TDS]	110 mg/L	
Calculated Total Dissolved Solids [TDS]	122 mg/L	
Ratio of Measured to Calculated TDS	0.90	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	220 umhos/cm	
Ratio of Calculated TDS to EC	0.55	(Should be 0.55 - 0.70)

Table 5.4D: Cation - Anion Balance for Monitoring Well MW-33

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	ND	74.95 g	+ 3	ND
Boron	B	0.15 mg/L	10.81 g	+ 3	0.04 meq/L
Barium	Ba	0.008 mg/L	137.33 g	+ 2	0.00 meq/L
Cadmium	Cd	ND	112.41 g	+ 2	ND
Calcium	Ca	17 mg/L	40.08 g	+ 2	0.85 meq/L
Chromium	Cr	ND	52.00 g	+ 3	ND
Iron	Fe	0.30 mg/L	55.85 g	+ 2	0.01 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	ND	39.10 g	+ 1	ND
Magnesium	Mg	7.7 mg/L	24.31 g	+ 2	0.63 meq/L
Manganese	Mn	0.017 mg/L	54.94 g	+ 2	0.00 meq/L
Sodium	Na	8.3 mg/L	22.99 g	+ 1	0.36 meq/L
Lead	Pb	0.003 mg/L	207.20 g	+ 2	0.00 meq/L
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.058 mg/L	87.62 g	+ 2	0.00 meq/L
				Total Cations	**1.90 meq/L**
Anions					
Bicarbonate	CaCO3	66.0 mg/L	100.00 g	- 1	0.66 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	2.9 mg/L	35.45 g	- 1	0.08 meq/L
Fluoride	F	0.07 mg/L	19.00 g	- 1	0.00 meq/L
Nitrate	NO3	1.263 mg/L	62.00 g	- 1	0.02 meq/L
Nitrite	NO2	0.016 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.200 mg/L	94.97 g	- 3	0.01 meq/L
Silicon	SiO3	32.5 mg/L	76.08 g	- 2	0.85 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	9.2 mg/L	96.06 g	- 2	0.19 meq/L
				Total Anions	**1.82 meq/L**
Percent Difference		**2%**		**Total difference**	**0.08 meq/L**

Calculated TDS / Electrical Conductivity

Measured Total Dissolved Solids [TDS]	110 mg/L	
Calculated Total Dissolved Solids [TDS]	118 mg/L	
Ratio of Measured to Calculated TDS	0.94	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	200 umhos/cm	
Ratio of Calculated TDS to EC	0.59	(Should be 0.55 - 0.70)

Table 5.4E: Cation - Anion Balance for Monitoring Well MW-34S

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	0.036 mg/L	74.95 g	+ 3	0.00 meq/L
Boron	B	ND	10.81 g	+ 3	ND
Barium	Ba	1.4 mg/L	137.33 g	+ 2	0.02 meq/L
Cadmium	Cd	0.004 mg/L	112.41 g	+ 2	0.00 meq/L
Calcium	Ca	82 mg/L	40.08 g	+ 2	4.09 meq/L
Chromium	Cr	0.066 mg/L	52.00 g	+ 3	0.00 meq/L
Iron	Fe	110 mg/L	55.85 g	+ 2	3.94 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	19 mg/L	39.10 g	+ 1	0.49 meq/L
Magnesium	Mg	36 mg/L	24.31 g	+ 2	2.96 meq/L
Manganese	Mn	1.8 mg/L	54.94 g	+ 2	0.07 meq/L
Sodium	Na	160 mg/L	22.99 g	+ 1	6.96 meq/L
Lead	Pb	0.006 mg/L	207.20 g	+ 2	0.00 meq/L
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	1.7 mg/L	87.62 g	+ 2	0.04 meq/L
				Total Cations	**18.57 meq/L**
Anions					
Bicarbonate	CaCO3	92 mg/L	100.00 g	- 1	0.92 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	1.2 mg/L	35.45 g	- 1	0.03 meq/L
Fluoride	F	0.12 mg/L	19.00 g	- 1	0.01 meq/L
Nitrate	NO3	9.644 mg/L	62.00 g	- 1	0.16 meq/L
Nitrite	NO2	0.075 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.368 mg/L	94.97 g	- 3	0.01 meq/L
Silicon	SiO3	124.7 mg/L	76.08 g	- 2	3.28 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	15 mg/L	96.06 g	- 2	0.31 meq/L
				Total Anions	**4.72 meq/L**
Percent Difference		**59%**		**Total difference**	**13.85 meq/L**

Calculated TDS / Electrical Conductivity		
Measured Total Dissolved Solids [TDS]	3000 mg/L	
Calculated Total Dissolved Solids [TDS]	495 mg/L	
Ratio of Measured to Calculated TDS	6.06	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	330 umhos/cm	
Ratio of Calculated TDS to EC	1.50	(Should be 0.55 - 0.70)

Table 5.4F: Cation - Anion Balance for Monitoring Well MW-34D

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	0.004 mg/L	74.95 g	+ 3	0.00 meq/L
Boron	B	0.2 mg/L	10.81 g	+ 3	0.04 meq/L
Barium	Ba	0.090 mg/L	137.33 g	+ 2	0.00 meq/L
Cadmium	Cd	ND	112.41 g	+ 2	ND
Calcium	Ca	24.0 mg/L	40.08 g	+ 2	1.20 meq/L
Chromium	Cr	0.380 mg/L	52.00 g	+ 3	0.02 meq/L
Iron	Fe	23.00 mg/L	55.85 g	+ 2	0.82 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	4.4 mg/L	39.10 g	+ 1	0.11 meq/L
Magnesium	Mg	12.0 mg/L	24.31 g	+ 2	0.99 meq/L
Manganese	Mn	0.510 mg/L	54.94 g	+ 2	0.02 meq/L
Sodium	Na	14.0 mg/L	22.99 g	+ 1	0.61 meq/L
Lead	Pb	ND	207.20 g	+ 2	ND
Selenium	Se	ND	74.92 g	+ 4	ND
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.150 mg/L	87.62 g	+ 2	0.00 meq/L
				Total Cations	**3.82 meq/L**
Anions					
Bicarbonate	CaCO3	68.0 mg/L	100.00 g	- 1	0.68 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	4.4 mg/L	35.45 g	- 1	0.12 meq/L
Fluoride	F	0.12 mg/L	19.00 g	- 1	0.01 meq/L
Nitrate	NO3	0.594 mg/L	62.00 g	- 1	0.01 meq/L
Nitrite	NO2	0.020 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.209 mg/L	94.97 g	- 3	0.01 meq/L
Silicon	SiO3	119.2 mg/L	76.08 g	- 2	3.13 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	8.4 mg/L	96.06 g	- 2	0.17 meq/L
				Total Anions	**4.14 meq/L**
Percent Difference		**4%**		**Total difference**	**0.32 meq/L**

Calculated TDS / Electrical Conductivity		
Measured Total Dissolved Solids [TDS]	110 mg/L	
Calculated Total Dissolved Solids [TDS]	227 mg/L	
Ratio of Measured to Calculated TDS	0.48	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	160 umhos/cm	
Ratio of Calculated TDS to EC	1.42	(Should be 0.55 - 0.70)

Table 5.4G: Cation - Anion Balance for Monitoring Well MW-35D

Ion Description	Symbol	Chemical Concentration	Molecular Weight	Valence	Milligram Equivalent Weight
Cations					
Arsenic	As	0.007 mg/L	74.95 g	+ 3	0.00 meq/L
Boron	B	0.23 mg/L	10.81 g	+ 3	0.06 meq/L
Barium	Ba	0.013 mg/L	137.33 g	+ 2	0.00 meq/L
Cadmium	Cd	0.002 mg/L	112.41 g	+ 2	0.00 meq/L
Calcium	Ca	11.0 mg/L	40.08 g	+ 2	0.55 meq/L
Chromium	Cr	0.050 mg/L	52.00 g	+ 3	0.00 meq/L
Iron	Fe	3.00 mg/L	55.85 g	+ 2	0.11 meq/L
Mercury	Hg	ND	200.37 g	+ 2	ND
Potassium	K	2.5 mg/L	39.10 g	+ 1	0.06 meq/L
Magnesium	Mg	2.9 mg/L	24.31 g	+ 2	0.24 meq/L
Manganese	Mn	0.047 mg/L	54.94 g	+ 2	0.00 meq/L
Sodium	Na	31.0 mg/L	22.99 g	+ 1	1.35 meq/L
Lead	Pb	ND	207.20 g	+ 2	ND
Selenium	Se	0.011 mg/L	74.92 g	+ 4	0.00 meq/L
Silver	Ag	ND	107.87 g	+ 1	ND
Strontium	Sr	0.080 mg/L	87.62 g	+ 2	0.00 meq/L
				Total Cations	**2.38 meq/L**
Anions					
Bicarbonate	CaCO3	120.0 mg/L	100.00 g	- 1	1.20 meq/L
Carbonate	CO3	0.0 mg/L	60.01 g	- 2	0.00 meq/L
Chloride	Cl	ND	35.45 g	- 1	ND
Fluoride	F	0.11 mg/L	19.00 g	- 1	0.01 meq/L
Nitrate	NO3	0.035 mg/L	62.00 g	- 1	0.00 meq/L
Nitrite	NO2	0.007 mg/L	46.01 g	- 1	0.00 meq/L
Orthophosphate	PO4	0.522 mg/L	94.97 g	- 3	0.02 meq/L
Silicon	SiO3	21.1 mg/L	76.08 g	- 2	0.56 meq/L
Sulfide	S	ND	32.06 g	- 2	ND
Sulfate	SO4	2.3 mg/L	96.06 g	- 2	0.05 meq/L
				Total Anions	**1.83 meq/L**
Percent Difference		**13%**		**Total difference**	**0.55 meq/L**

Calculated TDS / Electrical Conductivity

Measured Total Dissolved Solids [TDS]	100 mg/L	
Calculated Total Dissolved Solids [TDS]	143 mg/L	
Ratio of Measured to Calculated TDS	0.70	(Should be 1.0 - 1.2)
Electrical Conductivity [EC]	190 umhos/cm	
Ratio of Calculated TDS to EC	0.75	(Should be 0.55 - 0.70)

Table 5.5A: Duplicate Analyses for MW-30S

Water Quality Parameter	*MW-30S*	*Dup 3*	*Difference*	*Relative Standard Error*	*Precision*
Total Coliforms (MPN)	< 2	< 2			
pH	7.0	6.8	0.2	2 %	103 %
Alkalinity (as CaCO3)	35 mg/L	32 mg/L	3 mg/L	6 %	109 %
Chloride	1.9 mg/L	2.0 mg/L	0.1 mg/L	4 %	95 %
Conductivity	100 mg/L	86 mg/L	14 mg/L	11 %	115 %
Fluoride	0.04 mg/L	0.05 mg/L	0.01 mg/L	16 %	78 %
Nitrate + Nitrite Nitrogen	0.22 mg/L	0.23 mg/L	0.010 mg/L	3 %	96 %
Nitrate Nitrogen	0.005 mg/L	0.010 mg/L	0.005 mg/L	47 %	33 %
Orthophosphate (as P)	0.023 mg/L	0.020 mg/L	0.00 mg/L	10 %	114 %
Total Dissolved Solids	68 mg/L	58 mg/L	10.00 mg/L	11 %	116 %
Sulfide	< 1.0 mg/L	< 1.0 mg/L			
Sulfate	7.7 mg/L	6.1 mg/L	1.6 mg/L	16 %	123 %
Arsenic	< 0.001 mg/L	< 0.001 mg/L			
Boron	< 0.1 mg/L	< 0.1 mg/L			
Barium	0.007 mg/L	0.008 mg/L	0.001 mg/L	9 %	87 %
Calcium	9.2 mg/L	9.3 mg/L	0.1 mg/L	1 %	99 %
Cadmium	< 0.002 mg/L	< 0.002 mg/L			
Chromium	< 0.006 mg/L	< 0.006 mg/L			
Iron	0.65 mg/L	0.39 mg/L	0.26 mg/L	35 %	150 %
Mercury	< 0.0002 mg/L	< 0.0002 mg/L			
Potassium	< 1.0 mg/L	< 1.0 mg/L			
Magnesium	2.6 mg/L	2.6 mg/L	0.0 mg/L	0 %	100 %
Manganese	0.035 mg/L	0.026 mg/L	0.009 mg/L	21 %	130 %
Sodium	4.1 mg/L	4.2 mg/L	0.1 mg/L	2 %	98 %
Lead	< 0.001 mg/L	0.003 mg/L			
Selenium	< 0.001 mg/L	< 0.001 mg/L			
Silicon	8.8 mg/L	8.5 mg/L	0.3 mg/L	2 %	103 %
Silver	< 0.01 mg/L	< 0.01 mg/L			
Strontium	0.035 mg/L	0.035 mg/L	0.000 mg/L	0 %	100 %

Table 5.5B: Duplicate Analyses for MW-36S

Water Quality Parameter	*MW-36S*	*Dup 2*	*Difference*	*Relative Standard Error*	*Precision*
Total Coliforms (MPN)	8	8	0	0 %	100 %
pH	6.7	6.8	0.1	1 %	99 %
Alkalinity (as CaCO3)	100 mg/L	100 mg/L	0 mg/L	0 %	100 %
Chloride	6.9 mg/L	6.7 mg/L	0.2 mg/L	2 %	103 %
Conductivity	230 mg/L	220 mg/L	10 mg/L	3 %	104 %
Fluoride	0.17 mg/L	0.11 mg/L	0.06 mg/L	30 %	143 %
Nitrate + Nitrite Nitrogen	0.12 mg/L	0.12 mg/L	0.00 mg/L	0 %	100 %
Nitrate Nitrogen	0.065 mg/L	0.002 mg/L	0.063 mg/L	133 %	**288 %**
Orthophosphate (as P)	0.16 mg/L	0.15 mg/L	0.01 mg/L	5 %	106 %
Sulfide	2.0 mg/L	2.5 mg/L	0.5 mg/L	16 %	78 %
Sulfate	12.0 mg/L	9.0 mg/L	3.0 mg/L	20 %	129 %
Arsenic	0.004 mg/L	0.004 mg/L	0.000 mg/L	0 %	100 %
Boron	< 0.1 mg/L	< 0.1 mg/L			
Barium	0.022 mg/L	0.024 mg/L	0.002 mg/L	6 %	91 %
Cadmium	< 0.002 mg/L	< 0.002 mg/L			
Chromium	< 0.006 mg/L	< 0.006 mg/L			
Iron	3.8 mg/L	3.7 mg/L	0.1 mg/L	2 %	103 %
Mercury	< 0.0002 mg/L	< 0.0002 mg/L			
Potassium	2.9 mg/L	1.9 mg/L	1.0 mg/L	29 %	142 %
Magnesium	12 mg/L	14 mg/L	2 mg/L	11 %	85 %
Manganese	1.1 mg/L	1.3 mg/L	0.2 mg/L	12 %	83 %
Sodium	6.1 mg/L	7.3 mg/L	1.2 mg/L	13 %	82 %
Lead	< 0.001 mg/L	0.001 mg/L			
Selenium	< 0.001 mg/L	< 0.001 mg/L			
Silicon	16 mg/L	18 mg/L	2 mg/L	8 %	88 %
Silver	< 0.01 mg/L	< 0.01 mg/L			
Strontium	0.083 mg/L	0.098 mg/L	0.015 mg/L	12 %	83 %

Table 5.5C: Duplicate Analyses for MW-38D

Water Quality Parameter	*MW-38D*	*Dup 1*	*Difference*	*Relative Standard Error*	*Precision*
Total Coliforms (MPN)	< 2	< 2			
pH	7.7	7.3	0.4	4 %	105 %
Alkalinity (as CaCO3)	90 mg/L	76 mg/L	14 mg/L	12 %	117 %
Chloride	5.0 mg/L	4.3 mg/L	0.7 mg/L	11 %	115 %
Conductivity	160 mg/L	160 mg/L	0 mg/L	0 %	100 %
Fluoride	0.15 mg/L	0.14 mg/L	0.01 mg/L	5 %	107 %
Nitrate + Nitrite Nitrogen	< 0.01 mg/L	0.03 mg/L			
Nitrate Nitrogen	0.002 mg/L	0.039 mg/L	0.037 mg/L	128 %	**-80 %**
Orthophosphate (as P)	0.25 mg/L	0.25 mg/L	0.00 mg/L	0 %	100 %
Sulfide	2.1 mg/L	2.1 mg/L	0.0 mg/L	0 %	100 %
Sulfate	2.4 mg/L	2.2 mg/L	0.2 mg/L	6 %	109 %
Arsenic	0.002 mg/L	0.006 mg/L	0.004 mg/L	71 %	**0 %**
Boron	< 0.1 mg/L	< 0.1 mg/L			
Barium	0.007 mg/L	0.008 mg/L	0.001 mg/L	9 %	87 %
Cadmium	0.002 mg/L	0.002 mg/L	0.000 mg/L	0 %	100 %
Chromium	< 0.006 mg/L	< 0.006 mg/L			
Iron	0.41 mg/L	0.67 mg/L	0.26 mg/L	34 %	**52 %**
Mercury	< 0.0002 mg/L	< 0.0002 mg/L			
Potassium	2.9 mg/L	2.9 mg/L	0.0 mg/L	0 %	100 %
Magnesium	6.0 mg/L	5.6 mg/L	0.4 mg/L	5 %	107 %
Manganese	0.048 mg/L	0.050 mg/L	0.002 mg/L	3 %	96 %
Sodium	13 mg/L	13 mg/L	0 mg/L	0 %	100 %
Lead	0.001 mg/L	0.002 mg/L	0.001 mg/L	47 %	**33 %**
Selenium	< 0.001 mg/L	< 0.001 mg/L			
Silicon	15 mg/L	15 mg/L	0 mg/L	0 %	100 %
Silver	< 0.01 mg/L	< 0.01 mg/L			
Strontium	0.049 mg/L	0.047 mg/L	0.002 mg/L	3 %	104 %

APPENDIX A
BIBLIOGRAPHY

Monitoring Well Installation Project Report Bibliography

City of Renton - Comprehensive Water System Plan, RH2 Engineering (March 1990).

Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, National Water Well Association (1989).

Well Field Protection Study, CH2M Hill (August 1984).

Well Field Monitoring Study, CH2M Hill (June 1988).

Technical Memorandum - Results of Monitoring Well Installation and Pumping Text - Three Monitoring Wells South of Cedar River, CH2M Hill (February 1989).

Compliance Monitoring at Texaco Refining and Marketing, Inc, Service Station, 1408 Bronson Way North, Renton, Washington, Groundwater Technology, Inc. (1988).

Additional Groundwater Flow Assessment Date, PACCAR Defense System Facility, Renton, Washington, Hart Crowser (October 1987).

Groundwater Contamination and Emergency Response Guide, Guswa, J.H., et al., Pollution Technology Review (1984).

Practical Guide to Groundwater Sampling, Barcelona, M.J., et al., Illinois State Water Survey (1985).

Manual of Groundwater Sampling Procedures, Scalf, M.R., et al., NWWA/EPA Series (1981).

Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WPCF, 18TH Edition (1992).

Chemistry for Environmental Engineering, Sawyer, C.N. and McCarty, P.L., McGraw-Hill, Third Edition (1978).

Summary of Groundwater Modeling Efforts in Support of Renton Aquifer Management, RH2 Engineering/Pacific Groundwater Group (1989).

Technical Memorandum to City of Renton on Deep Exploratory Well Drilling Program, Golder Associates, Inc. (1990).

Final Hydrogeologic Report - Maplewood Production Wells PW-11 and PW-17, Pacific Groundwater Group (1990)

Geologic Map of the Renton Quadrangle, King County Washington, Mullineaux, D.R.(1965a)

Geologic Map of the Auburn Quadrangle, King County Washington, Mullineaux, D.R.(1965b)

Geologic Map of the Black Diamond Quadrangle, King County Washington, Mullineaux, D.R.(1965c)

Geology of the Renton, Auburn, and Black Diamond Quadrangle, King County Washington, Mullineaux, D.R.(1970)

Geology and Coal resources of the Cumberland, Hobart and Maplewood Valley Quadrangles, King County Washington, Vine, J.D. (1969)

Work Plan for the Monitoring Well Installation Project, RH2 Engineering, P.S. (March 1991).

City of Renton Drinking Water Quality Study, Economic and Engineering Services, Inc. (June 1992).

Progress Report No. 1 Geotechnical Engineering Services Pipeline Leak Abatement, Maplewood Neighborhood, Renton, Washington, for Olympic Pipeline Company, GeoEngineers Incorporated (1986).

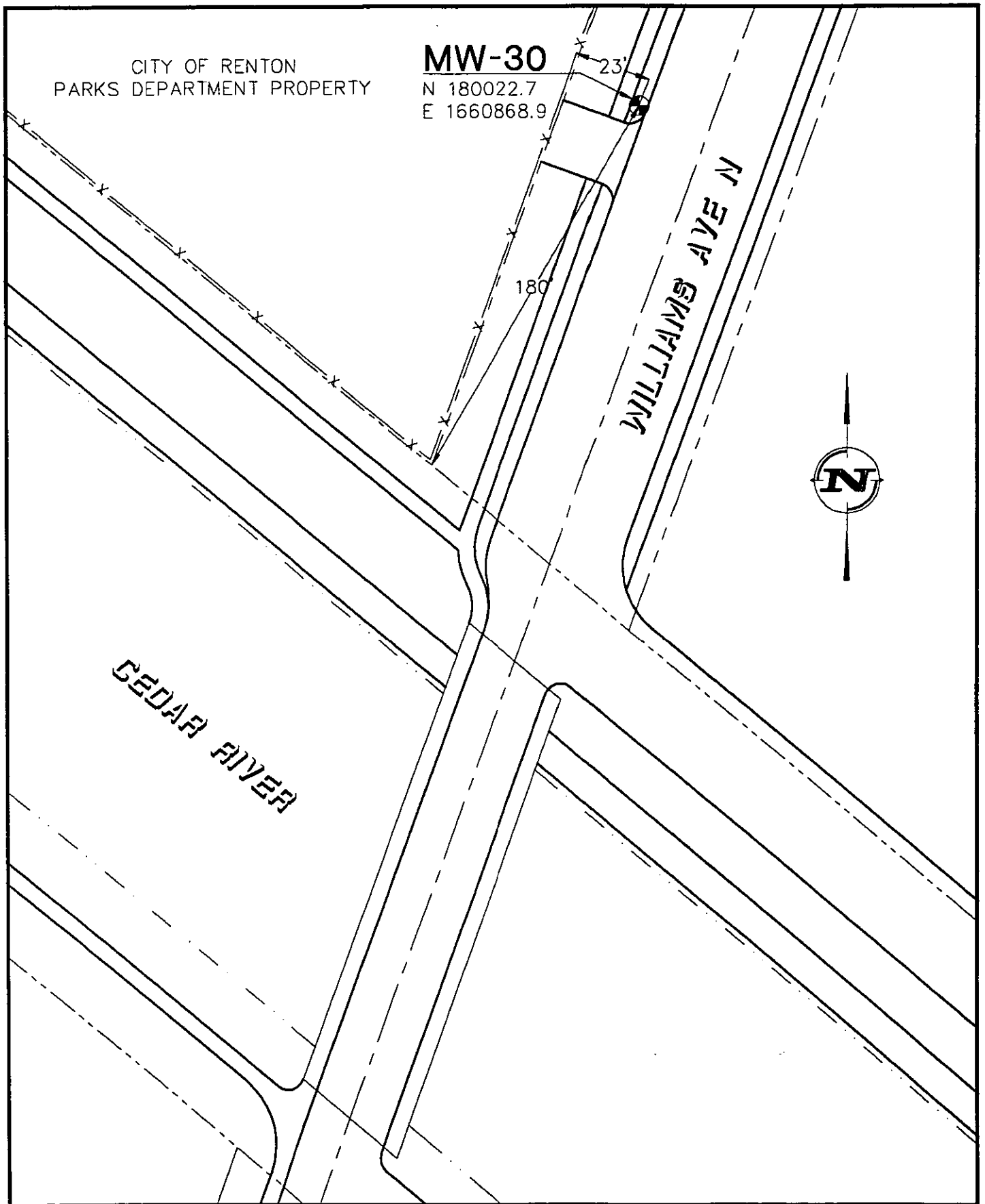
Technical Memorandum to City of Renton on Deep Exploratory Well Drilling Program Task 3 Construction of the Deep Exploratory Well and Aquifer Testing, for City of Renton, Golder Associates Inc., (April 30, 1991).

Replacement Production Wells RW-1, RW-2, and RW-3, City of Renton, Washington, J-1667, Hart Crowser, Inc., (July 14, 1987b).

Time Lag and Soil Permeability in Groundwater Observations, U.S. Army Corps of Engineers Waterways Experimental Station Bulletin #36, Hvorslev, M.J. (1951).

Groundwater Hydraulics, U.S. Geological Survey Professional Paper 708, Lohman, S.W., (1979).

APPENDIX B
MONITORING WELL VICINITY



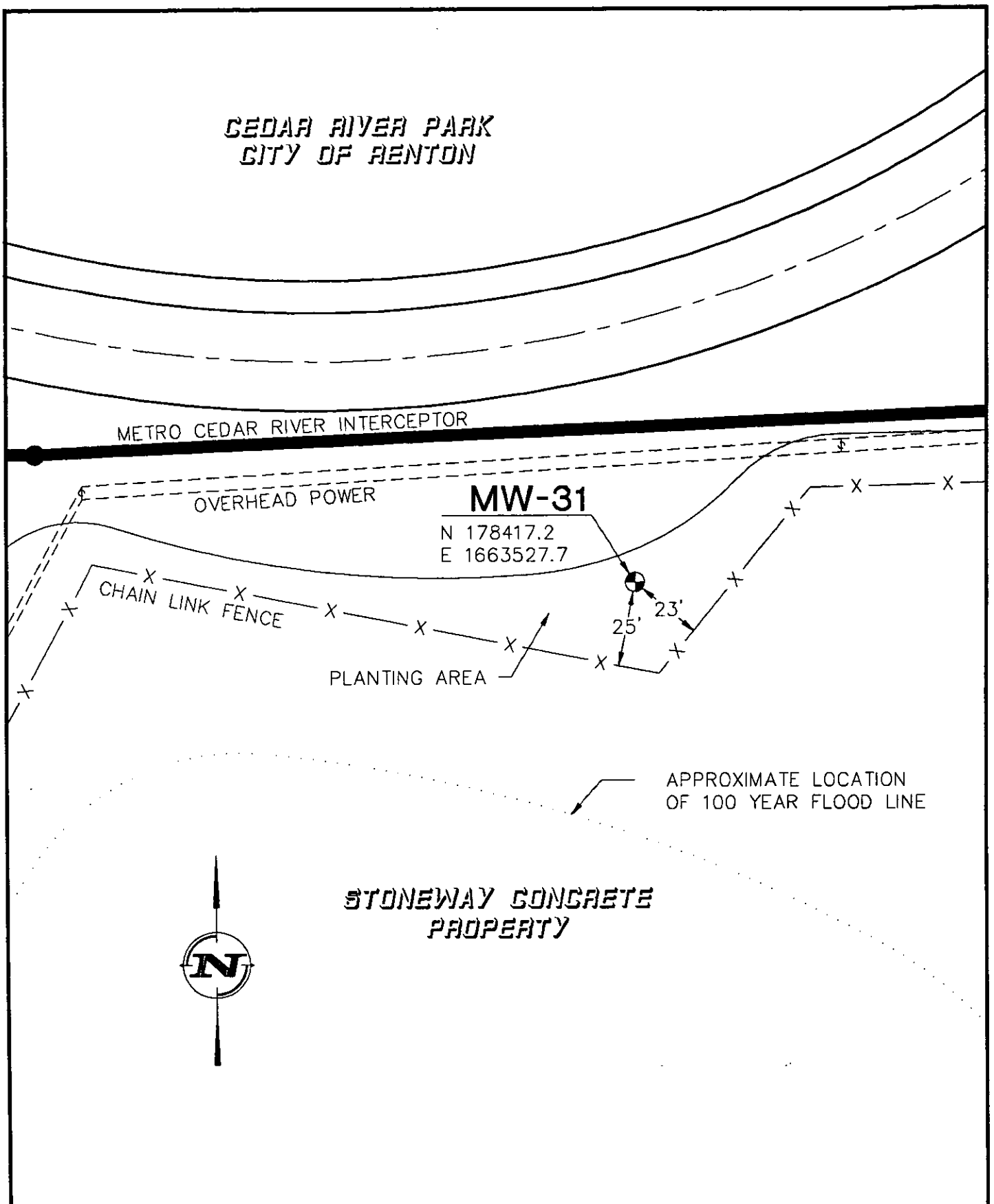
RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP MW-30

NOVEMBER 24, 1992

SCALE: 1" = 40'

FILE: MW30-VIC.DWG



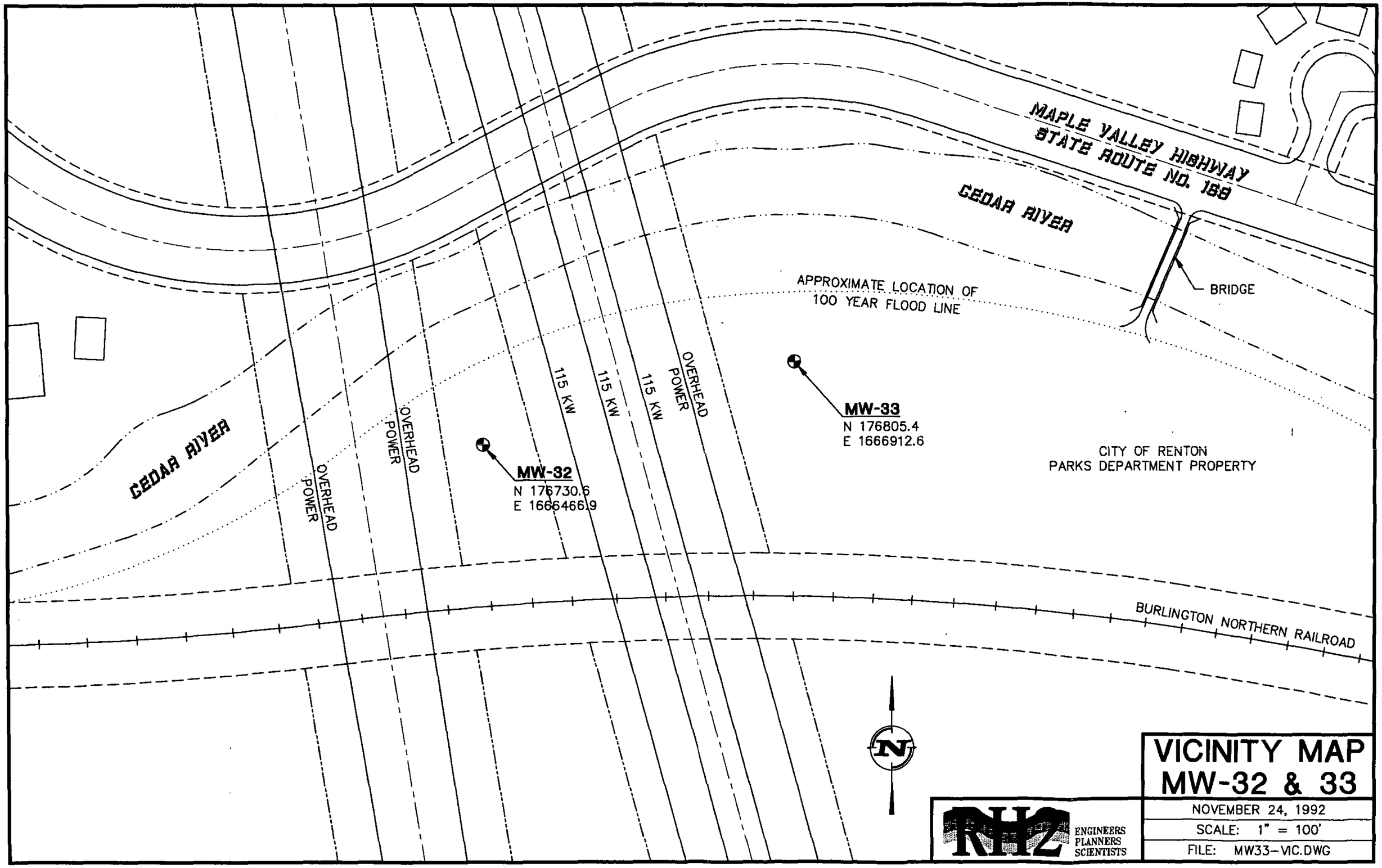
RH2 ENGINEERS PLANNERS SCIENTISTS

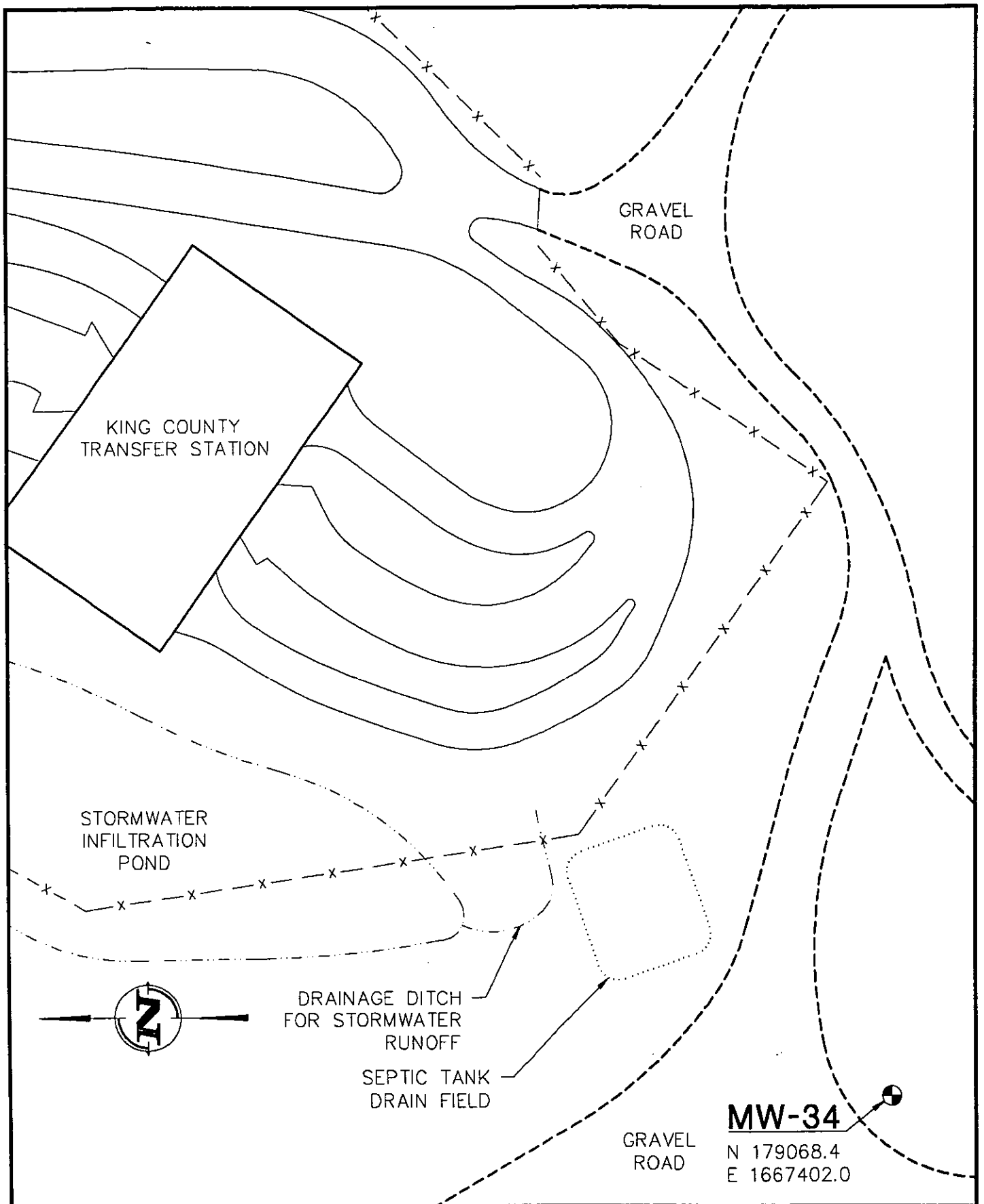
VICINITY MAP MW-31

NOVEMBER 24, 1992

SCALE: 1" = 40'

FILE: MW31-VIC.DWG

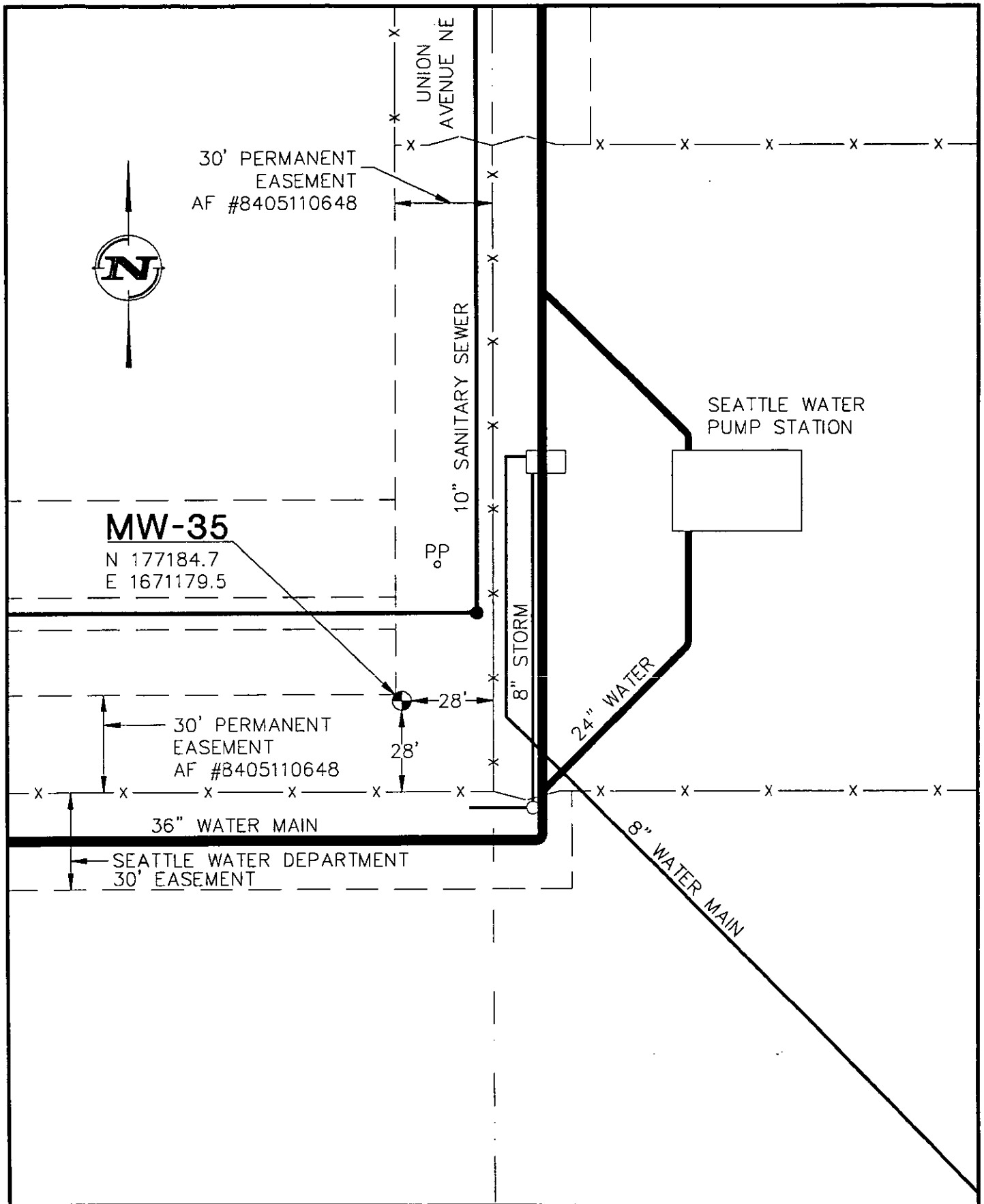

MAPLE VALLEY HIGHWAY
STATE ROUTE NO. 169
CEDAR RIVER
APPROXIMATE LOCATION OF
100 YEAR FLOOD LINE
BRIDGE
MW-33
N 176805.4
E 1666912.6
CITY OF RENTON
PARKS DEPARTMENT PROPERTY
MW-32
N 176730.6
E 16664669
115 KW
115 KW
115 KW
OVERHEAD
POWER
OVERHEAD
POWER
OVERHEAD
POWER
CEDAR RIVER
BURLINGTON NORTHERN RAILROAD
N
VICINITY MAP
MW-32 & 33
NOVEMBER 24, 1992
SCALE: 1" = 100'
FILE: MW33-VIC.DWG
RH2
ENGINEERS
PLANNERS
SCIENTISTS



RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP
MW-34

NOVEMBER 24, 1992
SCALE: 1" = 60'
FILE: MW34-VIC.DWG



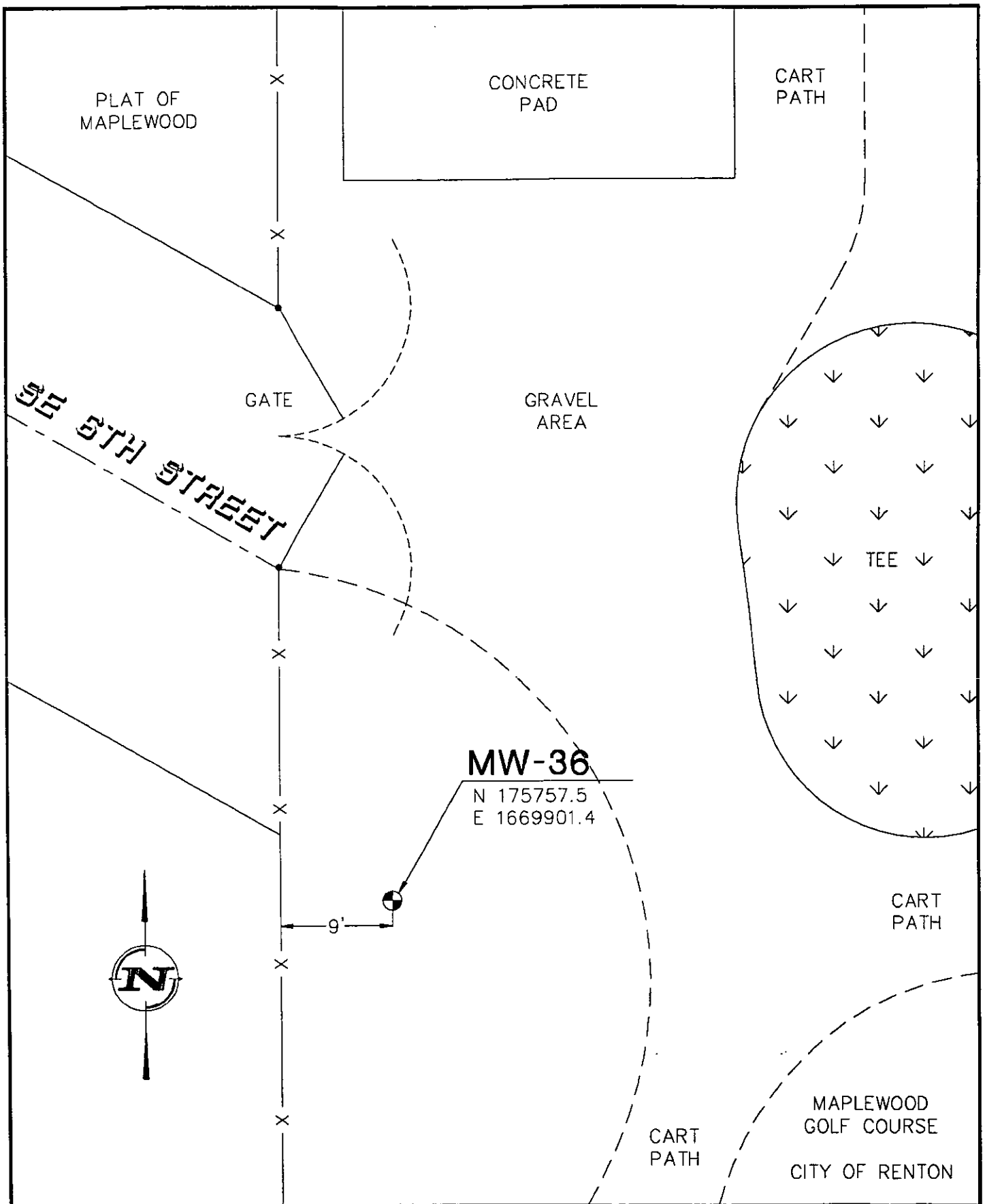
RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP MW-35

NOVEMBER 24, 1992

SCALE: 1" = 40'

FILE: MW35-VIC.DWG



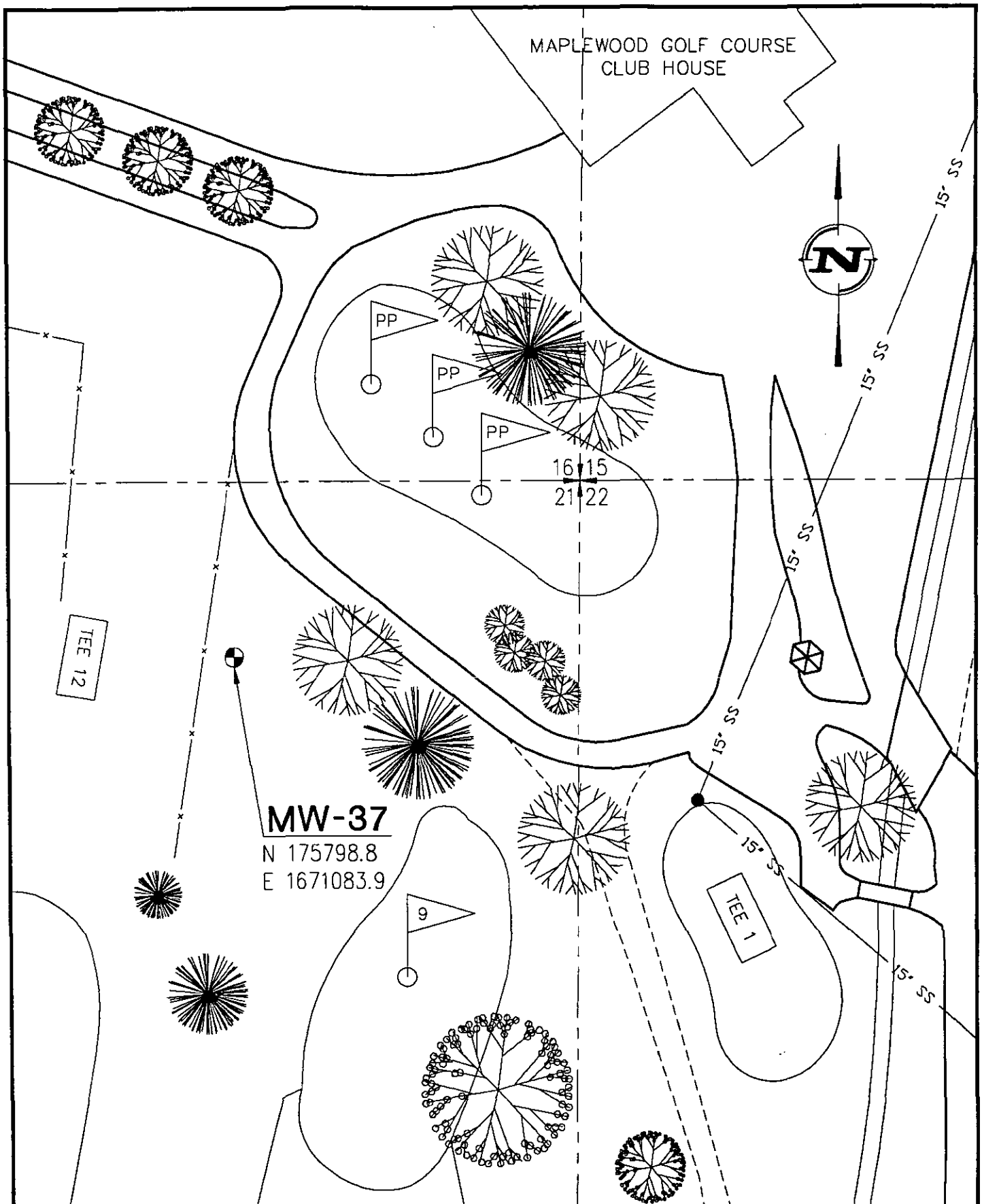
RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP MW-36

NOVEMBER 24, 1992

SCALE: 1" = 10'

FILE: MW36-VIC.DWG



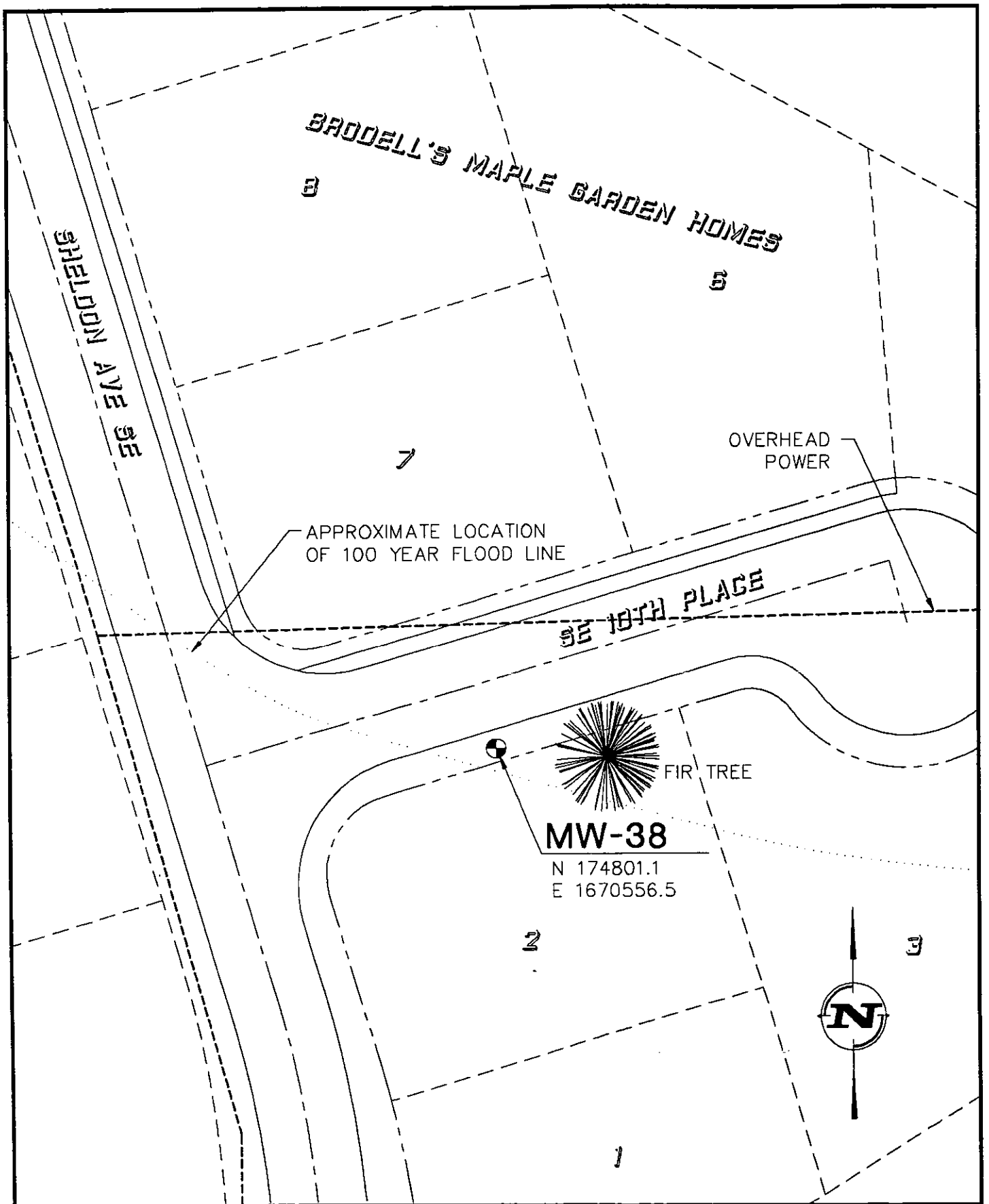
RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP MW-37

NOVEMBER 24, 1992

SCALE: 1" = 40'

FILE: MW37-VIC



RH2 ENGINEERS PLANNERS SCIENTISTS

VICINITY MAP MW-38

NOVEMBER 24, 1992

SCALE: 1" = 40'

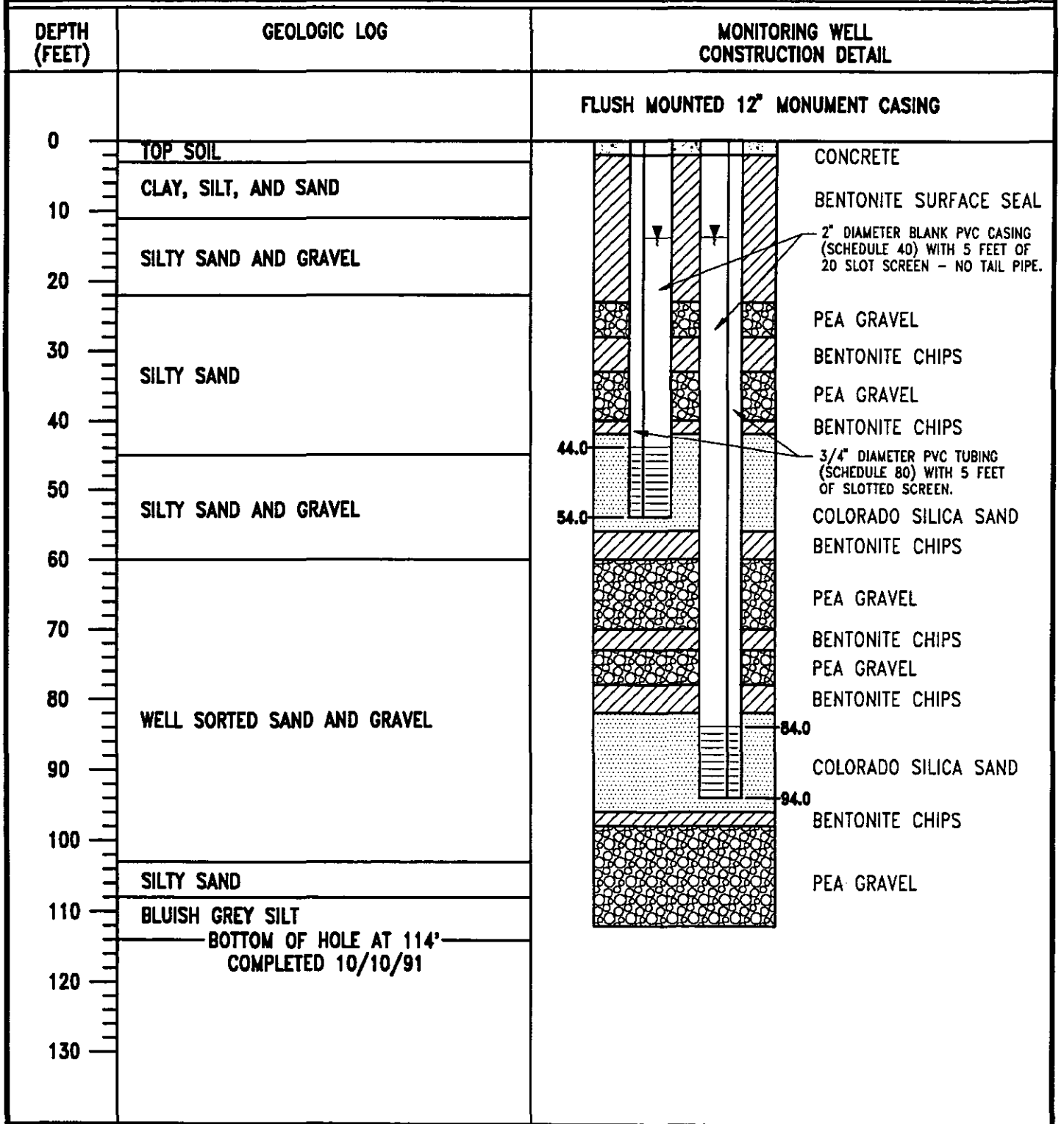
FILE: MW38-VIC

APPENDIX C
MONITORING WELL LOGS

RENTON MONITORING WELL LOG
REN-MW-30 S & D

MONITORING WELL	PVC CASING ELEVATION	DEPTH TO WATER (8/19/92)	GROUNDWATER ELEVATION
SHALLOW (S)	29.78 ft.	13.86 ft.	15.92 ft.
DEEP (D)	29.76 ft.	13.88 ft.	15.88 ft.

GROUND ELEVATION = 30.1 ft.
DRILLING METHOD: CABLE TOOL
DRILLER: HOLT DRILLING, INC.
PUYALLUP, WASHINGTON
GEOLOGIST: GEOFFREY CLAYTON
RH2 ENGINEERING, P.S.



FILE: MW30-LOG.DWG

RH2 ENGINEERING, P.S.

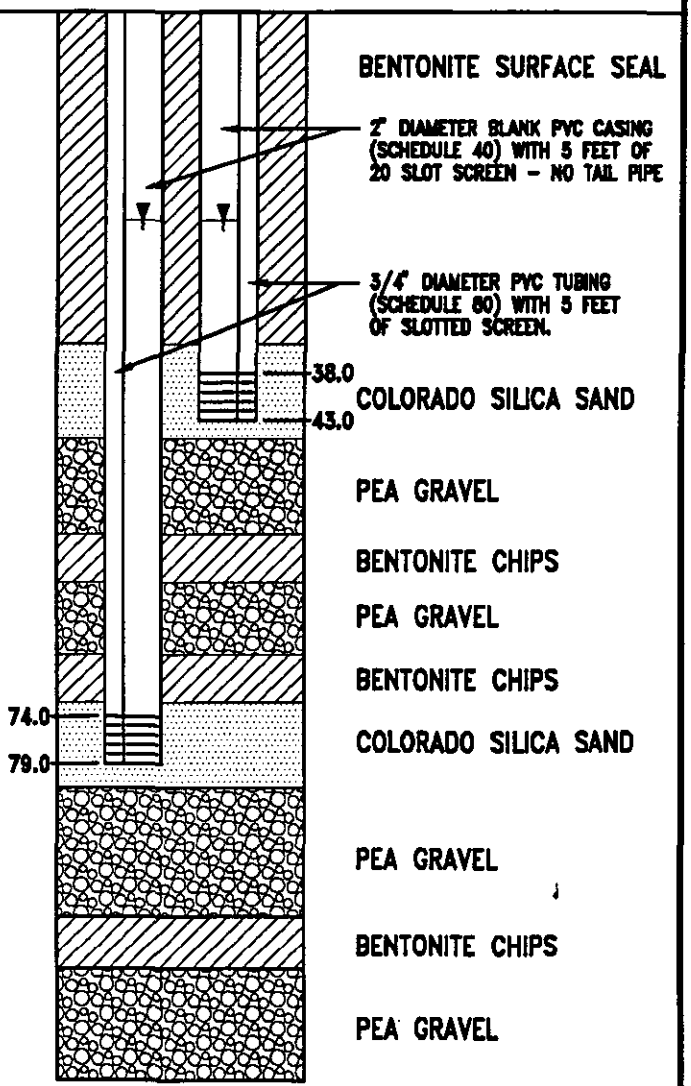
RENTON MONITORING WELL LOG
REN-MW-31 S & D

MONITORING WELL	PVC CASING ELEVATION	DEPTH TO WATER (3/10/92)	GROUNDWATER ELEVATION
SHALLOW (S)	47.18 ft.	22.02 ft.	25.16 ft.
DEEP (D)	47.22 ft.	22.06 ft.	25.16 ft.

GROUND ELEVATION = 47.9 ft.
DRILLING METHOD: CABLE TOOL
DRILLER: HOLT DRILLING, INC.
PUYALLUP, WASHINGTON
GEOLOGIST: GEOFFREY CLAYTON
RH2 ENGINEERING, P.S.

DEPTH (FEET)	GEOLOGIC LOG
0	TOP SOIL
	SAND AND GRAVEL
10	
	SILTY SAND AND GRAVEL; A FEW COBBLES
20	
	SILTY SAND
30	SILTY SAND AND GRAVEL; A FEW COBBLES
	WELL SORTED SAND AND GRAVEL
40	
	FINE TO COARSE SAND AND GRAVEL; ABUNDANT COBBLES
50	
60	
70	WELL SORTED SAND AND GRAVEL
	SAND AND GRAVEL; ABUNDANT COBBLES
80	SAND AND GRAVEL
	- - - - COLOR CHANGE TO GREY - - - -
	SAND AND GRAVEL
90	WELL SORTED PEA GRAVEL
	BLUISH GREY SILT AND CLAY; NO PEBBLES
100	
110	BOTTOM OF HOLE AT 112' COMPLETED 10/10/91
120	
130	

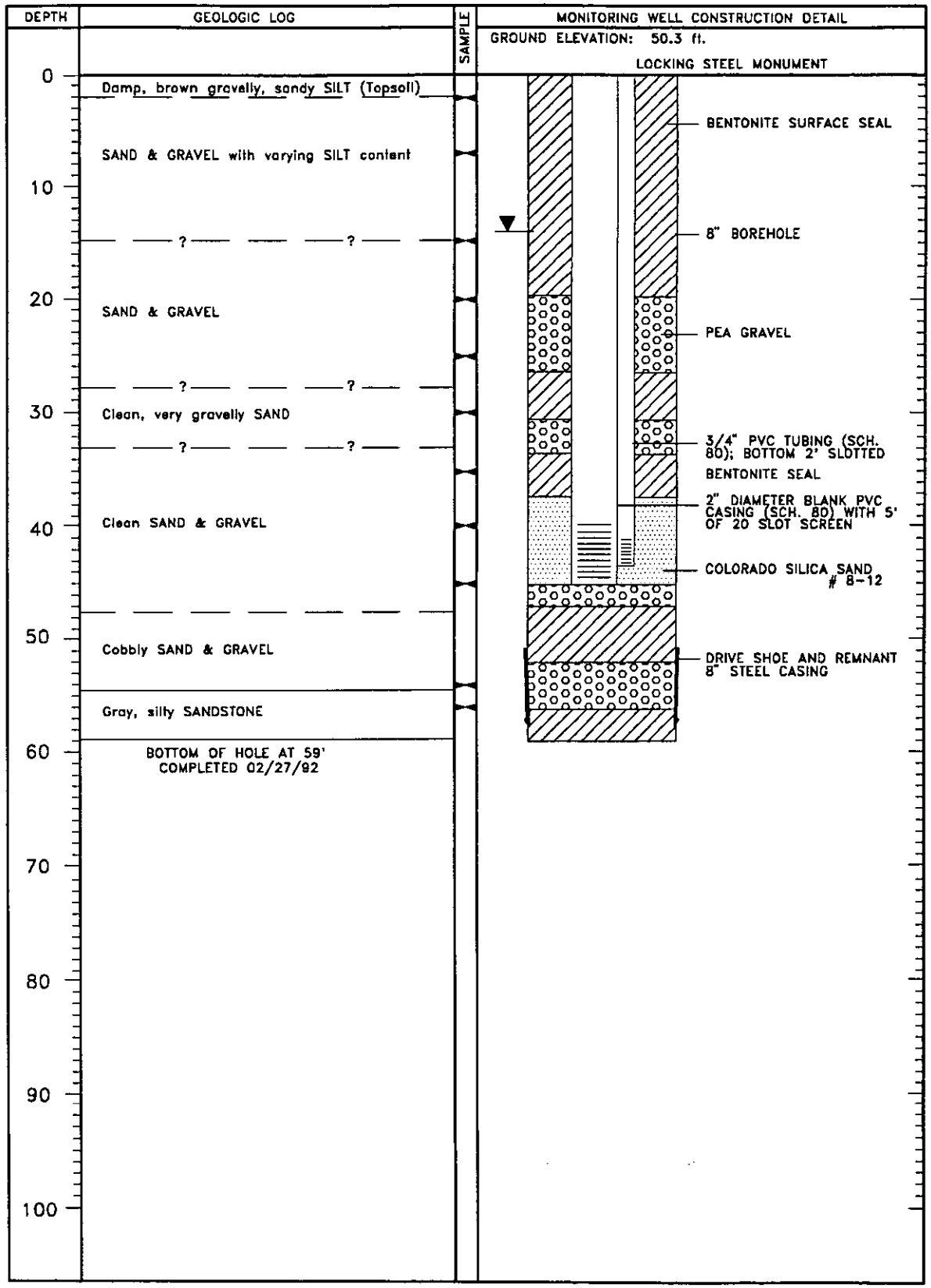
MONITORING WELL CONSTRUCTION DETAIL



FILE: MW31-LOG.DWG

RH2 ENGINEERING, P.S.

RENTON MONITORING WELL LOG
REN-MW-32



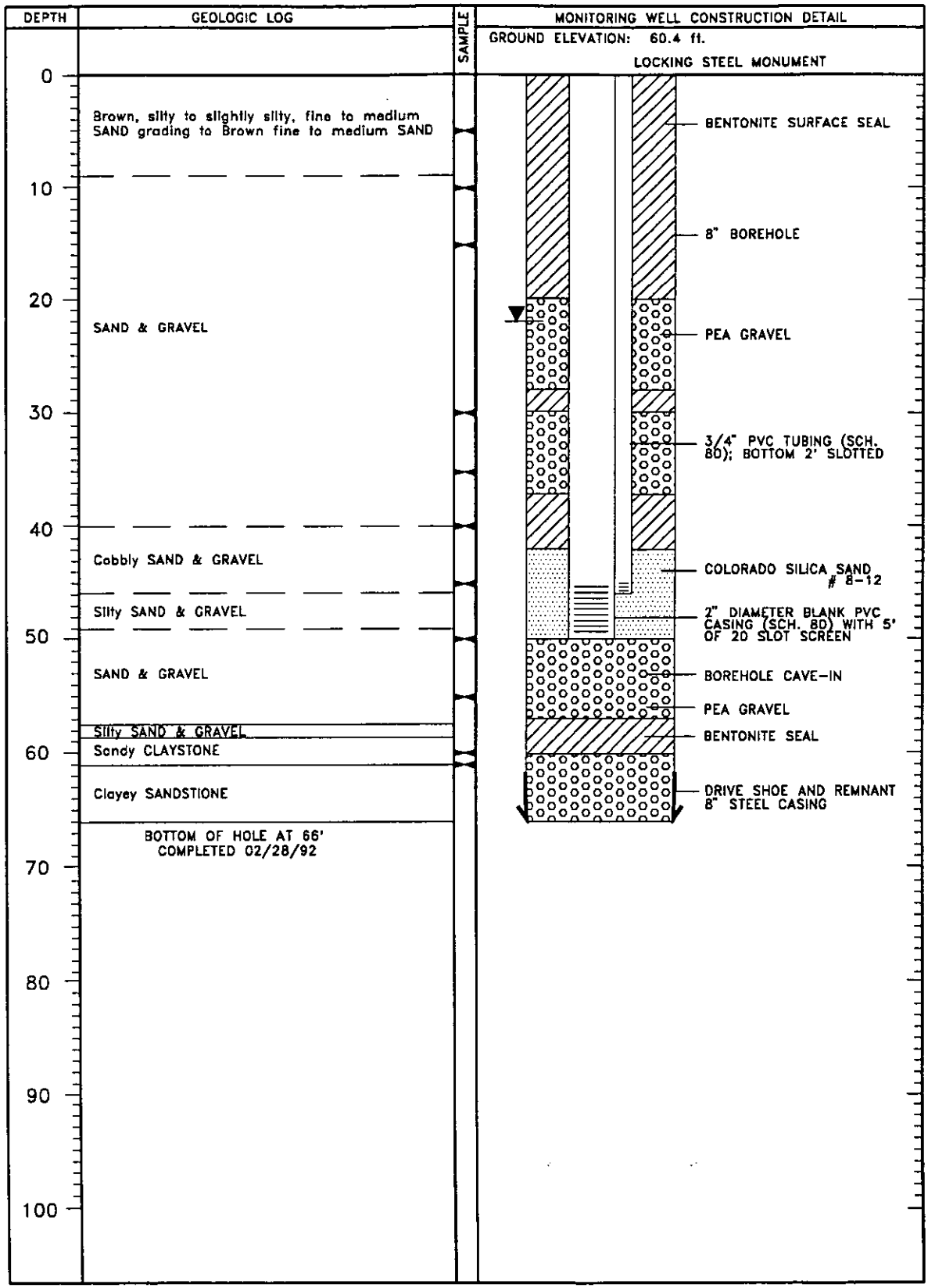
PROJECT NAME: Renton Monitoring Well Installation
WELL INDENTIFICATION NUMBER: MW-32
DRILLING METHOD: Cable Tool
DRILLER: Richard Miller
FIRM: Holt Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Russ Prior

LOCATION: SW¼ SW¼ Sec 16, T23N, R5E
DATUM: NGVD 1929
WATER LEVEL ELEVATION:
INSTALLED: 03/06/92

PVC ELEV.	DEPTH (8/19/92)	GW ELEV.
51.06'	14.46'	36.60'

Pacific Groundwater Group

RENTON MONITORING WELL LOG
REN-MW-33



PROJECT NAME: Renton Monitoring Well Installation
WELL INDENTIFICATION NUMBER: MW-33
DRILLING METHOD: Cable Tool
DRILLER: Richard "Larry" La Rance
FIRM: Holt Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Jim Mathieu

LOCATION: SW¼ SW¼ Sec.16, T23N, R5E
DATUM: NGVD 1929
WATER LEVEL ELEVATION:
INSTALLED: 03/09/92

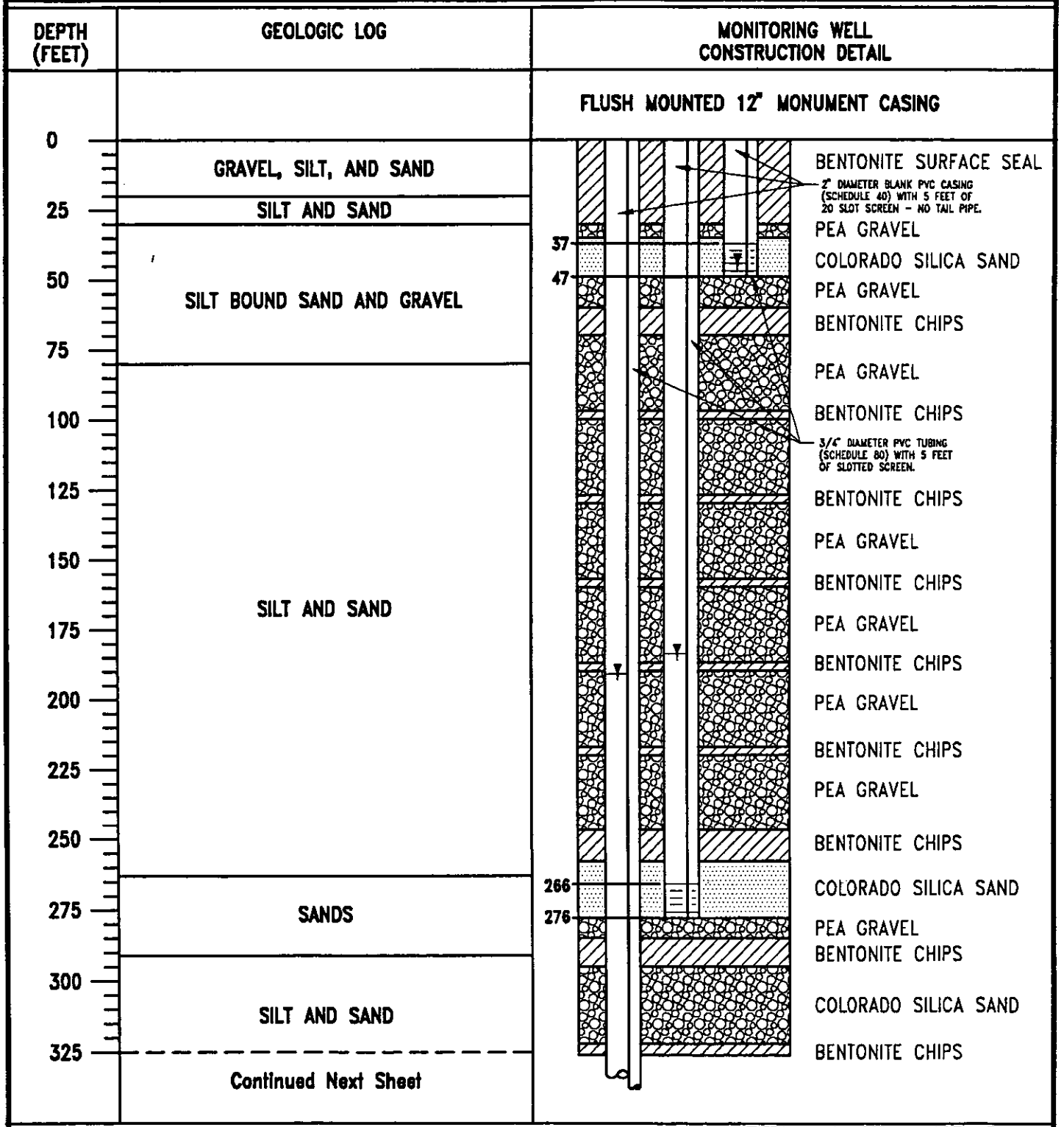
PVC ELEV.	DEPTH (8/19/92)	GW ELEV.
61.06'	22.83'	38.23'

Pacific Groundwater Group

RENTON MONITORING WELL LOG
REN-MW-34

MONITORING WELL	PVC CASING ELEVATION	DEPTH TO WATER (9/30/92)	GROUNDWATER ELEVATION
SHALLOW (S)	262.89 ft.	44.29 ft.	218.60 ft.
MEDIUM (M)	262.98 ft.	183.95 ft.	79.03 ft.
DEEP (D)	263.13 ft.	191.12 ft.	72.01 ft.

GROUND ELEVATION = 261.5 ft.
DRILLING METHOD: CABLE TOOL
DRILLER: HOLT DRILLING, INC.
PUYALLUP, WASHINGTON
GEOLOGIST: GEOFFREY CLAYTON
RH2 ENGINEERING, P.S.



RENTON MONITORING WELL LOG
REN-MW-34

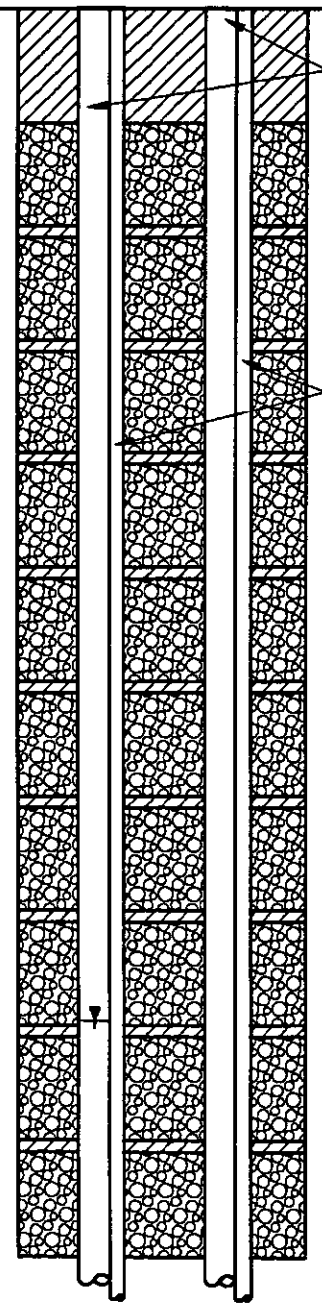
DEPTH (FEET)	GEOLOGIC LOG	MONITORING WELL CONSTRUCTION DETAIL
325	Continued From Previous Sheet	
350	SILT AND SAND	PEA GRAVEL BENTONITE CHIPS
375		PEA GRAVEL BENTONITE CHIPS
400		PEA GRAVEL
425		BENTONITE CHIPS PEA GRAVEL
450		BENTONITE CHIPS
475		PEA GRAVEL BENTONITE CHIPS
500		PEA GRAVEL
519		BENTONITE CHIPS
525	SANDS	COLORADO SILICA SAND
529		BENTONITE CHIPS
550	GRAVEL	
575		
600		
625		
650		
675		
700		

RENTON MONITORING WELL LOG
REN-MW-35

MONITORING WELL	PVC CASING ELEVATION	DEPTH TO WATER (9/14/92)	GROUNDWATER ELEVATION
SHALLOW (S)	357.79 ft.	NA	NA
DEEP (D)	357.78 ft.	265.84 ft.	91.94 ft.

GROUND ELEVATION = 356.1 ft.
DRILLING METHOD: CABLE TOOL
DRILLER: HOLT DRILLING, INC.
PUYALLUP, WASHINGTON
GEOLOGIST: GEOFFREY CLAYTON
RH2 ENGINEERING, P.S.

DEPTH (FEET)	GEOLOGIC LOG	MONITORING WELL CONSTRUCTION DETAIL
		FLUSH MOUNTED 12" MONUMENT CASING
0		
	SILT, SAND, AND GRAVEL	BENTONITE SURFACE SEAL
25		2" DIAMETER BLANK PVC CASING (SCHEDULE 40) WITH 5 FEET OF 20 SLOT SCREEN - NO TAIL PIPE.
50		PEA GRAVEL
		BENTONITE CHIPS
75		PEA GRAVEL
	SILT AND SAND	BENTONITE CHIPS
100		3/4" DIAMETER PVC TUBING (SCHEDULE 80) WITH 5 FEET OF SLOTTED SCREEN.
125		BENTONITE CHIPS
		PEA GRAVEL
150		BENTONITE CHIPS
	SAND AND GRAVEL	PEA GRAVEL
175		BENTONITE CHIPS
		PEA GRAVEL
200		BENTONITE CHIPS
225		PEA GRAVEL
		BENTONITE CHIPS
250	SILT AND SAND (SCATTERED GRAVELS)	PEA GRAVEL
275		BENTONITE CHIPS
		PEA GRAVEL
300		BENTONITE CHIPS
		PEA GRAVEL
325	Continued Next Sheet	



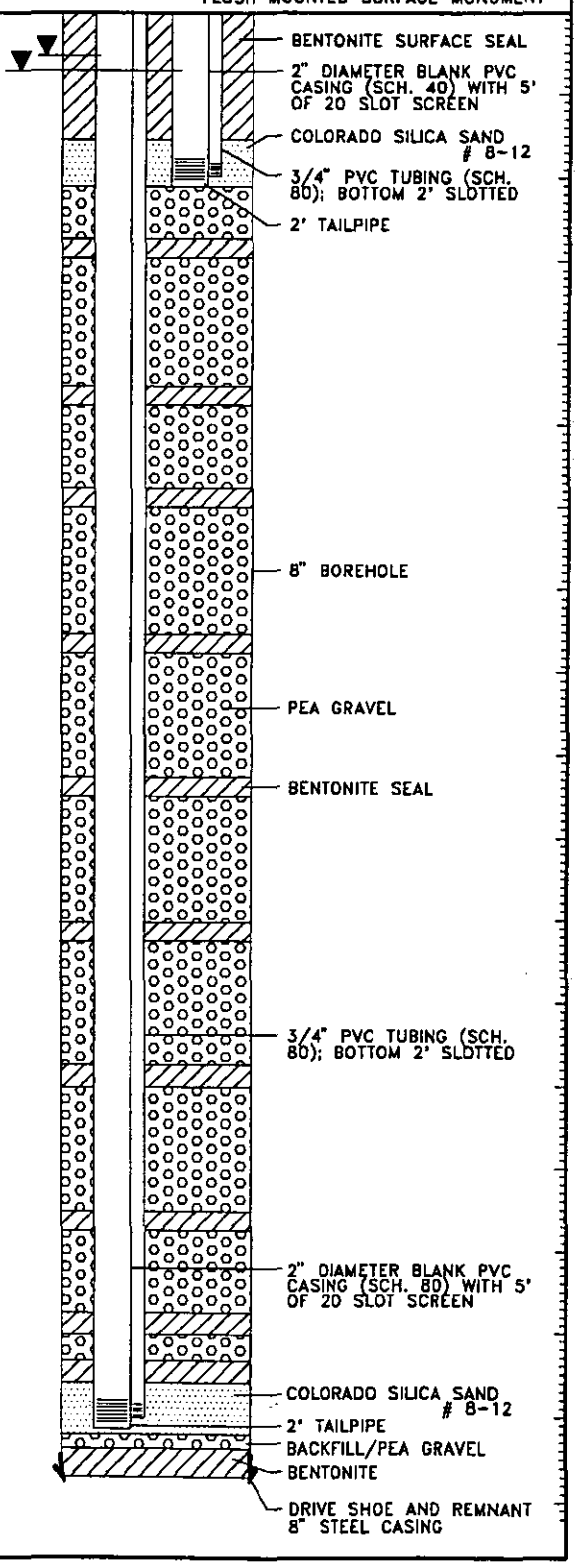
RENTON MONITORING WELL LOG
REN-MW-35

DEPTH (FEET)	GEOLOGIC LOG	MONITORING WELL CONSTRUCTION DETAIL
325	Continued From Previous Sheet	
350	SILT, SANDS, AND GRAVEL	BENTONITE CHIPS (335)
		COLORADO SILICA SAND (347)
		PEA GRAVEL
375		BENTONITE CHIPS
		PEA GRAVEL
400		BENTONITE CHIPS
425	SILT AND SAND (SCATTERED GRAVELS)	PEA GRAVEL
		BENTONITE CHIPS
450		PEA GRAVEL
475		BENTONITE CHIPS
		PEA GRAVEL
500		BENTONITE CHIPS
		PEA GRAVEL (506)
		COLORADO SILICA SAND (518)
525	SILT, SANDS, AND GRAVEL	PEA GRAVEL
		BENTONITE CHIPS
550		PEA GRAVEL
575	BEDROCK	
600		
625		
650		
675		
700		

RH2 ENGINEERING, P.S.

RENTON MONITORING WELL LOG
REN-MW-36 S & D

DEPTH	GEOLOGIC LOG	SAMPLE
0	Brown silty SAND	
20	Brown silty SAND and GRAVEL	
40	Brown SAND and GRAVEL	
60	Brownish-gray silty fine SAND	
80	Gray "clean" fine SAND	
100	Gray silty fine SAND	
120	Gray fine to medium SAND and GRAVEL	
140	Gray fine to medium SAND	
160	Gray slightly silty fine SAND with wood chips	
180	Gray medium SAND and GRAVEL	
200	Gray slightly silty to silty fine SAND, with gravelly layers, wood chips	
220	Gray fine to medium SAND with trace gravel, silt	
240	Gray silty very fine to fine SAND with wood chips	
260	Gray fine to coarse SAND and GRAVEL	
280	Gray silty fine to medium SAND with trace wood chips; occasional gravelly layers	
300	Gray silty fine to medium SAND with occasional layers of SILT or sandy SILT	
320	Gray silty fine to medium SAND with wood chips; occasional gravelly layers	
340	Gray silty fine to coarse SAND with trace gravel, wood	
360	Gray gravelly fine to coarse SAND; thin silt beds	
	Gray siltbound GRAVEL and fine to coarse silty SAND	
	Gray silty fine to medium SAND grading into silty CLAY	
	Gray sandy silty CLAY with occasional layers of siltbound SAND and GRAVEL	
	Gray silty fine to coarse SAND and GRAVEL	
	Gray silty fine SAND and GRAVEL, BOULDERS	
	BEDROCK	
	BOTTOM OF HOLE AT 354' COMPLETED 08/05/91	



PROJECT NAME: Renton Monitoring Well Installation
WELL INDENTIFICATION NUMBER: MW-36
DRILLING METHOD: Cable Tool
DRILLER: Richard Miller
FIRM: Holt Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Nancy Riccio

LOCATION: SE ¼ SE ¼ Sec. 16, T23N, R5E
DATUM: NGVD 1929
WATER LEVEL ELEVATION:
INSTALLED: 8/15/91

PVC ELEV.	DEPTH (8/19/92)	GW ELEV.	
64.61'	13.53'	51.08'	Shallow
64.64'	10.54'	54.10'	Deep

Pacific Groundwater Group

RENTON MONITORING WELL LOG
REN-MW-37 S & D

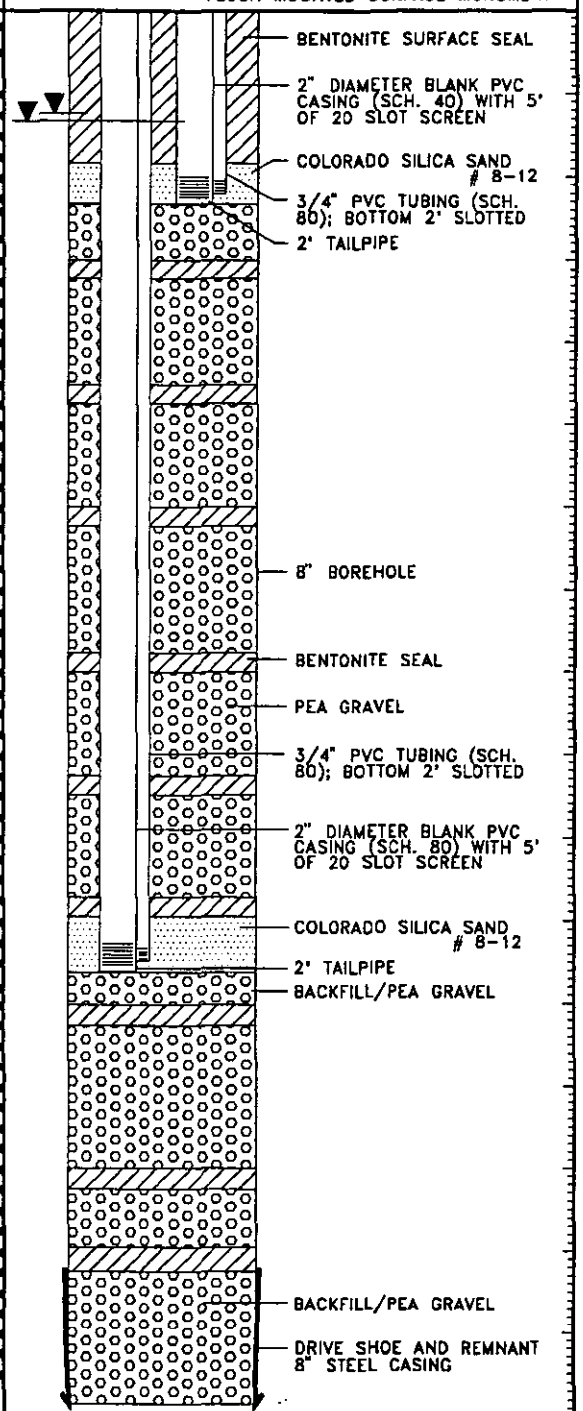
DEPTH	GEOLOGIC LOG
0	Gray-brown, slightly sandy, very siltbound, GRAVEL & COBBLES
40	Red-brown, slightly sandy GRAVEL & COBBLES
	Gray-brown siltbound GRAVEL
	Red-brown, slightly sandy GRAVEL & COBBLES
60	Grayish-brown/brownish-gray sandy SILT with some thin beds of clayey SILT/silty CLAY Grading to Grayish-brown silty fine SAND with some interbedded CLAY and clayey SILT
100	Brown silty fine SAND
	Gray, slightly sandy, clayey SILT grading to Gray sandy SILT
120	Grayish-brown, silty, fine to medium SAND
	Gray, very silty, fine SAND
140	Brown & Gray-brown, silty fine SAND
180	Brown, well graded, very gravelly, fine to coarse SAND grading to slightly gravelly SAND
	Brown fine to medium SAND with chunks of wood (Silty SAND bed at 190 feet)
200	Gray, silty, fine to medium SAND
	Gray sandy GRAVEL & gravelly fine to medium SAND
220	Gray, gravelly and very gravelly SAND & very sandy GRAVEL
240	Gray GRAVEL & fine to coarse (?) SAND with some interbedded siltbound layers
260	Gray, gravelly, silty SAND (gravel decreasing toward bottom of interval)
	Gray, slightly sandy, slightly gravelly fine to medium SAND
280	Gray, silty fine SAND with interbedded SILT
	Brownish-gray SILT; trace GRAVEL
300	
320	
340	BOTTOM OF HOLE AT 337' COMPLETED 11/25/91
360	

SAMPLE

MONITORING WELL CONSTRUCTION DETAIL

GROUND ELEVATION: 79.8 ft.

FLUSH MOUNTED SURFACE MONUMENT



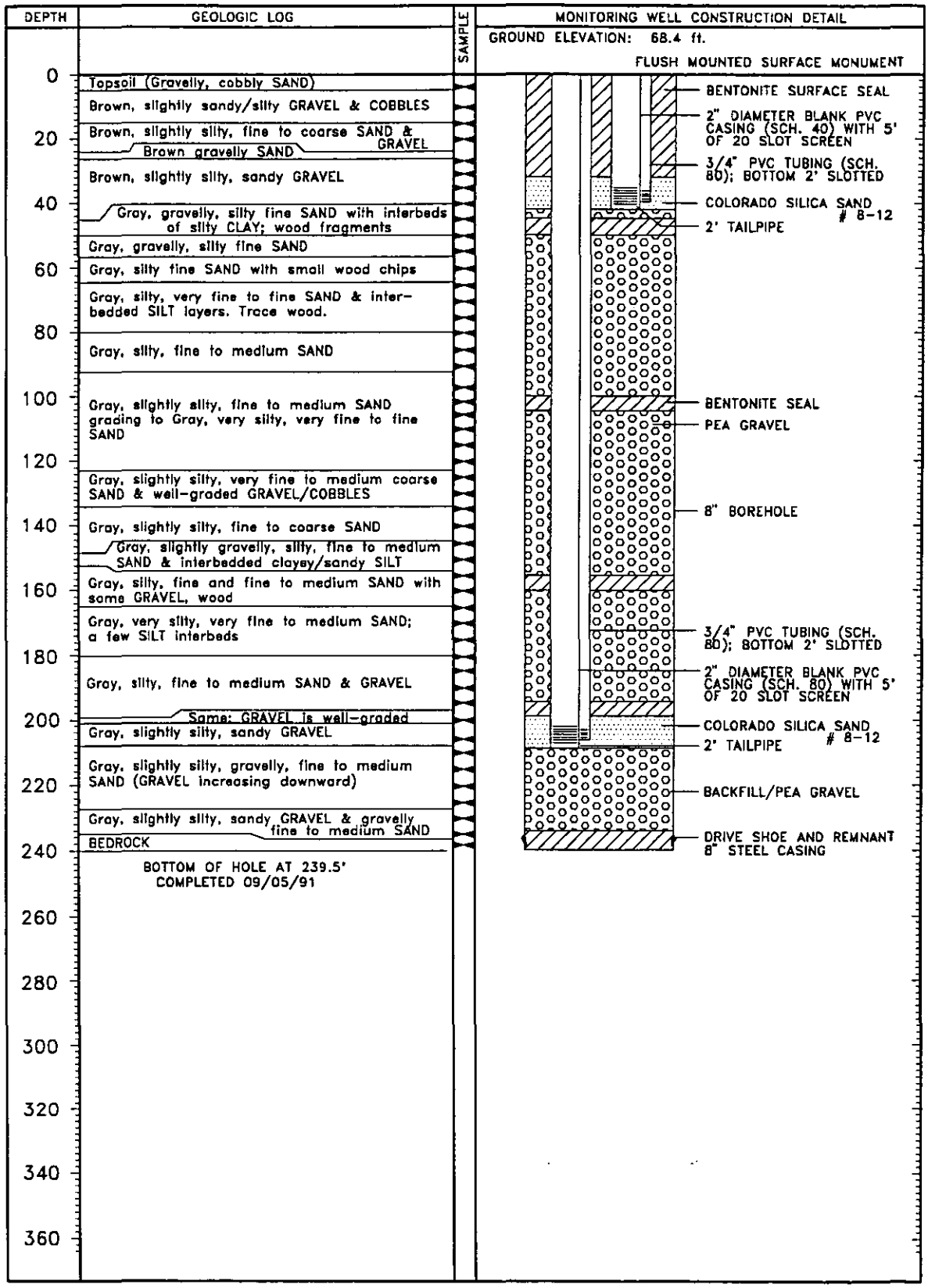
PROJECT NAME: Renton Monitoring Well Installation
WELL INDENTIFICATION NUMBER: MW-37
DRILLING METHOD: Cable Tool
DRILLER: Richard "Larry" La Rance
FIRM: Holt Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Nancy Riccio

LOCATION: NW¼ NW¼ Sec. 22, T23N, R5E
DATUM: NGVD 1929
WATER LEVEL ELEVATION:
INSTALLED: 12/05/91

PVC ELEV.	DEPTH (12/05/91)	GW ELEV.	
85.64'	24.29'	61.35'	Shallow
85.59'	23.54'	62.05'	Deep

Pacific Groundwater Group

RENTON MONITORING WELL LOG
REN-MW-38 S & D



PROJECT NAME: Renton Monitoring Well Installation
WELL INDENTIFICATION NUMBER: MW-38
DRILLING METHOD: Cable Tool
DRILLER: Tony Fehrenbach
FIRM: Holt Drilling
CONSULTING FIRM: Pacific Groundwater Group, Inc.
REPRESENTATIVE: Nancy Riccio

LOCATION: NE ¼ NE ¼ Sec. 22, T23N, R5E
DATUM: NGVD 1929
WATER LEVEL ELEVATION: Water Level
INSTALLED: 09/10/91

	DEPTH (3/10/92)	GW ELEV.	
PVC ELEV.			
67.71'	11.40'	56.31'	Shallow
67.69'	9.52'	58.17'	Deep

Pacific Groundwater Group

APPENDIX D
BOREHOLE PUMP TEST RESULTS

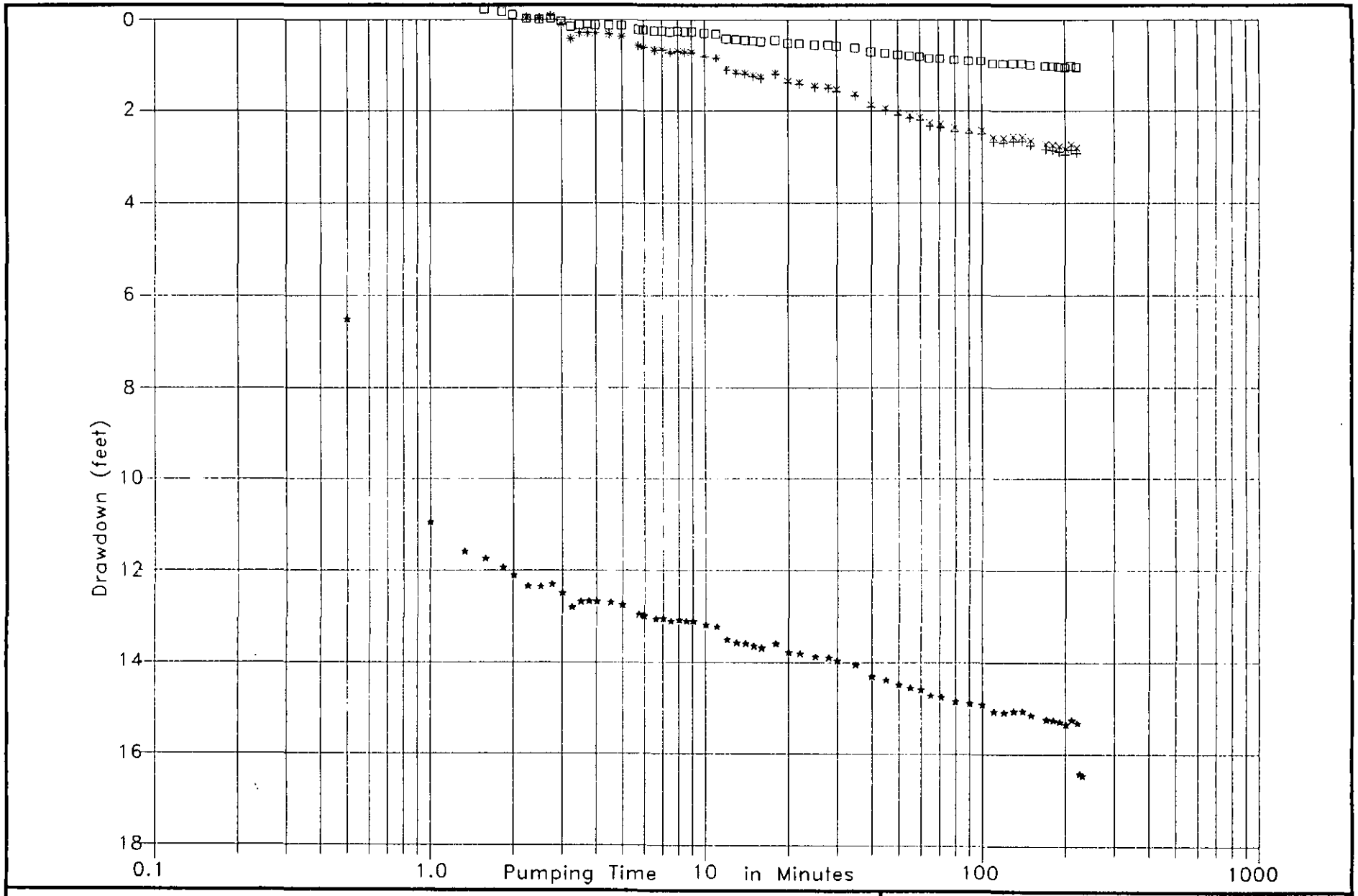
TABLE D.1

DRAWDOWN DATA
TEST OF RENTON WELL MW-33 WITH TEMPORARY SCREEN

TIME (MIN)	Correction for Partial Penetration and Unconfined Conditions	Correction for Unconfined Conditions	Aquifer Drawdown Subtracting Well loss	Theoretical Aquifer Drawdown	Measured Drawdown	Calculated Well Loss
0.50	−2.39	−6.39	−5.89	0.18	6.51	6.33
1.00	−0.55	−1.47	−1.44	0.36	10.96	10.60
1.33	−0.30	−0.80	−0.79	0.44	11.61	11.17
1.58	−0.24	−0.65	−0.64	0.48	11.76	11.28
1.83	−0.17	−0.45	−0.45	0.52	11.95	11.43
2.00	−0.11	−0.29	−0.29	0.55	12.11	11.56
2.25	−0.02	−0.05	−0.05	0.58	12.35	11.77
2.50	−0.01	−0.04	−0.04	0.61	12.36	11.75
2.75	−0.03	−0.09	−0.09	0.63	12.31	11.68
3.00	0.04	0.10	0.10	0.66	12.50	11.84
3.25	0.15	0.41	0.41	0.68	12.81	12.13
3.50	0.11	0.29	0.29	0.70	12.69	11.99
3.75	0.10	0.28	0.28	0.72	12.68	11.96
4.00	0.11	0.29	0.29	0.73	12.69	11.96
4.50	0.12	0.31	0.31	0.77	12.71	11.94
5.00	0.13	0.36	0.36	0.79	12.76	11.97
5.75	0.21	0.56	0.56	0.83	12.96	12.13
6.00	0.22	0.59	0.59	0.84	12.99	12.15
6.58	0.24	0.65	0.66	0.87	13.06	12.19
7.00	0.24	0.64	0.65	0.88	13.05	12.17
7.50	0.26	0.70	0.71	0.90	13.11	12.21
8.00	0.25	0.67	0.68	0.92	13.08	12.16
8.50	0.26	0.70	0.71	0.94	13.11	12.17
9.00	0.26	0.70	0.71	0.95	13.11	12.16
10.00	0.29	0.78	0.79	0.98	13.19	12.21
11.00	0.31	0.82	0.83	1.00	13.23	12.23
12.00	0.41	1.09	1.11	1.03	13.51	12.48
13.00	0.43	1.16	1.18	1.05	13.58	12.53
14.00	0.44	1.18	1.20	1.07	13.60	12.53
15.00	0.46	1.23	1.25	1.09	13.65	12.56
16.00	0.47	1.27	1.29	1.11	13.69	12.58
18.00	0.44	1.18	1.20	1.14	13.60	12.46
20.00	0.51	1.35	1.38	1.17	13.78	12.61
22.00	0.52	1.38	1.41	1.19	13.81	12.62
25.00	0.54	1.45	1.48	1.23	13.88	12.65
28.00	0.55	1.47	1.50	1.26	13.90	12.64
30.00	0.57	1.53	1.57	1.27	13.97	12.70
35.00	0.61	1.62	1.66	1.32	14.06	12.74
40.00	0.69	1.86	1.91	1.35	14.31	12.96
45.00	0.72	1.93	1.99	1.38	14.39	13.01
50.00	0.76	2.03	2.09	1.41	14.49	13.08
55.00	0.78	2.09	2.16	1.44	14.56	13.12
60.00	0.80	2.13	2.20	1.46	14.60	13.14
65.00	0.84	2.25	2.33	1.48	14.73	13.25
71.00	0.85	2.28	2.36	1.50	14.76	13.26
80.00	0.88	2.36	2.45	1.54	14.85	13.31
90.00	0.90	2.40	2.49	1.57	14.89	13.32
100.00	0.91	2.42	2.51	1.60	14.91	13.31
110.00	0.96	2.57	2.67	1.62	15.07	13.45
120.00	0.97	2.59	2.69	1.65	15.09	13.44
130.00	0.96	2.56	2.66	1.67	15.06	13.39
140.00	0.96	2.56	2.66	1.69	15.06	13.37
150.00	0.99	2.64	2.75	1.71	15.15	13.44
170.00	1.02	2.72	2.84	1.74	15.24	13.50
180.00	1.03	2.74	2.86	1.75	15.26	13.51
190.00	1.04	2.77	2.89	1.77	15.29	13.52
200.00	1.06	2.83	2.95	1.78	15.35	13.57
210.00	1.02	2.73	2.85	1.80	15.25	13.45
220.00	1.05	2.80	2.92	1.81	15.32	13.51

3/5/92; STATIC = 24.65; Q = 130 GPM

All water levels in feet



□ □ □ □ □ Drawdown Data Corrected for Partial Penetration and Unconfined Conditions
× × × × × Drawdown Data Corrected for Unconfined Conditions
+ + + + + Drawdown Data Corrected for Well Loss
★ ★ ★ ★ ★ Measured Drawdown Data

Discharge = 130 gpm
Static Water Level = 24.65 Feet Below Temproray Casing

FIGURE D.1
MW-33 PUMPING TEST
DRAWDOWN PLOT

RENTON MONITORING WELLS

Pacific Groundwater Group

TABLE D2:SUMMARY OF RESULTS OF SLUG AND POSITIVE/NEGATIVE DISPLACEMENT TESING AT RENTON MONITORING WELLS

SLUG TESTS

WELL	TEST NUMBER	SHOE DEPTH (feet)	FILL AT END OF TEST (feet)	APPROXIMATE DURATION OF TEST (minutes)	AQUITARD LITHOLOGY	COMPUTED K (cm/sec)	ANALYTICAL METHOD	REMARKS
MW-37	1	90.2	2	25	v slty vf-f sand	1.3 X 10-4	Hvorslev "C"	Basic Time Lag
	1					1.1 X 10-4	Hvorslev "C"	Variable Head
MW-37	2	103.5	3	30	sl sdy, cly silt	4.2 X 10-4	Hvorslev "C"	Basic Time Lag
	2					4 X 10-4	Hvorslev "C"	Variable Head
MW-37	3	129.5	10	40	v slty f sand	5 X 10-5	Hvorslev "C"	Basic Time Lag
	3					5 X 10-5	Hvorslev "C"	Variable Head
MW-38	1	154.5	12.25	28	Slty f & fm sand	4.6 X 10-3	Hvorslev "C"	Basic Time Lag
	1					3.8 X 10-3	Hvorslev "C"	Variable Head

DISPLACEMENT TESTS

WELL	TEST NUMBER	SCREEN INTERVAL (feet)	FILL AT END OF TEST (feet)	APPROXIMATE DURATION OF TEST (minutes)	AQUITARD LITHOLOGY	COMPUTED K (cm/sec)	ANALYTICAL METHOD	REMARKS
MW-38	1	50-55	NA	12	Grvly, slty f sand	5 X 10-4	Hvorslev "G"	
	1					6 X 10-4	Hvorslev "F"	
MW-38	2	50-55	NA	22	Grvly, slty f sand	---	---	K indeterminate
MW-38	3	50-55	NA	15	Grvly, slty f sand	5 X 10-4	Hvorslev "G"	
	3					6 X 10-4	Hvorslev "F"	

FIGURE D.2: DRAWDOWN GRAPH FOR POSITIVE DISPLACEMENT TEST #1, MW-38 AT RENTON

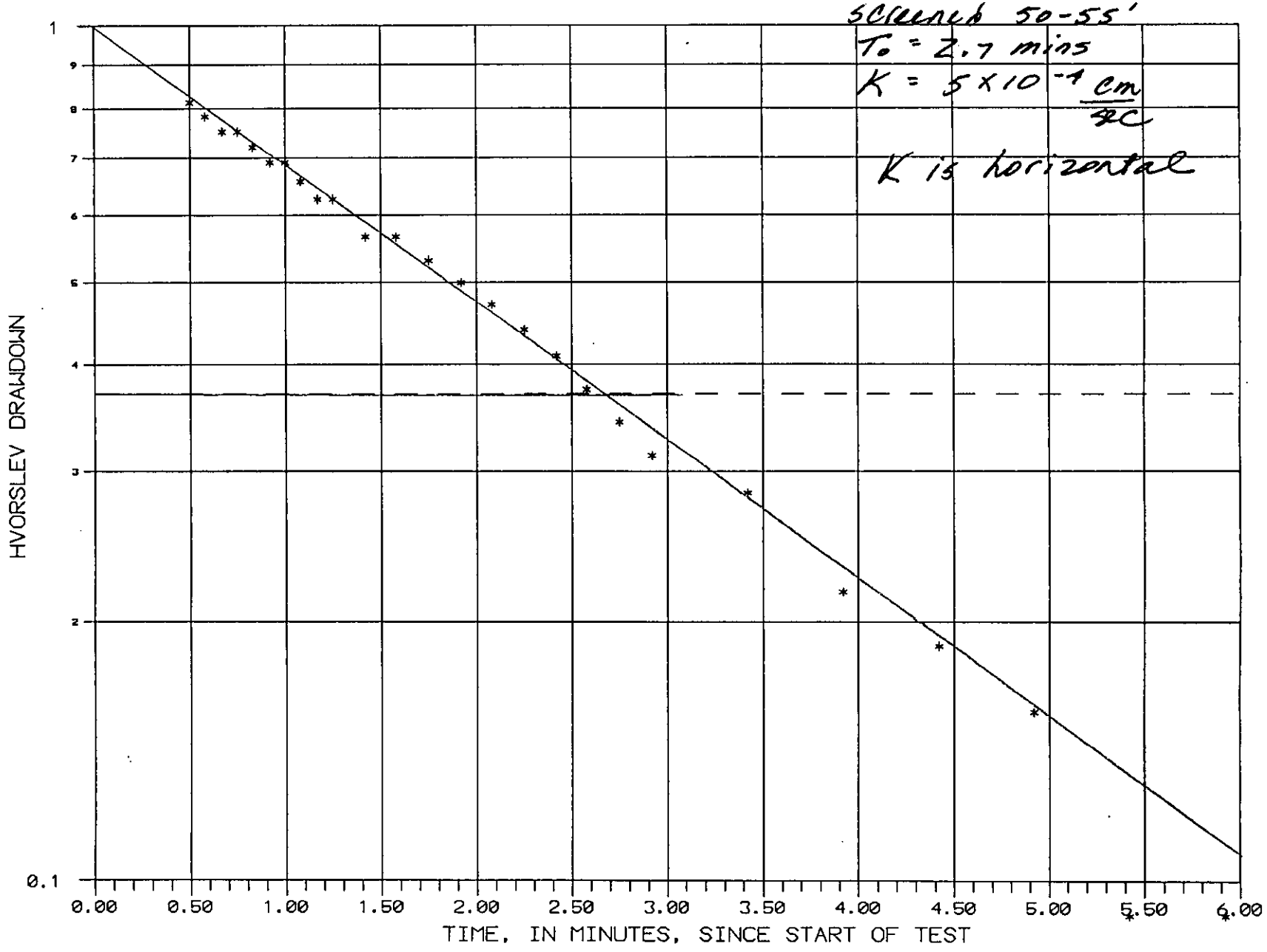


FIGURE D.3: DRAWDOWN GRAPH FOR NEGATIVE DISPLACEMENT TEST #1, MW-38 AT RENTON

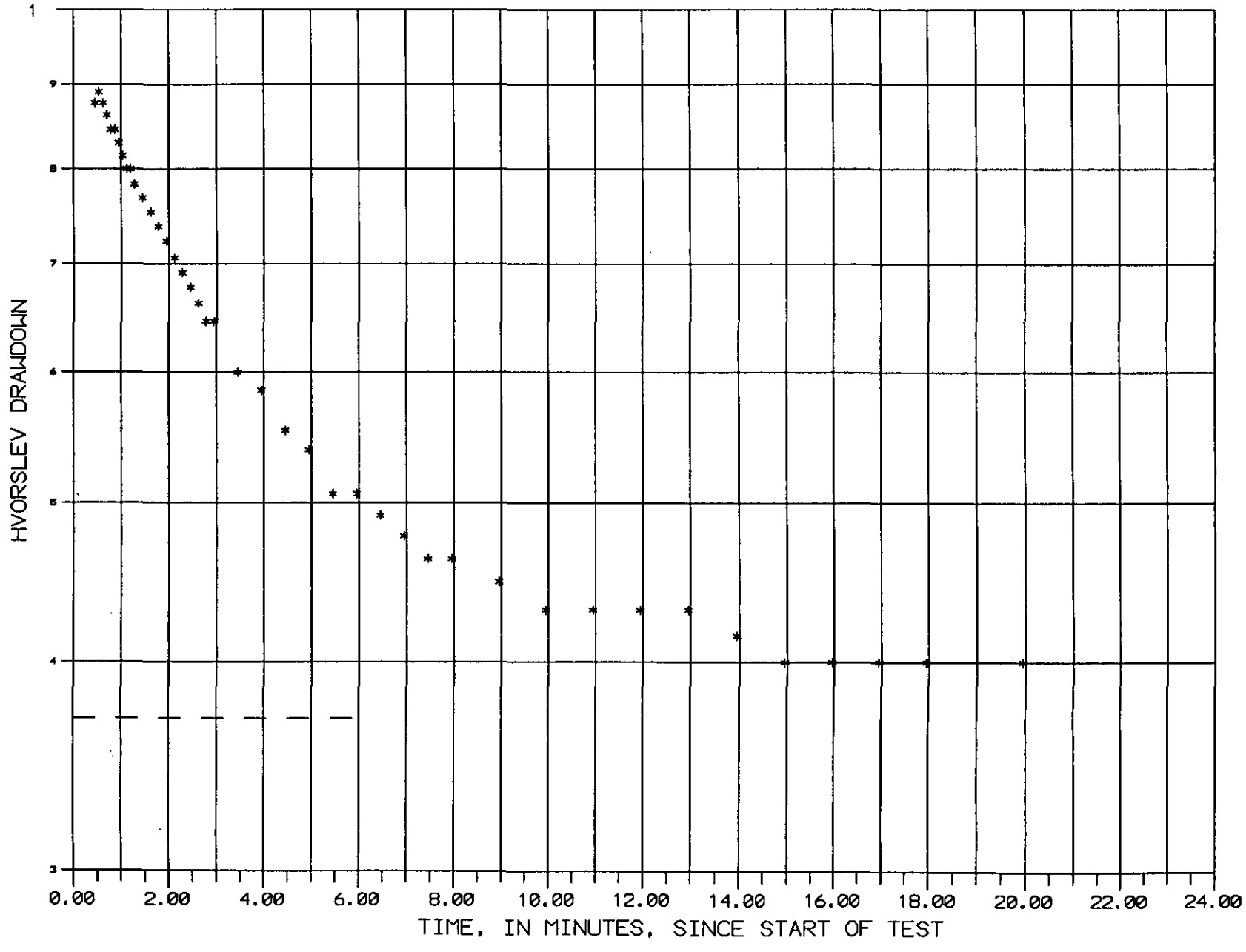


FIGURE D4: DRAWDOWN GRAPH FOR POSITIVE DISPLACEMENT TEST #2, MW-38 AT RENTON

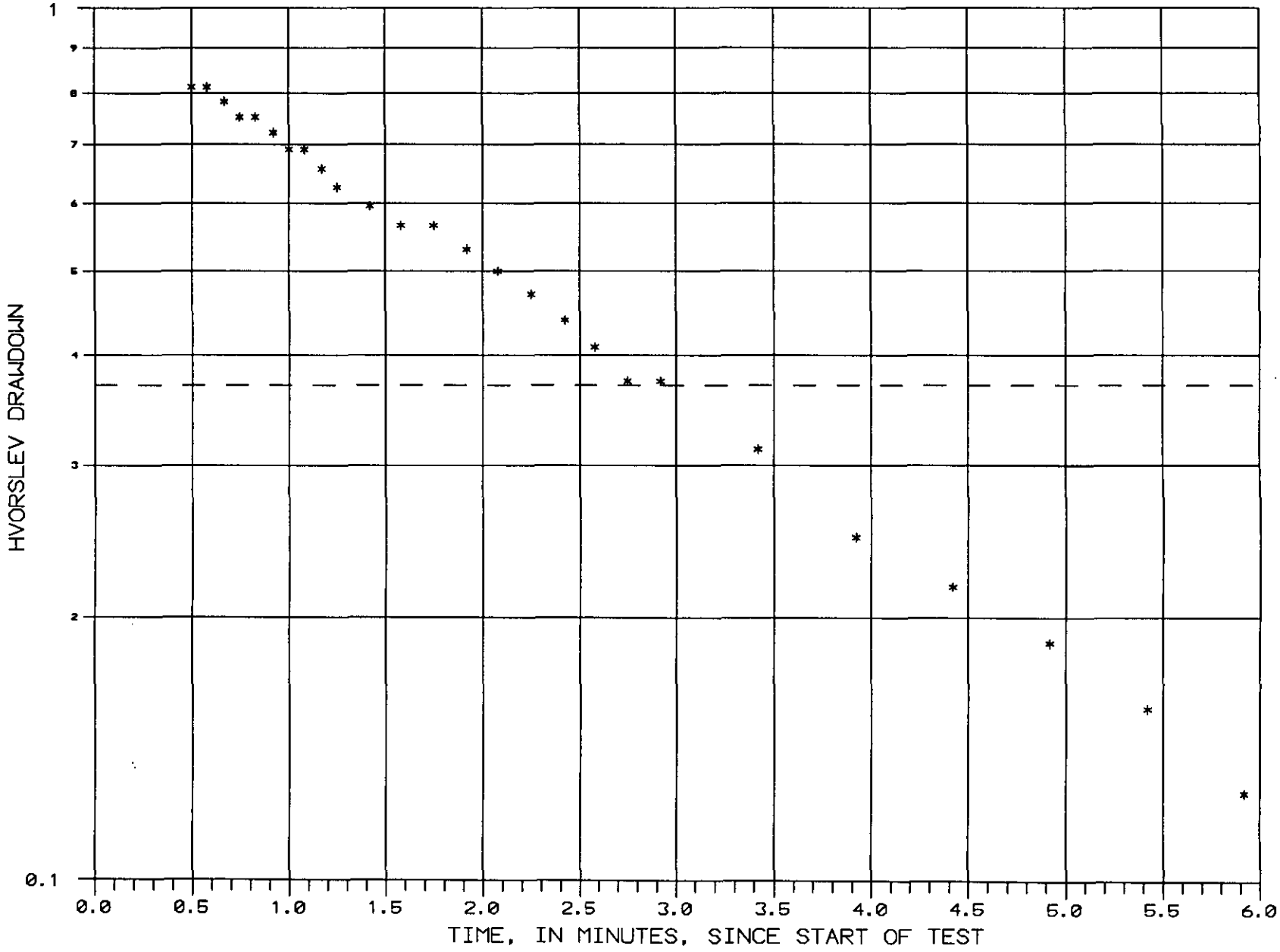


FIGURE D.5: DRAWDOWN GRAPH FOR POSITIVE DISPLACEMENT TEST #3 MW-38 RENTON

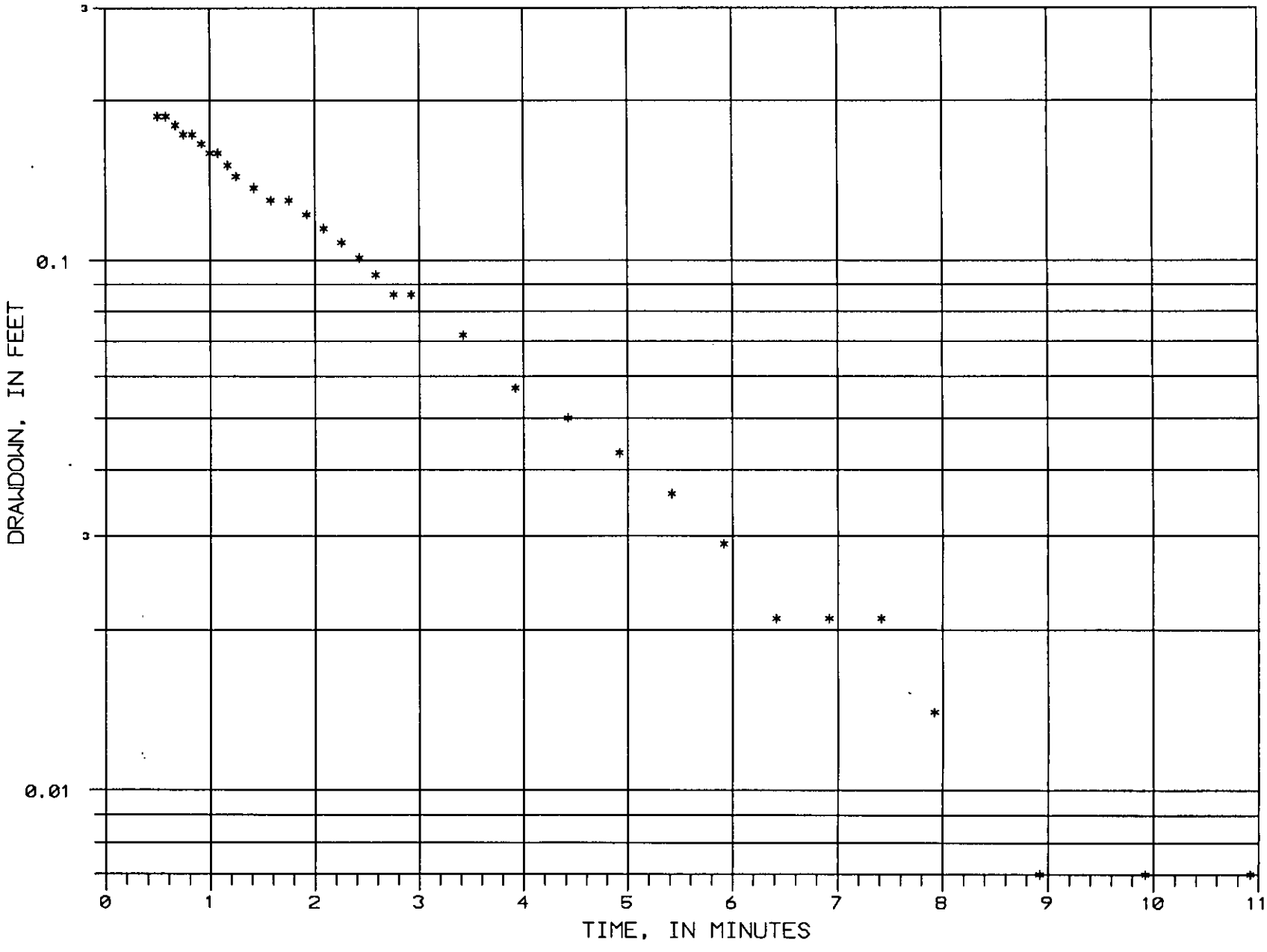


FIGURE D.6: NORMALIZED DRAWDOWN VS. TIME FOR SLUG TEST #1 MW-38 AT RENTON

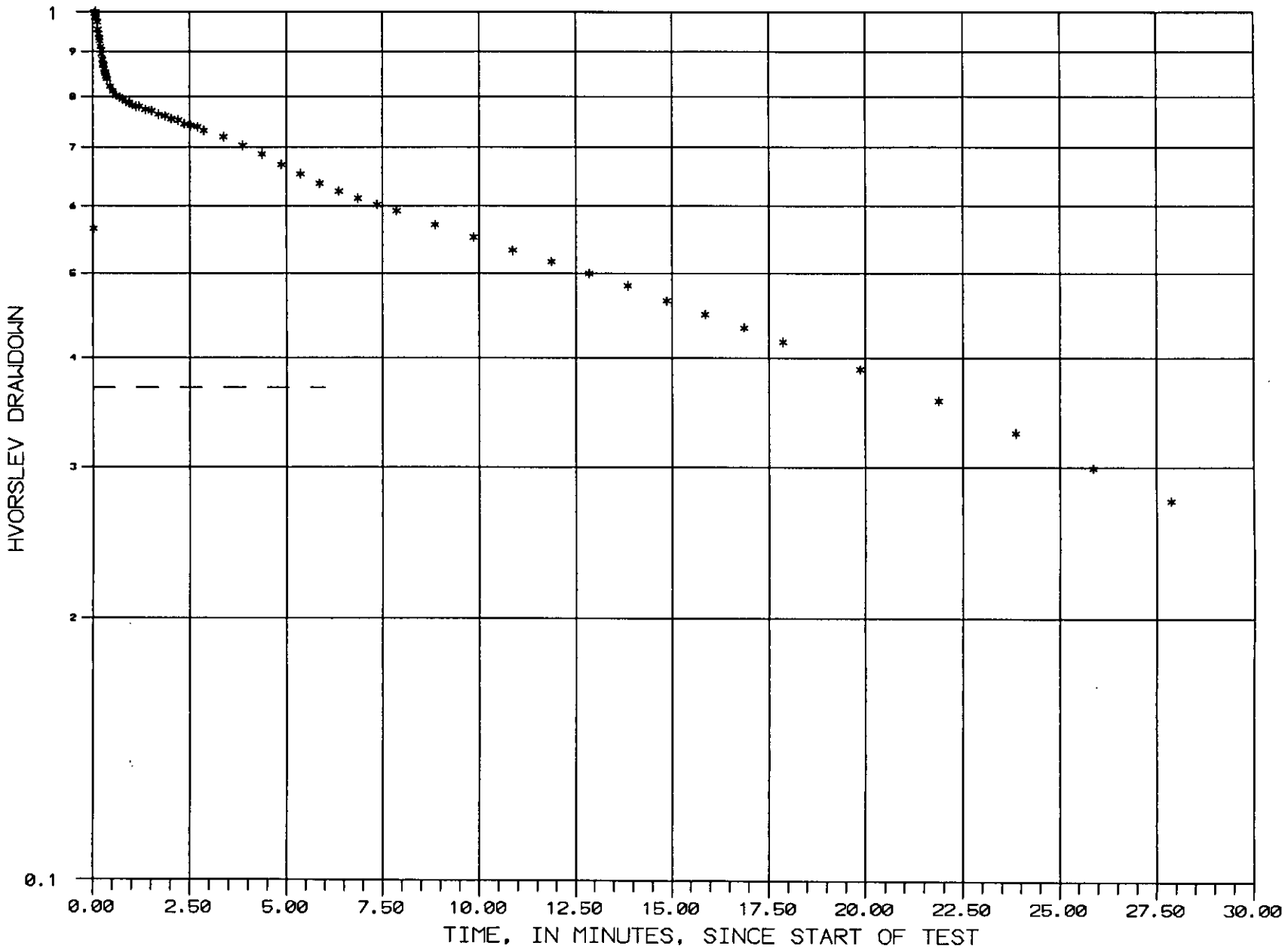


Figure D.7: Normalized DD vs. Time for Slug Test #1, MW-37, Random

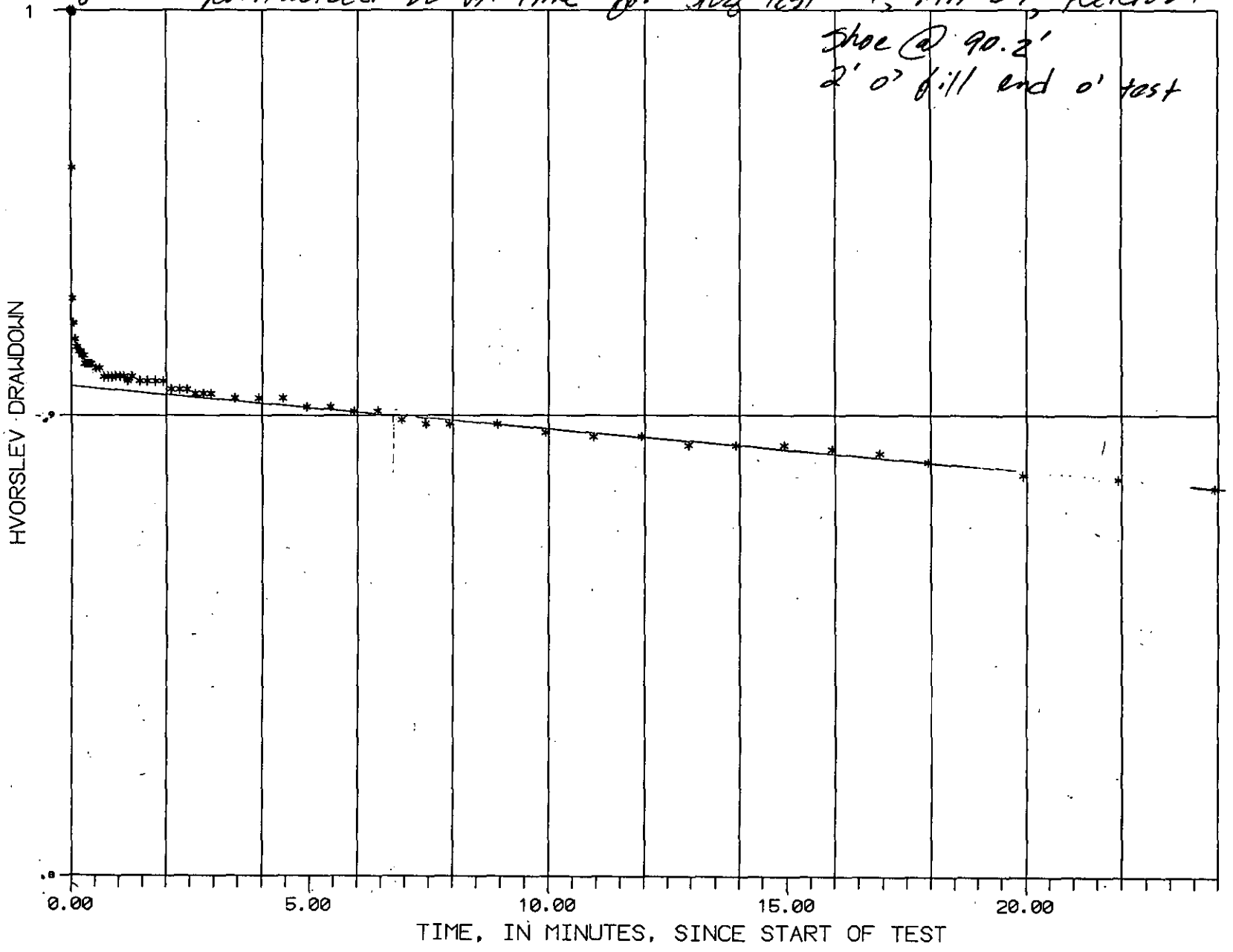


FIGURE D.8: NORMALIZED DRAWDOWN VS. TIME FOR SLUG TEST #2MW-37 AT RENTON

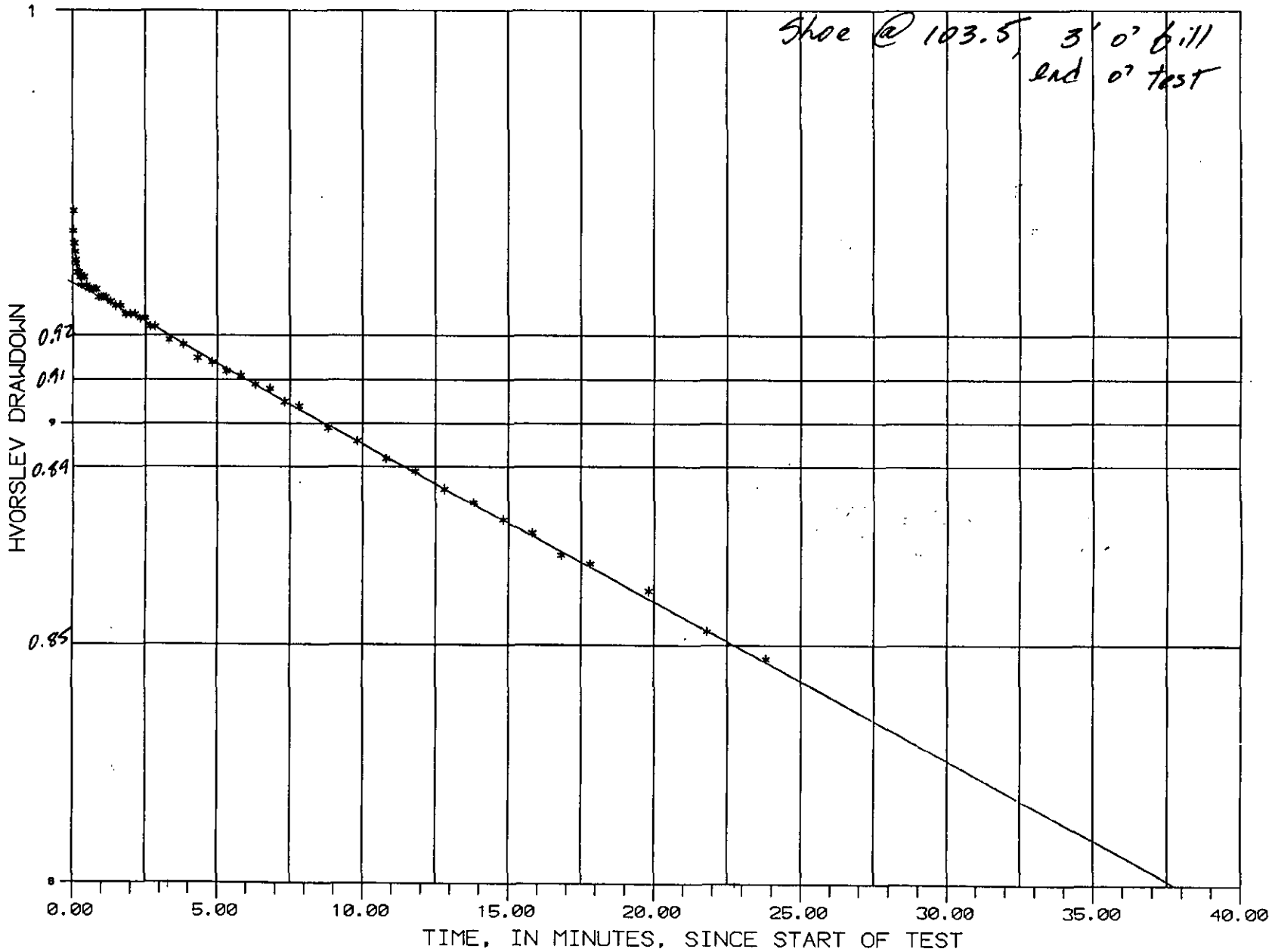
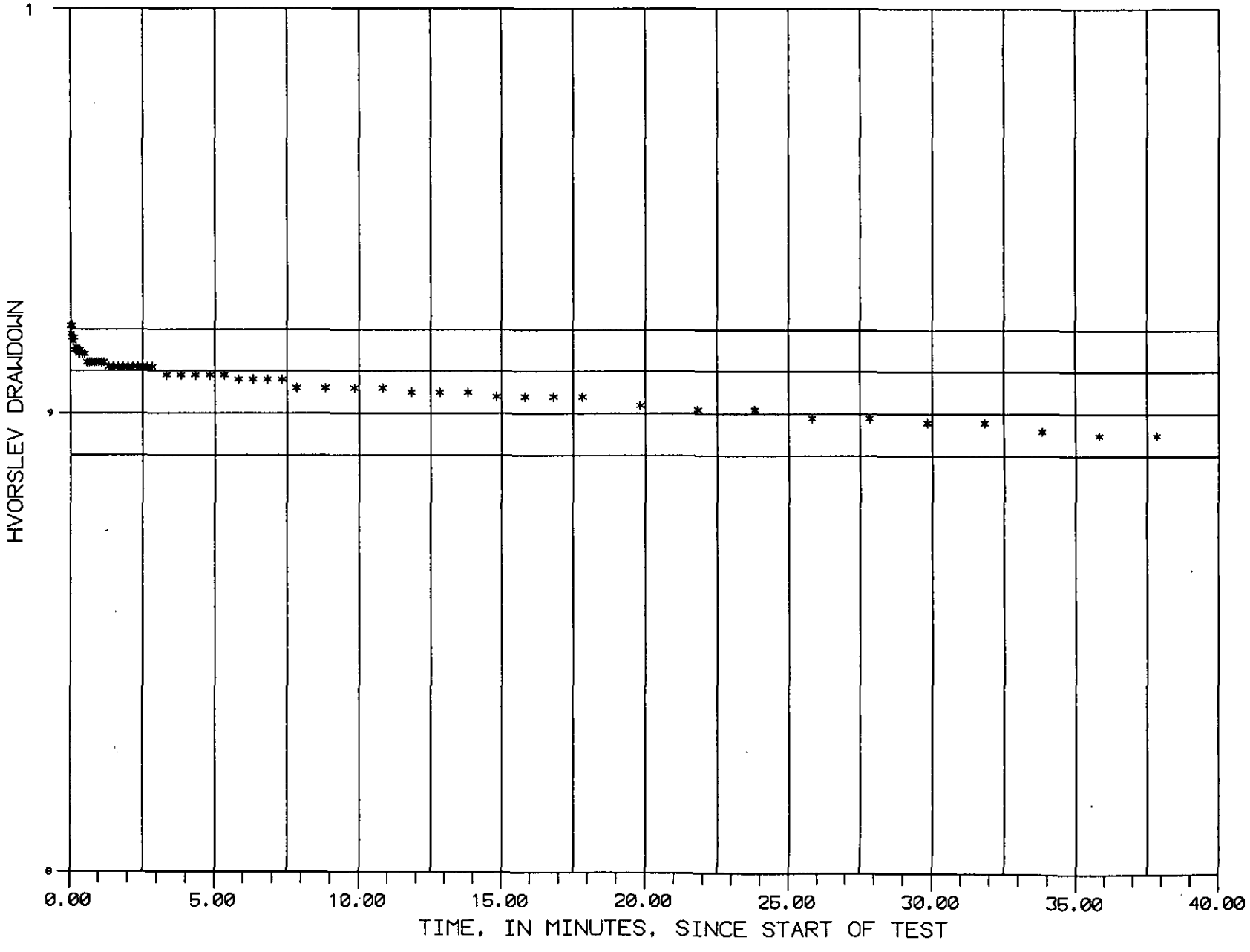


FIGURE D.9: NORMALIZED DRAWDOWN VS. TIME FOR SLUG TEST #3 MW-37 AT RENTON



APPENDIX E
GROUNDWATER QUALITY ANALYSES

QUALITY ASSURANCE PROJECT PLAN

FOR THE

MONITORING WELL

INSTALLATION PROJECT

JANUARY, 1991

PREPARED BY:

RH2 ENGINEERING, P.S.
KIRKLAND, WA 98033
(206) 827-6400

FOR THE:

CITY OF RENTON
DEPARTMENT OF PUBLIC WORKS

DEPARTMENT OF ECOLOGY APPROVAL

Cliff J. Kirchmer

Ecology QA Officer

1.0 Project Description

The goal of this project is to install approximately twenty (20) monitoring wells at nine (9) locations within the Cedar Valley aquifer in the City of Renton. These monitoring wells will be placed between potential sources of groundwater contamination and the City's water supply wells, thus providing an early warning for degradation of groundwater quality. Many of these potential sources can have a wide variety of unknown contaminants which could enter the groundwater. For this reason, a wide variety of parameters will be measured in each monitoring well. This will provide a screening of existing groundwater quality as well as provide a baseline on a variety of potential groundwater contaminants. The monitoring well boring will be accomplished through the cable tool drilling method and the monitoring well installations will be nested; therefore, providing two or three monitoring wells in each drilling borehole. The monitoring well screens will be placed within different aquifer zones or at different depths within a single aquifer. Each monitoring well will be equipped with a dedicated piston-style pump designed for 2-inch monitoring wells. The City's standard for groundwater sampling equipment is a HydroStar Sampling System Model HS-8000 supplied by Instrumentations Northwest, Inc.

This quality assurance project plan covers the first sampling round for these monitoring wells. The water quality data for each monitoring well will be used to begin the establishment of a water quality baseline for comparing future water quality data.

2.0 Project Organization

Table 1 shows the various individuals involved in this project along with their primary responsibility. Mark Semrau of RH2 Engineering will be responsible for coordinating and overseeing the groundwater sampling and field analyses. Janet Knox of the Pacific Groundwater Group, Inc. will be responsible for the water data quality assessment.

After approval of this plan by the Department of Ecology, competitive bids for the analytical work will be solicited from various local laboratory. The contact person at the selected laboratory will be provided to the Department of Ecology as soon as this information is available.

TABLE 1: PROJECT ORGANIZATION AND RESPONSIBILITIES

PERSONNEL	AGENCY/COMPANY	RESPONSIBILITY	TELEPHONE
William Miller	Department of Ecology	Grant Administrator	459-6971
Ron Olsen	City of Renton	Project Manager	277-6207
Lys Hornsby	City of Renton	Assist Project Manager	277-5539
Mark Semrau	RH2 Engineering, P.S.	Project Engineer	453-0241
Geoff Clayton	RH2 Engineering, P.S.	Geologist	453-0241
Russ Prior	Pac Groundwater Group	Senior Hydrogeologist	329-0141
	Pac Groundwater Group	Hydrogeologist	329-0141
Janet Knox	Pac Groundwater Group	Data Quality Assessment	329-0141

3.0 Data Quality Objectives

The data quality objectives will be expressed as accuracy, completeness, representativeness, and comparability. The data quality objectives will be similar to the data quality objectives for the Superfund Program. Which are designed to produce a consistent quality of data through standardization and documentation of project techniques. The laboratory's precision and bias objectives shall be those routinely achieved by these methods. The water quality parameters include physical, inorganic, and organic analyses. Tables 2 and 3 list the desired metals, inorganic and physical parameters for each monitoring well. Table 4 lists the organic parameters for each well.

4.0 Sampling Procedures

The following describes procedures to collect, analyze, preserve, and transport groundwater samples collected from each monitoring well installation. General sample collection and preservation procedures shall be in accordance with Standard Methods, (Section 1060) and the Clean Water Act (Federal Register 1984). Prior to sampling, samplers will establish a sample staging area at, or near the site, complete with decontamination equipment as specified in the site Health and Safety Plan. Specific sampling procedures are presented below.

1. Establish a field log book for recording all measurements taken during each sampling round. Upon completion of each round, make two copies of field notes for RH2 Engineering and Pacific Groundwater Group files.

2. Calibrate field water quality instruments and record calibration data at the beginning of each sampling day. Check calibration at the end of the day. Record calibrated and non-calibrated readings.

The City owns a portable laboratory which will be used for this project. All fields instruments, reagents and standards are manufactured by Hach Company of Loveland, Colorado. Calibration of Field instruments shall be in accordance with standard procedures provided within the portable laboratory.

3. Measure and record static water-levels (using an electrical water-level indicator) in each monitoring well to the nearest 0.01 foot. Calculate and record casing storage volume.

4. Purge at least three casing storage volumes from each well and monitor water temperature, pH, and specific conductance at least three times after purging 1-1/2 volumes. Record the purged water volume and field parameter values. The collected, purged water should be discharged into the storm sewer. After three casing volumes are removed from the monitoring well, sampling may begin if the temperature, pH, and specific conductance are reasonably stable. If these field water quality parameters continually change in an upward or downward trend, purge until reasonable stability is achieved before collecting the groundwater sample. Reasonable stability means specific conductance that does not trend and does not vary by more than 10% between readings. Reasonable stable pH measurements would likewise be defined by having no trends and by varying by more than 0.1 pH units between readings. These criteria assume equivalent sampling and handling techniques and a properly operating field instrument. Record all measurements.

5. Record sample identification data on each container, in the field book and on sample chain-of-custody record. Sample labels shall include the following information:

   a. Project Name and Job Number
   b. Name of Sampling Personnel
   c. Date and Time of Collection
   d. Monitoring Well Designation No.

6. Collect samples in a manner that minimizes volatilization of potential contaminants from water into the air. Collect samples in the following order:

   a. Volatile Organic Compounds
   b. Other Organics
   c. Inorganics
   d. Metals

   Hands and clothing should be clean during the sampling process. In addition clean, disposable latex gloves will be worn throughout sampling and replaced between each monitoring well. Samples will not be filtered. Follow individual sample container requirements for sample collection handling, preservation, and shipment.

7. Immediately upon filling bottles, place bottles on ice in a clean ice chest for storage and delivery to the laboratory. Maintain custody of samples from time of sampling to receipt at the laboratory. Custody means that samples should remain in direct possession of a single person or locked in secure vehicles or offices. If sample custody is transferred, chain-of-custody forms will be signed appropriately. Samples will be delivered to the laboratory accompanied by chain-of-custody forms and any other pertinent shipping sampling

documentation. One set of chain-of-custody forms will be used per laboratory shipment. Sample container custody seals will be used if the containers are mailed.

5.0 Analytical Procedures

Table 4 lists the groundwater quality parameters to be measured for each monitoring well installation as well as the desired analytical procedures. The reference methods are from the US Environmental Protection Agency Methods for Chemical Analysis of Water and Wastes (1984), Clean Water Act (Federal Register, 1984), or Standard Methods for Examination of Water and Wastewater, 17th Edition (1989). Some groundwater quality parameters will be measured in the field using field equipment. These parameters include conductivity, pH, and temperature. The concentrations of the remaining parameters will be determined by a laboratory accredited by the Department of Ecology for the analytical methods listed or their equivalents in Test Methods for Evaluating Solid Waste (SW-846, 1986).

6.0 Quality Control

Quality control measures will be required for both field and laboratory analyses for this project. Field quality control measures will include the following procedures:

1. Recalibrate field analytical equipment at each monitoring well site.

2. Thoroughly rinse (thrice) analytical instruments between sample collections with distilled water.

3. Collect at least three readings for conductivity, Ph, and temperature during the monitoring well purging process. Any significant changes in these parameters will be noted.

4. Collect one field duplicate per round or one per 20 samples, whichever is greater

5. Collect one field blank by filling one set of bottles with the distilled water used for field decontamination.

6. Carry a transport blank (VOA only) with samples from the time the bottles leave the laboratory to delivery of samples. Request that the transport blank be analyzed if contamination is found in the field blank.

Quality Assurance/Quality Control procedures are required of the laboratory performing the water quality analyses. This includes setup, initial and continuing calibration, check standards, internal standards, and performance checks. Laboratories will run the following QA/QC samples:

1. One laboratory method blank per analytical batch or every 20 samples, whichever is greater.

2. One laboratory matrix spike per analytical batch or every 20 samples, whichever is greater.

3. One matrix spike duplicate per analytical batch or every 20 samples, whichever is grater.

4. Laboratory surrogate spike for every VOC sample.

5. Check standards every 20 samples.

Prior to sampling, City will discuss analytical methods, sampling containers, holding times, laboratory QA/QC and other project requirements with the selected laboratory.

7.0 Data Assessment Procedures

Janet Knox from the Pacific Groundwater Group will be responsible for data assessment. Any abnormalities in the sample results will be noted. If quality control procedures warrant, verification samples will be collected and analyzed.

The data validation will be assessed by review of the following QA/QC data:

Methodology
Holding Times
Surrogate Spikes
Matrix Spikes
Matrix Spike Duplicates
Method Blanks
Method and Instrument Detection Limits
Field Duplicators
Field Blanks

Accuracy, precision, completeness, representativeness, and comparability will be assessed for the data set. The data will be validated using the guidelines and standards established by the analytical methods.

Data assessment will include the following procedures for checking correctness of analyses.

1. Total Random Error

   The total random error (precision) shall be estimated by calculating the relative standard deviation (RSD) of duplicate results. The relative standard deviation, also known as the coefficient of variation, will be expressed as a percentage.

2. Anion, Cadion Balance

   The major ions commonly found in groundwater will be measured. Because groundwater for the most part is electrically neutral, the cadions (positively charged ions) and the Anions (negatively charged ions) must balance. Since different ions have different valances, each ion's concentration will be converted from milligrams per liter

to milli-equivalents per liter, in order to properly preform the analysis. Results of this analysis will be expressed as a percent difference between the sums of the cadions and anions.

3. Measured TDS Equal Calculated TDS

The total dissolved solids of a solution can be calculated from the sum concentration of the constituents and the alkalinity as expressed as milligrams per liter. This calculated TDS value should compare favorably with the measured TDS which is performed within the laboratory. The calculated TDS should be slightly lower than the measured TDS since not all constituents will be accounted for in the TDS calculation.

4. Measured TDS to Electrical Conductivity Ratio

The total dissolved solids of the solution can be related to the electrical conductivity of the solution since the electrical current is carried by the ions. The higher the TDS is in the solution the higher the electrical conductivity will be. An exceptable value of this ratio is between 0.55 to 0.7.

5. Field to Laboratory Precision

Four parameters will be measured in both the field and the laboratory. These parameters include ph electrical conductivity, bicarbonate, and carbonate. Precision is a measure of the closeness with which multiple analysis of a given sample agree with each other. This precision can be expressed as the standard deviation between these two results. Precision will also be calculated for any duplicate analysis that may be performed within the laboratory.

TABLE 2: PHYSICAL PROPERTIES FOR GROUNDWATER MONITORING

PHYSICAL DATA	SYMBOL		PRIMARY MCL	SECONDARY MCL	PROPOSED MCL
Acidity					
Alkalinity					
Conductivity	EC			700 umhos/cm	
Hydrogen-ion Concentration	pH			6.5 - 8.5	
Temperature	T				
Total Coliform					

TABLE 3: INORGANICS, METALS AND MAJOR GROUNDWATER IONS

MAJOR GROUNDWATER IONS	SYMBOL	VALENCE	PRIMARY MCL	SECONDARY MCL	PROPOSED MCL
Arsenic	As	+3	0.05 mg/l		
Barium	Ba	+2	1 mg/l		
Bicarbonate	HCO3	-1			
Boron	B	+3			
Cadmium	Cd	+2	0.01 mg/l		
Calcium	Ca	+2			
Carbonate	CO3	-2			
Chloride	Cl	-1		250 mg/l	
Chromium	Cr	+3	0.05 mg/l		
Fluoride	F	-1	4 mg/l	2 mg/l	
Iron	Fe	+2		0.30 mg/l	
Lead	Pb	+2	0.05 mg/l		
Magnesium	Mg	+2			
Manganeese	Mn	+2		0.05 mg/l	
Mercury	Hg	+2	0.002 mg/l		
Nitrate (as N)	NO3	-1	10 mg/l		10 mg/l
Nitrite (as N)	NO2	-1			1 mg/l
Ortho-phosphate	PO4	-3			
Potassium	K	+1			
Selenium	Se	+4	0.01 mg/l		
Silica	Si	+4			
Silver	Ag	+1	0.05 mg/l		
Sodium	Na	+1			
Strontium	Sr	+2			
Sulfate	SO4	-2		250 mg/l	400 mg/l
Sulfide	SO3	-2			0.5 mg/l

MCL = Maximum Contaminant Level

TABLE 4: ANALYTICAL PROCEDURES FOR GROUNDWATER QUALITY PARAMETERS

GROUNDWATER QUALITY PARAMETERS	LOCATION	TECHNIQUE	REFERENCE METHOD	DETECTION LIMIT OR PRECISION
Acidity	Field	Titration	SM (89) 2310B	0.1 mg/l
Alkalinity	Field	Titration	SM (89) 2320B	0.1 mg/l
Conductivity	Field	Electrometric	SM (89) 2510B	10 umhos/cm
Hydrogen-ion Concentration	Field	Electrometric	SM (89) 4500H-B	0.1 pH units
Temperature	Field	Thermometer	SM (89) 2550B	1 degree C
Total Coliform	Laboratory	MPN	SM (89) 9221B	2 counts
Arsenic	Laboratory	AA/GF	EPA 206.2	0.001 mg/l
Barium	Laboratory	ICP	EPA 200.7	0.003 mg/l
Bicarbonate	Field	Titration	SM (89) 2320B	0.1 mg/l
Boron	Laboratory	ICP	EPA 200.7	0.01 mg/l
Cadmium	Laboratory	ICP	EPA 200.7	0.002 mg/l
Calcium	Laboratory	ICP	EPA 200.7	0.01 mg/l
Carbonate	Field	Titration	SM (89) 2320B	0.1 mg/l
Chloride	Laboratory	IC/CSEC	EPA 300.0	0.5 mg/l
Chromium	Laboratory	ICP	EPA 200.7	0.006 mg/l
Fluoride	Field	SPADNS	SM (89) 4500F-D	0.1 mg/l
Iron	Laboratory	ICP	EPA 200.7	0.01 mg/l
Lead	Laboratory	AA/GF	EPA 239.2	0.001 mg/l
Magnesium	Laboratory	ICP	EPA 200.7	0.01 mg/l
Manganeese	Laboratory	ICP	EPA 200.7	0.002 mg/l
Mercury	Laboratory	AA/Cold Vapor	EPA 245.1	0.2 ug/l
Nitrate (as N)	Laboratory	IC/CSEC	EPA 300.0	0.5 mg/l
Nitrite (as N)	Laboratory	IC/CSEC	EPA 300.0	0.01 mg/l
Ortho-phosphate	Laboratory	IC/CSEC	EPA 365.1	0.002 mg/l
Potassium	Laboratory	ICP	EPA 200.7	1.0 mg/l
Selenium	Laboratory	AA/GF	EPA 270.2	0.001 mg/l
Silica	Laboratory	ICP	EPA 200.7	0.10 mg/l
Silver	Laboratory	ICP	EPA 200.7	0.01 mg/l
Sodium	Laboratory	ICP	EPA 200.7	0.02 mg/l
Strontium	Laboratory	ICP	EPA 200.7	0.003 mg/l
Sulfate	Laboratory	IC/CSEC	EPA 300.0	0.5 mg/l
Sulfide	Laboratory	Titration	EPA 376.1	0.1 mg/l
Volatile Organic Chemicals	Laboratory	GC/MS	EPA 624	1-10 ug/l
Organochlorine Pesticides and PCB Chemicals	Laboratory	GC/ECD	EPA 608	2-10 ug/l

APPENDIX E

City of Renton
Monitoring Well Installation Project
MW-31, 36, 37, and 38
Quality Assurance/Quality Control Review
March 10 and 11, 1992 Sampling

Upon receipt of the analytical results, a review of the Quality Assurance/Quality Control (QA/QC) data was performed to assess the validity of the analytical results. AmTest Inc. was the analytical laboratory for this data set of a total 10 water samples which included 8 groundwater samples and 2 groundwater field duplicates. The groundwater samples were collected on March 10 and 11, 1992.

In summary, the analytical results were found to be generally acceptable with respect to the QA/QC program. The analytical results were generally found to meet Clean Water Act standards (40 Code of Federal Regulations Part 136), Contract Laboratory Program (CLP) National Functional Guidelines (Environmental Protection Agency (EPA), 1988 and 1991), EPA Method specifications, or project-acceptable requirements.

In terms of completeness of the analytical results, the following applies:

- Neither a field blank nor a transport blank were collected as specified in the Quality Assurance Project Plan (October, 1990). As no volatile organic compounds were detected (except methylene chloride likely due to laboratory contamination), field contamination is not suspected. Therefore, the omission of field blanks does not compromise the data quality for this sampling event.

- Calcium was not analyzed in samples, as specified in the Quality Assurance Project Plan (October, 1990).

The following summarizes the findings of the QA/QC review:

1. Methodology: ACCEPTABLE

   Samples were analyzed using acceptable EPA and standard methods as listed on the methodology report page following the analytical results. No methods are requested on Chain-of-Custody forms, however methods were requested by presenting a copy of the Quality Assurance Project Plan to the laboratory. In some cases, the laboratory used a different EPA method. The methods used are acceptable and meet the project objectives.

2. Holding Times: ACCEPTABLE

The holding times were met for all analyses with the following exception:

- The holding time for total coliform bacteria is 6 hours according to the Clean Water Act (40 CFR 136). As this holding time is unreasonable for most projects, recommended holding times have been 24 to 30 hours. The samples were received by the laboratory at 7:45 a.m. on March 12 and were analyzed the same day. No data qualifier is recommended.

3. Surrogate Spikes: ACCEPTABLE

Surrogates spikes are known concentrations of compounds not normally found in samples added to samples to check for analytical interferences in every sample. Three surrogates were added to all samples for volatile organic compound analyses. Only one surrogate was added to all samples for pesticide/polychlorinated biphenyl (PCB) analyses. This is found to be acceptable as the surrogate recoveries are within control limits. As is standard practice, surrogate spikes were not added to inorganic analyses.

The surrogate percent recoveries are within acceptable ranges without exception.

4. Matrix Spikes/Matrix Spike Duplicates (MS/MSD): ACCEPTABLE

MS/MSD are known concentrations of analytes added to one sample in 20 to check for matrix interferences in recovering the analyte from the sample matrix; the duplicate is then run to check analytical duplication. MS/MSD were run for volatile organic compounds and pesticide/PCB analyses. MS were analyzed for all inorganic parameters. As is standard practice, MSD were not run for inorganic analyses. Instead, laboratory duplicates were run to quantify laboratory duplication, as is acceptable.

The MS/MSD results indicate acceptable recovery of analytes and acceptable relative percent differences. For organic analyses, the number of MS/MSD that were run meet CLP requirements, although the MS/MSD samples were analyzed only for spiked compounds, rather than all parameters. The spike recoveries were within the acceptable ranges recommended by the CLP or project acceptable criteria. The relative percent differences between MS and MSD met project acceptable limits of 35%.

5. Laboratory Duplicates: ACCEPTABLE

Laboratory duplicates were analyzed for all inorganic analyses. The relative percent differences between sample and duplicate met project acceptable limits of 35%.

6. Method Blanks: ACCEPTABLE

Method Blanks were run by the laboratory to check for possible laboratory contamination. Blanks were analyzed for all analytes in all analytical batches at a rate of at least one in 20. The following analytes were detected in the laboratory method blanks:

- o Iron, 0.01 milligrams per liter (mg/l) (detection limit 0.01 mg/l)
- o Magnesium, 0.20 mg/l (detection limit 0.1 mg/l)
- o Sodium, 0.30 mg/l (detection limit 0.5 mg/l)
- o Acetone, 16 micrograms per liter (ug/l) (detection limit 10 ug/l)
- o Methylene chloride, 5.0 micrograms per liter (ug/l) (detection limit 1.0 ug/l)

Methylene chloride concentrations ranging from (2.0 to 5.0 ug/l) are found in the method blank and in all samples. Methylene chloride is a common laboratory contaminant and concentrations found in samples are 0 to 3.0 ug/l lower than the concentration found in the method blank. Therefore, the presence of methylene chloride is most likely due to laboratory contamination and the qualifier "B" is assigned by the laboratory and is recommended for methylene chloride in the analytical results.

Acetone is found in the method blank at a concentration of 16 ug/l, but is not detected in any of the project samples.

7. Method Detection Limits: ACCEPTABLE

Method reporting limits were found to be lower or equivalent to those required by the analytical methods. The exception was toxaphene, a pesticide analyzed by method 608. The practical quantitation limit given for the method is 2 ug/l. The reported method detection limit was 6 ug/l for only the method blank, all other analyses had an acceptable detection limit of 1 ug/l. According to Mark Fugiel of Am Test, this detection limit is a typographical error and the report page will be reissued. Therefore, the data is found acceptable.

8. Field Duplicates: ACCEPTABLE

Two water field duplicates were collected from MW-38D (labeled Dup 1) and MW-36S (labeled Dup 2) and analyzed for all parameters. The relative percent differences (RPD) defined as the difference divided by the average of the two samples, met project-acceptable limits of 35% with the following exceptions:

- MW-38D and Dup 1. RPD for nitrate nitrogen, arsenic, iron, and lead exceeded the RPD project-acceptable limit. The variability in arsenic, iron, and lead may be due to sediment in samples. These RPDs are not considered to indicate a field duplication problem and no data qualifier is recommended.

- MW-36S and Dup 2. RPD for fluoride, nitrate nitrogen, and potassium exceeded the project-acceptable limit. The variability in fluoride and potassium may be due to sediment in samples. These RPDs are not considered to indicate a field duplication problem and no data qualifier is recommended.

APPENDIX E

City of Renton
Monitoring Well Installation Project
MW-30, 32, 33, and 34D
Quality Assurance/Quality Control Review
August 19, 1992 Sampling

Upon receipt of the analytical results, a review of the Quality Assurance/Quality Control (QA/QC) data was performed to assess the validity of the analytical results. AmTest Inc. was the analytical laboratory for this data set which included 5 groundwater samples and 1 groundwater field duplicate. The groundwater samples were collected on August 19, 1992.

In summary, the analytical results were found to be generally acceptable with respect to the QA/QC program. The analytical results were generally found to meet Clean Water Act standards (40 Code of Federal Regulations Part 136), Contract Laboratory Program (CLP) National Functional Guidelines Environmental Protection Agency (EPA, 1988 and 1991), EPA Method specifications, or project-acceptable requirements. The exception is that a qualifier "B" is recommended for methylene chloride found in the laboratory method blank and in the samples.

In terms of completeness of the analytical results, the following applies:

- Neither a field blank nor a transport blank were collected as specified in the Quality Assurance Project Plan (January, 1991). As no volatile organic compounds were detected (except methylene chloride), field contamination is not suspected. Therefore, the omission of field blanks does not compromise the data quality for this sampling event.

The following summarizes the findings of the QA/QC review:

1. Methodology: ACCEPTABLE

   Samples were analyzed using acceptable EPA and standard methods as listed on the methodology report page following the analytical results. No methods are requested on Chain-of-Custody forms; however, methods were requested by presenting a copy of the Quality Assurance Project Plan to the laboratory. In some cases, the laboratory used a different EPA method. The methods used are acceptable and meet the project objectives.

2. Holding Times: ACCEPTABLE

   The holding times were met for all analyses with the following exception:

- The holding time for total coliform bacteria is 6 hours according to the Clean Water Act (40 CFR 136). As this holding time is unreasonable for most projects, recommended holding times have been 24 to 30 hours. The samples were received by the laboratory at 5:00 p.m. on August 19 and were analyzed the next day. No data qualifier is recommended.

3. Surrogate Spikes: ACCEPTABLE

Surrogates spikes are known concentrations of compounds not normally found in samples added to samples to check for analytical interferences in every sample. Three surrogates were added to all samples for volatile organic compound analyses. Only one surrogate was added to all samples for pesticide/polychlorinated biphenyl (PCB) analyses. This is found to be acceptable as the surrogate recoveries are within control limits. As is standard practice, surrogate spikes were not added to inorganic analyses.

The surrogate percent recoveries are within acceptable ranges without exception.

4. Matrix Spikes/Matrix Spike Duplicates (MS/MSD): ACCEPTABLE

MS/MSD are known concentrations of analytes added to one sample in 20 to check for matrix interferences in recovering the analyte from the sample matrix; the duplicate is then run to check analytical duplication. MS/MSD were run for volatile organic compounds and pesticide/PCB analyses. MS were analyzed for all inorganic parameters. As is standard practice, MSD were not run for inorganic analyses. Instead, laboratory duplicates were run to quantify laboratory duplication, as is acceptable.

The MS/MSD results indicate acceptable recovery of analytes and acceptable relative percent differences. For organic analyses, the number of MS/MSD that were run meet CLP requirements, although the MS/MSD samples were analyzed only for spiked compounds, rather than all parameters. The spike recoveries were within the acceptable ranges recommended by the CLP or project acceptable criteria. The relative percent differences between MS and MSD met project acceptable limits of 35%.

5. Laboratory Duplicates: ACCEPTABLE

Laboratory duplicates were analyzed for all inorganic analyses. The relative percent differences between sample and duplicate met project acceptable limits of 35%.

6. Method Blanks: VOLATILE ORGANIC COMPOUNDS - QUALIFIER "B" RECOMMENDED FOR METHYLENE CHLORIDE DETECTED IN SAMPLES AND IN LABORATORY METHOD BLANK; OTHER ANALYSES ACCEPTABLE

Method Blanks were run by the laboratory to check for possible laboratory contamination. Blanks were analyzed for all analytes in all analytical batches at a rate of at least one in 20. The following analytes were detected in the laboratory method blanks:

- Alkalinity, 1.0 milligram per liter (mg/l) (detection limit 1.0 mg/l)
- Total Dissolved Solids, 5.0 mg/l (detection limit 1.0 mg/l)
- Silicon, 0.21 mg/l (detection limit 0.1 mg/l)
- Methylene chloride, 3.0 micrograms per liter (ug/l) (detection limit 1.0 ug/l)
- Chloroform, 3.0 ug/l (detection limit 1.0 ug/l)

Methylene chloride (2.0 to 4.0 ug/l) is detected in the method blank and in all samples. Methylene chloride is a common laboratory contaminant and concentrations found in samples are 0 to 1.0 ug/l lower or higher than the concentration found in the method blank. Therefore, the presence of methylene chloride is most likely due to laboratory contamination and the qualifier "B" is recommended for methylene chloride in the analytical results.

7. Method Detection Limits: ACCEPTABLE

Method reporting limits were found to be lower or equivalent to those required by the analytical methods.

8. Field Duplicates: ACCEPTABLE

One water field duplicate was collected from MW-30S and analyzed for all parameters. The relative percent differences (RPD) met project-acceptable limits of 35% with the following exceptions:

- RPD for nitrite, iron, and lead exceeded the project-acceptable limit. The concentrations found are low (the difference in concentration is 0.005 mg/l for nitrite, 0.26 mg/l for iron, and 0.002 mg/l for lead). The variability in iron and lead may be due to sediment in samples. These RPDs are not considered to indicate a field duplication problem and no data qualifier is recommended.

APPENDIX E

City of Renton
Monitoring Well Installation Project
MW-35D
Quality Assurance/Quality Control Review
September 14, 1992 Sampling

Upon receipt of the analytical results, a review of the Quality Assurance/Quality Control (QA/QC) data was performed to assess the validity of the analytical results. AmTest Inc. was the analytical laboratory for this data set (one groundwater sample). The sample was collected on September 14, 1992. The sample was analyzed for total coliforms, coventionals, total metals, volatile organic compounds (EPA Method 624), and Pesticides and PCBs (Method 608).

In summary, the analytical results were found to be generally acceptable with respect to the QA/QC program. The analytical results were generally found to meet Clean Water Act standards (40 Code of Federal Regulations Part 136), Contract Laboratory Program (CLP) National Functional Guidelines (Environmental Protection Agency (EPA), 1988 and 1991), EPA Method specifications, or project-acceptable requirements.

In terms of completeness of the analytical results, the following applies:

- Neither a field blank nor a transport blank were collected as is specified in the Quality Assurance Project Plan (October, 1990). As no volatile organic compounds were detected (except methylene chloride), likely due to laboratory contamination), field contamination is not suspected. Therefore, the omission of field blanks does not compromise the data quality for this sampling event.

The following summarizes the findings of the QA/QC review:

1. Methodology: ACCEPTABLE

   Samples were analyzed using acceptable EPA and standard methods as listed on the methodology report page following the analytical results. No methods are requested on Chain-of-Custody forms; however, methods were requested by presenting a copy of the Quality Assurance Project Plan to the laboratory. In some cases, the laboratory used a different EPA method. The methods used are acceptable and meet the project objectives.

2. Holding Times: ACCEPTABLE

   The holding times were met for all analyses with the following exception:

- The holding time for total coliform bacteria is 6 hours according to the Clean Water Act (40 CFR 136). As this holding time is unreasonable for most projects, recommended holding times have been 24 to 30 hours. The samples were analyzed within 24 hours of sample receipt and are found acceptable. No data qualifier is recommended.

3. Surrogate Spikes: ACCEPTABLE

Surrogates spikes are known concentrations of compounds not normally found in samples added to samples to check for analytical interferences in every sample. Three surrogates were added to all samples for volatile organic compound analyses. Only one surrogate was added to all samples for pesticide/polychlorinated biphenyl (PCB) analyses. This is found to be acceptable as the surrogate recoveries are within control limits. As is standard practice, surrogate spikes were not added to inorganic analyses.

The surrogate percent recoveries are within acceptable ranges without exception.

4. Matrix Spikes/Matrix Spike Duplicates (MS/MSD): ACCEPTABLE

MS/MSD are known concentrations of analytes added to one sample in 20 to check for matrix interferences in recovering the analyte from the sample matrix; the duplicate is then run to check analytical duplication. MS/MSD were run pesticide/PCB analyses only and were not run for volatile organic compounds. This omission lends some un uncertainty to the volatile organic results, however, as surrogate spikes meet quality control limits, the data are not qualified at this time. As is standard practice, MS were MSD were not run for inorganic analyses. Therefore, for volatile organic compounds and inorganic parameters, it is not possible to quantify analytical duplication. Possibly the reason that the laboratory did not run MS/MSD of laboratory duplicates is because only one sample was submitted for analysis. It is recommended that samples be submitted in few, large groups.

The MS/MSD results indicate acceptable recovery of analytes and acceptable relative percent differences for pesticides/PCBs. The spike recoveries were within the acceptable ranges recommended by the CLP or project acceptable criteria. The relative percent differences between MS and MSD met project acceptable limits of 35%.

5. Laboratory Duplicates: ACCEPTABLE

Laboratory duplicates were not analyzed

6. Method Blanks: ACCEPTABLE

Method Blanks were run by the laboratory to check for possible laboratory contamination. Blanks were analyzed for all analytes in all analytical batches at a rate of at least one in

20. The following analytes were detected in the laboratory method blanks:

- Arsenic, 0.001 milligrams per liter (mg/l) (detection limit 0.001 mg/l)
- Ortho-Phosphate, 0.005 mg/l (detection limit 1.0 mg/l)
- Total Dissolved Solids, 1.0 mg/l (detection limit 1.0 mg/l)
- Chloroform, 4.0 micrograms per liter (ug/l) (detection limit 1.0 ug/l)
- Methylene chloride, 1.0 ug/l (detection limit 1.0 ug/l)

Arsenic, ortho-phosphate, and total dissolved solids are found in the sample at concentrations which are 7 to 100 times the concentration found in the method blank which are at the detection limit. Therefore, the values in the sample are not qualified.

One ug/l methylene chloride was found in the method blank and in the sample. Methylene chloride is a common laboratory contaminant. The presence of methylene chloride at this concentration is most likely due to laboratory contamination and the qualifier "B" is recommended for methylene chloride in the analytical results.

7. Method Detection Limits: ACCEPTABLE

Method reporting limits were found to be lower or equivalent to those required by the analytical methods.

8. Field Duplicates: ACCEPTABLE

Field duplicates were not collected for this sampling event as it is considered part of earlier sampling.

APPENDIX F
GROUNDWATER QUALITY DATA

AMTEST

AmTest Inc.
Professional
Analytical
Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

March 30, 1992

RECEIVED BY:
....2 ENGINEERING, P.S.
Date RECEIVED APR - 2 1992
File No.
Route To:
MS

RH2 Engineering
attn. Mark Semrau
8383 158th Ave. NE, suite 200
Redmond, WA 98052

Dear Mark,

On the 12th of March 1992, Am Test received a total of 10 water samples from the Renton Monitoring Well Installation project (# S1312.00) for chemical analysis.

The samples were all received in good condition. A total of 70 containers were received. At the time of receipt, the samples were logged in, stored, and handled according to the protocols of the USEPA.

The samples were prepared and analyzed in accordance with the methods described in either the "Methods for Chemical Analysis of Water and Wastes", or in the "Standard Methods for the Examination of Water and Wastewater". A detailed listing of the analytical methods can be found in the quality control summary, which follows the data section of the report. The majority of the metals were analyzed by ICP. With the exception of Mercury (Cold Vapor), the remaining metals were analyzed by Graphite Furnace Atomic Absorption (GFAA) using Zeeman Background Correction. As a result of the relatively high conductivity of the samples, the major anions (chloride, nitrate, nitrite and sulfate) were analyzed by conventional chemical procedures as opposed to ion chromatography.

All of the analyses included the control elements (initial calibration, continuing calibration verification, reagent blanks etc.) documented in the respective methods. The analyses of Total Coliform, Nitrite and ortho-Phosphate were performed the day of sample receipt. There were no major problems associated with any of the analyses.

AMTEST

Following the analytical data you will find the quality control summary. The information in this section includes the method references, analysis dates, and the results of the blanks, duplicates and matrix spikes. The QC data was well within the control limits of the laboratory, as well as the guidelines described by the analytical methods.

Included in the report package you will find the original chain of custody form that was submitted with the sample sets.

All of the data has been reviewed for completeness, accuracy and release. Please forward the report and invoice to the City of Renton after your review. Feel free to contact me if you have any questions.

Respectfully submitted,

Mark C. Fugiel

Mark A. Fugiel
Am Test Inc.

[redacted]

Analytical Services

[redacted] Redmond, WA 98052 Tel: 206 885 1664

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
51312.00	RENTON MONITORING WELL INSTALLATION PROJECT

SAMPLERS: *(Signature)*
Mark L. Semrau
MARK L. SEMRAU - RH2 ENGINEERING
CLIFF NELSON - CITY OF RENTON

Client Name: CITY OF RENTON
Client Address: 200 MILL AVE S.
Client Phone: 277-5539
Contact Person: LYS HORNSBY
P.O. No.:

	STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS						
310	31D	3/10	10:30		X	CEDAR RIVER PARK							MON. WELL 31 DEEP
311	31S	3/10	11:00		X	CEDAR RIVER PARK							MON. WELL 31 SHALLOW
312	38D	3/10	~~2:50~~ 3:15		X	SE 10TH PLACE							MON. WELL 38 DEEP
313	38S	3/10	~~3:15~~ 2:50		X	SE 10TH PLACE							MON. WELL 38 SHALLOW
314	DUP 1	3/10			X								DUPLICATE NO. 1
315	DUP 2	3/11			X								DUPLICATE NO. 2
316	36D	3/11	10:15		X	MAPLEWOOD GOLF COARSE							MON. WELL 36 DEEP
317	36S	3/11	10:35		X	MAPLEWOOD GOLF COARSE							MON. WELL 36 SHALLOW
318	37D	3/11	2:25		X	MAPLEWOOD GOLF COARSE							MON WELL 37 DEEP
319	37S	3/11	2:45		X	MAPLEWOOD GOLF COARSE							MOH. WELL 37 SHALLOW

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Mark Semrau	3/12/92 7:45 AM				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	
		V. Hale	3/12-93 7:45		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005311
Client Identification	31S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.4		
Alkalinity (mg/l as CaCO3)	62.		1.0
Chloride (mg/l)	4.7		1.0
Conductivity (umhos/cm)	130		0.5
Fluoride (mg/l)	0.07		0.1
Nitrate + Nitrite Nitrogen (mg/l)	0.075		0.01
Nitrite Nitrogen (mg/l)	0.004		0.001
Ortho-Phosphate (mg/l)	0.088		0.005
Sulfide (mg/l)	2.0		1.0
Sulfate (mg/l)	6.8		1.0
Total Metals			
Arsenic (mg/l)	0.009		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.005		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.71		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	1.3		1.0
Magnesium (mg/l)	1.1		0.10
Manganese (mg/l)	0.040		0.002
Sodium (mg/l)	5.5		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	4.5		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.066		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005311
Client Identification	31S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.081
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	81.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005311
Client Identification	31S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	95.0		
D8-Toluene	89.0		
4-Bromofluorobenzene	88.0		

ANALYSIS REPORT AMTEST

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA 98052
Fax: 206 883 3495
Tel: 206 885 1664

City of Renton
200 Mill Ave. S

Renton, WA
Attention: Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

Project Name: Renton Monitor Well
Project #: S1312.00

WATER SAMPLES

AM TEST Identification Number	92-A005310
Client Identification	31D
Sampling Date	3/10/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	6.9		
Alkalinity (mg/l as CaCO3)	84.		1.0
Chloride (mg/l)	200		1.0
Conductivity (umhos/cm)	580		0.5
Fluoride (mg/l)	0.06		0.1
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.003		0.001
Ortho-Phosphate (mg/l)	0.054		0.005
Sulfide (mg/l)	2.2		1.0
Sulfate (mg/l)	1.1		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.014		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.43		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	4.9		1.0
Magnesium (mg/l)	9.3		0.10
Manganese (mg/l)	0.15		0.002
Sodium (mg/l)	83.		0.1
Lead (mg/l)	0.004		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	7.8		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.11		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005310
Client Identification	31D
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	90.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005310
Client Identification	31D
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	2.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	94.0		
D8-Toluene	95.0		
4-Bromofluorobenzene	91.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005313
Client Identification	38S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	6.7		
Alkalinity (mg/l as CaCO3)	32.		1.0
Chloride (mg/l)	3.1		1.0
Conductivity (umhos/cm)	88.		0.5
Fluoride (mg/l)	0.06		0.1
Nitrate + Nitrite Nitrogen (mg/l)	0.71		0.01
Nitrite Nitrogen (mg/l)	0.005		0.001
Ortho-Phosphate (mg/l)	0.023		0.005
Sulfide (mg/l)	2.1		1.0
Sulfate (mg/l)	3.4		1.0
Total Metals			
Arsenic (mg/l)	0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	< 0.003		0.003
Cadmium (mg/l)	0.004		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	< 0.01		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	2.3		0.10
Manganese (mg/l)	0.005		0.002
Sodium (mg/l)	3.9		0.1
Lead (mg/l)	0.002		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	5.9		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.033		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005313
Client Identification	38S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	91.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005313
Client Identification	38S
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	2.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	93.0		
D8-Toluene	91.0		
4-Bromofluorobenzene	88.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005312
Client Identification	38D
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.7		
Alkalinity (mg/l as CaCO3)	90.		1.0
Chloride (mg/l)	5.0		1.0
Conductivity (umhos/cm)	160		0.5
Fluoride (mg/l)	0.15		0.1
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.002		0.001
Ortho-Phosphate (mg/l)	0.25		0.005
Sulfide (mg/l)	2.1		1.0
Sulfate (mg/l)	2.4		1.0
Total Metals			
Arsenic (mg/l)	0.002		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.007		0.003
Cadmium (mg/l)	0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.41		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.9		1.0
Magnesium (mg/l)	6.0		0.10
Manganese (mg/l)	0.048		0.002
Sodium (mg/l)	13.		0.1
Lead (mg/l)	0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	15.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.049		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005312
Client Identification	38D
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	87.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number 92-A005312
Client Identification 38D
Sampling Date 3/10/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	90.0		
D8-Toluene	87.0		
4-Bromofluorobenzene	87.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005314
Client Identification	DUP 1
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.3		
Alkalinity (mg/l as CaCO3)	76.		1.0
Chloride (mg/l)	4.3		1.0
Conductivity (umhos/cm)	160		0.5
Fluoride (mg/l)	0.14		0.1
Nitrate + Nitrite Nitrogen (mg/l)	0.030		0.01
Nitrite Nitrogen (mg/l)	0.039		0.001
Ortho-Phosphate (mg/l)	0.25		0.005
Sulfide (mg/l)	2.1		1.0
Sulfate (mg/l)	2.2		1.0
Total Metals			
Arsenic (mg/l)	0.006		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.008		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.67		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.9		1.0
Magnesium (mg/l)	5.6		0.10
Manganese (mg/l)	0.050		0.002
Sodium (mg/l)	13.		0.1
Lead (mg/l)	0.002		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	15.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.047		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005314
Client Identification	DUP 1
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	85.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005314
Client Identification	DUP 1
Sampling Date	3/10/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	100.		
D8-Toluene	96.0		
4-Bromofluorobenzene	96.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005317
Client Identification	36S
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	8.		2
Conventionals			
pH	7.0		
Alkalinity (mg/l as CaCO3)	76.		1.0
Chloride (mg/l)	3.8		1.0
Conductivity (umhos/cm)	160		0.5
Fluoride (mg/l)	0.13		0.1
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.049		0.001
Ortho-Phosphate (mg/l)	0.17		0.005
Sulfide (mg/l)	2.2		1.0
Sulfate (mg/l)	5.4		1.0
Total Metals			
Arsenic (mg/l)	0.006		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.014		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	1.5		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.5		1.0
Magnesium (mg/l)	6.1		0.10
Manganese (mg/l)	0.47		0.002
Sodium (mg/l)	11.		0.1
Lead (mg/l)	0.002		0.001
Selenium (mg/l)	0.001		0.001
Silicon (mg/l)	16.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.055		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005317
Client Identification	36S
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	80.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number 92-A005317
Client Identification 36S
Sampling Date 3/11/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	5.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	95.0		
D8-Toluene	91.0		
4-Bromofluorobenzene	89.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number 92-A005316
Client Identification 36D
Sampling Date 3/11/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	8.0		
Alkalinity (mg/l as CaCO3)	110		1.0
Chloride (mg/l)	16.		1.0
Conductivity (umhos/cm)	250		0.5
Fluoride (mg/l)	0.20		0.1
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.010		0.001
Ortho-Phosphate (mg/l)	0.26		0.005
Sulfide (mg/l)	2.0		1.0
Sulfate (mg/l)	< 1		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	0.17		0.10
Barium (mg/l)	0.006		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.08		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.5		1.0
Magnesium (mg/l)	3.1		0.10
Manganese (mg/l)	0.043		0.002
Sodium (mg/l)	46.		0.1
Lead (mg/l)	0.002		0.001
Selenium (mg/l)	0.001		0.001
Silicon (mg/l)	13.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.035		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005316
Client Identification	36D
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.031
Lindane	< 0.03		0.031
Heptachlor	< 0.02		0.021
Aldrin	< 0.03		0.031
Beta-BHC	< 0.04		0.041
Delta-BHC	< 0.05		0.052
Heptachlor Epoxide	< 0.03		0.031
Endosulfan I	< 0.04		0.041
pp-DDE	< 0.04		0.041
Dieldrin	< 0.04		0.041
Endrin	< 0.05		0.052
pp-DDD	< 0.05		0.052
Endosulfan II	< 0.05		0.052
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.082
Methoxychlor	< 0.2		0.21
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.52		0.52
Arochlor 1221	< 2		2.1
Arochlor 1232	< 0.52		0.52
Arochlor 1242	< 0.52		0.52
Arochlor 1248	< 0.52		0.52
Arochlor 1254	< 0.52		0.52
Arochlor 1260	< 0.52		0.52
SURROGATE (% Recovery)			
Hexabromobenzene	89.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005316
Client Identification	36D
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	4.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	90.0		
D8-Toluene	88.0		
4-Bromofluorobenzene	87.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number 92-A005319
Client Identification 37S
Sampling Date 3/11/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	8.		2
Conventionals			
pH	6.7		
Alkalinity (mg/l as CaCO3)	100		1.0
Chloride (mg/l)	6.9		1.0
Conductivity (umhos/cm)	230		0.5
Fluoride (mg/l)	0.17		0.1
Nitrate + Nitrite Nitrogen (mg/l)	0.12		0.01
Nitrite Nitrogen (mg/l)	0.065		0.001
Ortho-Phosphate (mg/l)	0.16		0.005
Sulfide (mg/l)	2.0		1.0
Sulfate (mg/l)	12.		10
Total Metals			
Arsenic (mg/l)	0.004		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.022		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	3.8		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.9		1.0
Magnesium (mg/l)	12.		0.10
Manganese (mg/l)	1.1		0.002
Sodium (mg/l)	6.1		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	16.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.083		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005319
Client Identification	37S
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	73.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005319
Client Identification	37S
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	4.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	90.0		
D8-Toluene	86.0		
4-Bromofluorobenzene	86.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005315
Client Identification	Dup 2
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	8.		2
Conventionals			
pH	6.8		
Alkalinity (mg/l as CaCO3)	100		1.0
Chloride (mg/l)	6.7		1.0
Conductivity (umhos/cm)	220		0.5
Fluoride (mg/l)	0.11		0.1
Nitrate + Nitrite Nitrogen (mg/l)	0.12		0.01
Nitrite Nitrogen (mg/l)	0.002		0.001
Ortho-Phosphate (mg/l)	0.15		0.005
Sulfide (mg/l)	2.5		1.0
Sulfate (mg/l)	9.0		1.0
Total Metals			
Arsenic (mg/l)	0.004		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.024		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	3.7		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	1.9		1.0
Magnesium (mg/l)	14.		0.10
Manganese (mg/l)	1.3		0.002
Sodium (mg/l)	7.3		0.1
Lead (mg/l)	0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	18.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.098		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005315
Client Identification	Dup 2
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	88.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005315
Client Identification	Dup 2
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	98.0		
D8-Toluene	94.0		
4-Bromofluorobenzene	92.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005318
Client Identification	37D
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	2.		2
Conventionals			
pH	7.6		
Alkalinity (mg/l as CaCO3)	100		1.0
Chloride (mg/l)	3.4		1.0
Conductivity (umhos/cm)	150		0.5
Fluoride (mg/l)	0.17		0.1
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.004		0.001
Ortho-Phosphate (mg/l)	0.43		0.005
Sulfide (mg/l)	1.8		1.0
Sulfate (mg/l)	< 1		1.0
Total Metals			
Arsenic (mg/l)	0.011		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.097		0.003
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	0.028		0.006
Iron (mg/l)	31.		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	6.7		1.0
Magnesium (mg/l)	10.		0.10
Manganese (mg/l)	0.46		0.002
Sodium (mg/l)	10.		0.1
Lead (mg/l)	0.008		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	43.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.13		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number	92-A005318
Client Identification	37D
Sampling Date	3/11/92

PARAMETER	Result	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha-BHC	< 0.03		0.030
Lindane	< 0.03		0.030
Heptachlor	< 0.02		0.020
Aldrin	< 0.03		0.030
Beta-BHC	< 0.04		0.040
Delta-BHC	< 0.05		0.050
Heptachlor Epoxide	< 0.03		0.030
Endosulfan I	< 0.04		0.040
pp-DDE	< 0.04		0.040
Dieldrin	< 0.04		0.040
Endrin	< 0.05		0.050
pp-DDD	< 0.05		0.050
Endosulfan II	< 0.05		0.050
pp-DDT	< 0.1		0.10
Endrin Aldehyde	< 0.1		0.10
Endosulfan Sulfate	< 0.08		0.080
Methoxychlor	< 0.2		0.20
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	87.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 3/12/92
Date Reported: 3/30/92

WATER SAMPLES

AM TEST Identification Number 92-A005318
Client Identification 37D
Sampling Date 3/11/92

PARAMETER	Result	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.
Vinyl Chloride	< 5		2.0
Bromomethane	< 5		5.
Chloroethane	< 5		5.
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 10		10.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	99.0		
D8-Toluene	98.0		
4-Bromofluorobenzene	97.0		

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

ANALYTE	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
AM TEST IDENTIFICATION NUMBER 92-A005310 CLIENT ID 31D				
Pesticides and PCB's	608	EPA	0.03-5.0	3/23/92
Volatile Organics	624	EPA	1.0-10	3/13/92
Total Coliforms	9221 B	SM	2	3/12/92
pH	150.1	EPA		3/12/92
Alkalinity (as CaCO3)	310.1	EPA	1	3/23/92
Chloride	325.2	EPA	1.0	3/13/92
Conductivity	120.1	EPA	0.10	3/12/92
Fluoride	340.2	EPA	0.02	3/23/92
Nitrate + Nitrite	353.2	EPA	0.010	3/19/92
Nitrite Nitrogen	354.1	EPA	0.001	3/12/92
Ortho-Phosphate	365.2	EPA	0.005	3/12/92
Sulfide	376.1	EPA	1.0	3/18/92
Sulfate	375.4	EPA	1.0	3/27/92
Silver	200.7	EPA	0.01	3/18/92
Arsenic	206.2	EPA	0.001	3/23/92
Boron	200.7	EPA	0.1	3/18/92
Barium	200.7	EPA	0.003	3/18/92
Cadmium	200.7	EPA	0.002	3/18/92
Chromium	200.7	EPA	0.006	3/18/92
Iron	200.7	EPA	0.01	3/18/92
Mercury	245.1	EPA	0.0002	3/16/92
Potassium	200.7	EPA	1.0	3/18/92
Magnesium	200.7	EPA	0.10	3/18/92
Manganese	200.7	EPA	0.002	3/18/92
Sodium	200.7	EPA	0.5	3/18/92
Lead	239.2	EPA	0.001	3/20/92
Selenium	270.2	EPA	0.001	3/23/92
Silicon	200.7	EPA	0.1	3/18/92
Strontium	200.7	EPA	0.003	3/18/92
Acid Dig.(Tot Metals)	3010	EPA		3/17/92
Sep. Funnel Ext. (608)	3510	EPA 3510		3/16/92

AM TEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 624

AM TEST Sample Number	BLANK 03/13/92
Client Identification	---

COMPOUNDS	CONCENTRATION (ug/l)	DETECTION LIMIT (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethene	ND	1.0
Acetone	16.	10.
Carbon Disulfide	ND	1.0
Methylene Chloride	5.0	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	ND	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0

Surrogate Compound	Recovery (%)
D4-1,2-Dichloroethane	97.
D8-Toluene	93.
4-Bromofluorobenzene	95.

ND = Not Detected

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
MATRIX SPIKE DATA

AM TEST Sample Number	92-A005310	
Client Identification	MATRIX SPIKE 31D 03/10/92	

COMPOUNDS	Matrix Spike (mg/l)	Amount Spiked (mg/l)	Recovery (%)
1,1-Dichloroethylene	44.0	50.0	87.
Benzene	50.0	50.0	100.
1,1,2-Trichloroethylene	51.0	50.0	102.
Toluene	49.0	50.0	98.
Chlorobenzene	50.0	50.0	100.

AM TEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
MATRIX SPIKE DATA

AM TEST Sample Number	92-A005310
Client Identification	MATRIX SPIKE DUPLICATE 31D 03/10/92

COMPOUNDS	Matrix Spike DUPLICATE (mg/l)	Amount Spiked (mg/l)	Recovery (%)
1,1-Dichloroethylene	43.0	50.0	86.
Benzene	49.0	50.0	97.
1,1,2-Trichloroethylene	50.0	50.0	100.
Toluene	48.0	50.0	97.
Chlorobenzene	50.0	50.0	99.

AM TEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
MATRIX SPIKE DUPLICATES

AM TEST Sample Number		92-A005310 MS + MSD	
Client Identification		31D 03/10/92	
COMPOUNDS	Matrix Spike (mg/l)	Matrix Spike DUPLICATE (mg/l)	Relative Percent Difference (%)
1,1-Dichloroethylene	44.0	43.0	1.0
Benzene	50.0	49.0	3.0
1,1,2-Trichloroethylene	51.0	50.0	2.0
Toluene	49.0	48.0	1.0
Chlorobenzene	50.0	50.0	1.0

MS + MSD = Matrix Spike + Matrix Spike Duplicate

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608
BLANK

AM TEST Sample Number	BLANK
Client Identification	-----

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	6.00
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.00
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50

SURROGATE COMPOUNDS	RECOVERY (%)
Hexabromobenzene	88.

ND = Not Detected

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608
SPIKE RECOVERIES

AM TEST Sample Numbers Client Identification	SPIKE #1 --------	SPIKE #2 --------	
COMPOUNDS	Recovery (%)		AMOUNT SPIKED (ug)
Lindane	82.	89.	0.40
Heptachlor	84.	92.	0.40
Aldrin	79.	81.	0.40
Dieldrin	77.	82.	1.00
Endrin	85.	92.	1.00
p,p'-DDT	69.	78.	1.00
Surrogate Compound			
Hexabromobenzene	75.	81.	1.00

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS - DUPLICATES

PARAMETERS/Sample Nos.	Sample Value	Duplicate Value	Relative Percent Difference (%)
ALKALINITY (mg/l)			
92-A005310	84.	82.	2.4
CHLORIDE (mg/l)			
92-A005310	200.	210.	4.9
92-A005318	3.4	2.9	16.
FLUORIDE (mg/l)			
92-A005310	0.06	0.06	0.
NITRATE + NITRITE (mg/l)			
92-A005310	<0.01	<0.01	-
NITRITE (mg/l)			
92-A005310	0.003	0.003	0.
ORTHO - PHOSPHATE (mg/l)			
92-A005310	0.054	0.056	3.6
SULFATE (mg/l)			
92-A005310	1.1	1.3	17.
CONDUCTIVITY (umhos/cm)			
92-A005310	580.	570.	1.5
pH			
92-A005310	6.9	6.9	0.

< = less than

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS - MATRIX SPIKES

COMPOUNDS/ /Sample Nos.	Sample Value (mg/l)	Sample + Spike (mg/l)	Spike Concentration (mg/l)	Recovery (%)
CHLORIDE				
92-A005311	4.7	62.	50.	114.
92-A005319	6.9	61.	50.	108.
FLUORIDE				
92-A005311	0.07	1.1	1.0	107.
NITRATE + NITRITE				
92-A005311	0.075	0.57	0.50	99.
NITRITE				
92-A005311	0.004	0.028	0.025	96.
ORTHO - PHOSPHATE				
92-A005311	0.088	0.20	0.10	112.
SULFATE				
92-A005311	2.4	11.	10.	86.

< = less than

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - METALS - DUPLICATES

AM TEST Sample Number	92-A005310
Client Identification	31D 03/10/92

ELEMENTS	Sample Value (mg/l)	Sample DUPLICATE Value (mg/l)	Relative Percent Difference (%)
Arsenic	<0.001	<0.001	-
Boron	<0.1	<0.1	-
Barium	0.014	0.017	19.
Cadmium	<0.002	<0.002	-
Chromium	<0.006	<0.006	-
Iron	0.43	0.50	15.
Potassium	4.9	6.0	18.
Magnesium	9.3	9.8	5.2
Manganese	0.15	0.16	6.5
Mercury	<0.0002	<0.0002	-
Sodium	83.	88.	5.8
Lead	0.004	0.005	22.
Selenium	<0.001	<0.001	-
Silicon	7.8	7.0	11.
Strontium	0.11	0.12	8.7

< = less than

AMTEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - METALS - MATRIX SPIKES

AM TEST Sample Number 92-A005311
Client Identification 31S 03/10/92

ELEMENTS	Sample Value (mg/l)	Sample + Spike (mg/l)	Spike Concentration (mg/l)	Recovery (%)
Arsenic	0.009	0.033	0.025	96.
Barium	0.005	1.0	1.0	100.
Cadmium	<0.002	0.51	0.50	102.
Chromium	<0.006	0.93	1.0	93.
Iron	0.71	5.1	5.0	87.
Manganese	0.04	0.98	1.0	94.
Mercury	<0.0002	0.0051	0.0050	102.
Lead	<0.001	0.048	0.050	96.
Selenium	<0.001	0.027	0.025	109.
Potassium	1.3	95.	100.	94.
Magnesium	1.1	10.	10.	91.
Sodium	5.5	13.	10.	75.
Strontium	0.07	1.0	1.0	97.

< = less than

AM TEST

City of Renton
Lys Hornsby

Date Received: 03/12/92
Date Reported: 03/30/92
Project: Renton Monitor Well
Project No.: S1312.00

QUALITY CONTROL - BLANK

AM TEST Sample Number	BLANK
Client Identification	-----
Conventionals	
Alkalinity (mg/l)	<1.
Chloride (mg/l)	<1.
Conductivity (umhos/cm)	<0.5
Fluoride (mg/l)	<0.1
Nitrate + Nitrite (mg/l)	<0.01
Nitrite (mg/l)	<0.001
Ortho - Phosphate (mg/l)	<0.005
Sulfide (mg/l)	<1.0
Sulfate (mg/l)	<1.0
Metals	
Arsenic (mg/l)	<0.001
Boron (mg/l)	<0.1
Barium (mg/l)	<0.003
Cadmium (mg/l)	<0.002
Chromium (mg/l)	<0.006
Iron (mg/l)	0.01
Mercury (mg/l)	<0.0002
Potassium (mg/l)	<1.0
Magnesium (mg/l)	0.20
Manganese (mg/l)	<0.002
Sodium (mg/l)	0.30
Lead (mg/l)	<0.001
Selenium (mg/l)	<0.001
Silicon (mg/l)	<0.1
Silver (mg/l)	<0.01
Strontium (mg/l)	<0.003

< = less than

REPORTED BY Mark C. Fugiel
Mark A. Fugiel

MAF/pb

AMTEST

AmTest Inc.
Professional
Analytical
Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

September 4, 1992

F.
P.S.
Date RECEIVED SEP
File No. S1312.00

Route To:	Seen:
MS	9/10/92

RH2 Engineering
attn. Mark Semrau
8383 158th Ave. NE, suite 200
Redmond, WA 98052

Dear Mark,

On the 20th of August 1992, Am Test received a total of six water samples from the Renton Monitoring Well Installation project (# S1312.00) for chemical analysis.

The samples were all received in good condition. A total of 42 containers were received. At the time of receipt, the samples were logged in, stored, and handled according to the protocols of the USEPA.

The samples were prepared and analyzed in accordance with the methods described in either the "Methods for Chemical Analysis of Water and Wastes", or in the "Standard Methods for the Examination of Water and Wastewater". A detailed listing of the analytical methods can be found in the quality control summary, which follows the data section of the report. The majority of the metals were analyzed by ICP. With the exception of Mercury (Cold Vapor), the remaining metals were analyzed by Graphite Furnace Atomic Absorption (GFAA) using Zeeman Background Correction. As a result of the relatively high conductivity of the samples, the major anions (chloride, nitrate, nitrite and sulfate) were analyzed by conventional chemical procedures as opposed to ion chromatography.

All of the analyses included the control elements (initial calibration, continuing calibration verification, reagent blanks etc.) documented in the respective methods. The analyses of Total Coliform, Nitrite and ortho-Phosphate were performed the day of sample receipt. There were no major problems associated with any of the analyses.

AMTEST

Following the analytical data you will find the quality control summary. The information in this section includes the method references, analysis dates, and the results of the blanks, duplicates and matrix spikes. The QC data was well within the control limits of the laboratory, as well as the guidelines described by the analytical methods.

Included in the report package you will find the original chain of custody form that was submitted with the sample sets.

All of the data has been reviewed for completeness, accuracy and release. Please forward the report and invoice to the City of Renton after your review. Feel free to contact me if you have any questions.

Respectfully submitted,

Mark A. Fugiel
Am Test Inc.

AMTEST

AMTest Inc.
Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495
Tel: 206 885 1664

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
51212.00	CITY OF RENTON MONITORING WELL INSTALLATION PROJECT

SAMPLERS: *(Signature)*
MACK SEMRAU *Mark Semrau*
CLIFF NELSON

Client Name: CITY OF RENTON
Client Address: 200 MILL AVE S
Client Phone: (206) 277-5539
Contact Person: LYS HORNSBY
P.O. No.

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS
266 MW-30S	4/11	10:50		X		
267 MW-30D	"	10:25		X		
268 MW-32	"	12:50		X		
269 MW-33	"	1:15		X		
270 MW-34D	"	3:40		X		
271 DUP 3	"			X		

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Mark Semrau	4/11/12 5:00				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	

ANALYSIS REPORT

AMTEST

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

City of Renton
200 Mill Ave S

Renton , WA
Attention: Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

Project Name: MW Installation Proj
Project #: S1312.00

WATER SAMPLES

AM TEST Identification Number	92-A018266
Client Identification	MW-30S
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.0		
Alkalinity (mg/l as CaCO3)	35.		1.0
Chloride (mg/l)	1.9		1.0
Conductivity (umhos/cm)	100		0.5
Fluoride (mg/l)	0.04		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.22		0.01
Nitrite Nitrogen (mg/l)	0.005		0.001
Ortho-Phosphate (mg/l)	0.023		0.005
Total Dissolved Solids (mg/l)	68.		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	7.7		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.007		0.003
Calcium (mg/l)	9.2		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.65		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	2.6		0.10
Manganese (mg/l)	0.035		0.002
Sodium (mg/l)	4.1		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	8.8		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.035		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018266
Client Identification	MW-30S
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	86.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number 92-A018266
Client Identification MW-30S
Sampling Date 8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	101.		
D8-Toluene	101.		
4-Bromofluorobenzene	99.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018267
Client Identification	MW-30D
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.3		
Alkalinity (mg/l as CaCO3)	66.		1.0
Chloride (mg/l)	3.4		1.0
Conductivity (umhos/cm)	260		0.5
Fluoride (mg/l)	0.07		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.21		0.01
Nitrite Nitrogen (mg/l)	0.018		0.001
Ortho-Phosphate (mg/l)	0.073		0.005
Total Dissolved Solids (mg/l)	140		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	35.		10
Total Metals			
Arsenic (mg/l)	0.020		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.27		0.003
Calcium (mg/l)	29.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	0.066		0.006
Iron (mg/l)	47.		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	5.7		1.0
Magnesium (mg/l)	17.		0.10
Manganese (mg/l)	1.6		0.002
Sodium (mg/l)	18.		0.1
Lead (mg/l)	0.010		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	69.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.22		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018267
Client Identification	MW-30D
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	69.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018267
Client Identification	MW-30D
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	2.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	98.0		
D8-Toluene	100.		
4-Bromofluorobenzene	97.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018268
Client Identification	MW-32
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.0		
Alkalinity (mg/l as CaCO3)	72.		1.0
Chloride (mg/l)	3.1		1.0
Conductivity (umhos/cm)	220		0.5
Fluoride (mg/l)	0.08		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.20		0.01
Nitrite Nitrogen (mg/l)	0.003		0.001
Ortho-Phosphate (mg/l)	0.062		0.005
Total Dissolved Solids (mg/l)	110		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	9.7		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	< 0.003		0.003
Calcium (mg/l)	15.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.24		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	7.1		0.10
Manganese (mg/l)	0.003		0.002
Sodium (mg/l)	11.		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	12.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.053		0.003

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018268
Client Identification	MW-32
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	84.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018268
Client Identification	MW-32
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			**(ug/l)**
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	4.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	93.0		
D8-Toluene	95.0		
4-Bromofluorobenzene	95.0		

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018269
Client Identification	MW-33
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	6.9		
Alkalinity (mg/l as CaCO3)	66.		1.0
Chloride (mg/l)	2.9		1.0
Conductivity (umhos/cm)	200		0.5
Fluoride (mg/l)	0.07		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.29		0.01
Nitrite Nitrogen (mg/l)	0.005		0.001
Ortho-Phosphate (mg/l)	0.065		0.005
Total Dissolved Solids (mg/l)	110		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	9.2		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	0.15		0.10
Barium (mg/l)	0.008		0.003
Calcium (mg/l)	17.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.30		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	7.7		0.10
Manganese (mg/l)	0.017		0.002
Sodium (mg/l)	8.3		0.1
Lead (mg/l)	0.003		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	12.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.058		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018269
Client Identification	MW-33
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	91.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number 92-A018269
Client Identification MW-33
Sampling Date 8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	2.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	93.0		
D8-Toluene	94.0		
4-Bromofluorobenzene	95.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018270
Client Identification	MW-34D
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	8.3		
Alkalinity (mg/l as CaCO3)	68.		1.0
Chloride (mg/l)	4.4		1.0
Conductivity (umhos/cm)	160		0.5
Fluoride (mg/l)	0.12		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.14		0.01
Nitrite Nitrogen (mg/l)	0.006		0.001
Ortho-Phosphate (mg/l)	0.068		0.005
Total Dissolved Solids (mg/l)	110		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	8.4		1.0
Total Metals			
Arsenic (mg/l)	0.004		0.001
Boron (mg/l)	0.15		0.10
Barium (mg/l)	0.090		0.003
Calcium (mg/l)	24.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	0.38		0.006
Iron (mg/l)	23.		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	4.4		1.0
Magnesium (mg/l)	12.		0.10
Manganese (mg/l)	0.51		0.002
Sodium (mg/l)	14.		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	44.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.15		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number 92-A018270
Client Identification MW-34D
Sampling Date 8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	97.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018270
Client Identification	MW-34D
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	3.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2- chloroethane	95.0		
D8-Toluene	93.0		
4-Bromofluorobenzene	91.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018271
Client Identification	DUP 3
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	6.8		
Alkalinity (mg/l as CaCO3)	32.		1.0
Chloride (mg/l)	2.0		1.0
Conductivity (umhos/cm)	86.		0.5
Fluoride (mg/l)	0.05		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.23		0.01
Nitrite Nitrogen (mg/l)	0.010		0.001
Ortho-Phosphate (mg/l)	0.020		0.005
Total Dissolved Solids (mg/l)	58.		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	6.1		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.008		0.003
Calcium (mg/l)	9.3		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.39		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	2.6		0.10
Manganese (mg/l)	0.026		0.002
Sodium (mg/l)	4.2		0.1
Lead (mg/l)	0.003		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	8.5		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.035		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number	92-A018271
Client Identification	DUP 3
Sampling Date	8/19/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	77.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AM TEST

City of Renton
Lys Hornsby

Date Received: 8/20/92
Date Reported: 9/ 4/92

WATER SAMPLES

AM TEST Identification Number 92-A018271
Client Identification DUP 3
Sampling Date 8/19/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	2.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	94.0		
D8-Toluene	97.0		
4-Bromofluorobenzene	96.0		

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

AM TEST IDENTIFICATION NUMBER 92-A018266
CLIENT ID MW-30S

ANALYTE	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
Pesticides and PCB's	608	EPA	0.03-5.0	8/21/92
Volatile Organics	624	EPA	1.0-10	8/25/92
Total Coliforms	9221 B	SM	2	8/20/92
pH	150.1	EPA		8/24/92
Alkalinity (as CaCO3)	310.1	EPA	1	8/25/92
Chloride	325.2	EPA	1.0	9/ 1/92
Conductivity	120.1	EPA	0.10	8/24/92
Fluoride	340.2	EPA	0.02	9/ 4/92
Nitrate + Nitrite	353.2	EPA	0.010	8/27/92
Nitrite Nitrogen	354.1	EPA	0.001	8/20/92
Ortho-Phosphate	365.2	EPA	0.005	8/21/92
Total Dissolved Solids	160.1	EPA	1.0	8/21/92
Sulfide	376.1	EPA	1.0	8/25/92
Sulfate	375.4	EPA	1.0	9/ 4/92
Silver	200.7	EPA	0.01	8/25/92
Arsenic	206.2	EPA	0.001	8/26/92
Boron	200.7	EPA	0.1	8/25/92
Barium	200.7	EPA	0.003	8/25/92
Calcium	200.7	EPA	0.10	8/25/92
Cadmium	200.7	EPA	0.002	8/25/92
Chromium	200.7	EPA	0.006	8/25/92
Iron	200.7	EPA	0.01	8/25/92
Mercury	245.1	EPA	0.0002	8/29/92
Potassium	200.7	EPA	1.0	8/25/92
Magnesium	200.7	EPA	0.10	8/25/92
Manganese	200.7	EPA	0.002	8/25/92
Sodium	200.7	EPA	0.5	8/25/92
Lead	239.2	EPA	0.001	8/25/92
Selenium	270.2	EPA	0.001	8/24/92
Silicon	200.7	EPA	0.1	8/25/92
Strontium	200.7	EPA	0.003	8/25/92
Acid Dig.(Tot Metals)	3010	EPA		8/24/92
Sep. Funnel Ext. (608)	3510	EPA 3510		8/20/92

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS
DUPLICATES

PARAMETERS/Sample Nos.	Sample Value (mg/l)	DUPLICATE Value (mg/l)	Relative Percent Difference (%)
Alkalinity			
92-A018266	35.	33.	5.9
Chloride			
92-A018326	120.	120.	0.
Fluoride			
92-A018266	0.04	0.05	4.3
Nitrate + Nitrite Nitrogen			
92-A018266	0.22	0.22	0.
Ortho - Phosphate			
92-A018266	0.23	0.22	4.4
Sulfate			
92-A018268	9.7	9.6	1.0
Total Dissolved Solids			
92-A018266	68.	64.	6.1
Nitrite Nitrogen			
92-A018266	0.005	0.005	0.
Sulfide			
92-A018266	<1.	<1.	-

< = less than

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS
MATRIX SPIKES

PARAMETERS	Sample Value (mg/l)	Sample + Spike (mg/l)	Spike Concentration (mg/l)	Recovery (%)
Chloride				
92-A018327	35.	85.	50.	98.
Fluoride				
92-A018267	0.07	1.06	1.0	99.
Nitrate + Nitrite Nitrogen				
92-A018267	0.21	0.45	0.25	96.
Nitrite Nitrogen				
92-A018267	0.018	0.042	0.025	96.
Sulfate				
92-A018267	35.	57.	20.	110.
Ortho - Phosphate				
92-A018267	0.073	0.26	0.20	94.

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - METALS
DUPLICATES

Am Test Sample Number	92-A018267
Client Identification	MW-30D

METALS	Sample Value (mg/l)	Sample DUPLICATE Value (mg/l)	Relative Percent Difference (%)
Arsenic	0.020	0.020	0.
Boron	<0.1	<0.1	-
Barium	0.27	0.27	0.
Calcium	29.	29.	0.
Cadmium	<0.002	<0.002	-
Chromium	0.66	0.67	1.5
Iron	47.	48.	2.1
Potassium	5.7	5.6	1.8
Magnesium	17.	18.	5.7
Manganese	1.6	1.7	6.1
Sodium	18.	18.	0.
Lead	0.010	0.008	22.
Selenium	<0.001	<0.001	-
Silicon	69.	72.	4.3
Strontium	0.22	0.22	0.
Silver	<0.01	<0.01	-

Am Test Sample Number	92-A018270
Client Identification	MW-34D

METALS	Sample Value (mg/l)	Sample DUPLICATE Value (mg/l)	Relative Percent Difference (%)
Mercury	<0.0002	<0.0002	-

< = less than

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - METALS
MATRIX SPIKES

Am Test Sample Number: 92-A018266
Client Identification: MW-30S

METALS	Sample Value (mg/l)	Sample + Spike (mg/l)	Spike Concentration (mg/l)	Recovery (%)
Arsenic	<0.001	0.024	0.025	96.
Barium	0.007	1.0	1.0	99.
Calcium	9.2	20.	10.	108.
Cadmium	<0.002	0.52	0.50	104.
Chromium	<0.006	1.1	1.0	110.
Iron	0.65	6.3	5.0	113.
Manganese	0.035	1.1	1.0	107.
Lead	<0.001	0.024	0.025	96.
Selenium	<0.001	0.022	0.025	88.
Potassium	<1.0	12.	10.	120.
Magnesium	2.6	13.	10.	104.
Sodium	4.1	15.	10.	109.
Strontium	0.035	1.0	1.0	97.

Am Test Sample Number: 92-A018271
Client Identification: DUP 3

METALS	Sample Value (mg/l)	Sample + Spike (mg/l)	Spike Concentration (mg/l)	Recovery (%)
Mercury	<0.0002	0.0050	0.005	100.

< = less than

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS
BLANK

Am Test Sample Number	BLANK
Client Identification	-----

PARAMETERS	RESULTS (mg/l)
Alkalinity	1.0
Chloride	<1.0
Fluoride	<0.02
Nitrate + Nitrite Nitrogen	<0.01
Nitrite Nitrogen	<0.001
Ortho - Phosphate	<0.005
Sulfide	<1.
Sulfate	<1.
Total Dissolved Solids	5.0

< = less than

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - METALS
BLANK

Am Test Sample Number	BLANK
Client Identification	-----

PARAMETERS	RESULTS (mg/l)
Silver	<0.01
Arsenic	<0.001
Boron	<0.1
Barium	<0.003
Calcium	<0.1
Cadmium	<0.002
Chromium	<0.006
Iron	<0.01
Mercury	<0.0002
Potassium	<1.0
Magnesium	<0.10
Manganese	<0.002
Sodium	<0.5
Lead	<0.001
Selenium	<0.001
Silicon	0.21
Strontium	<0.003

< = less than

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 624

AM TEST Sample Number	VOA BLANK 08/25/92
Client Identification	---

COMPOUNDS	CONCENTRATION (ug/l)	DETECTION LIMIT (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethene	ND	1.0
Acetone	ND	20.
Carbon Disulfide	ND	1.0
Methylene Chloride	3.0	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	3.0	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0

Surrogate Compound	Recovery (%)
D4-1,2-Dichloroethane	95.
D8-Toluene	102.
4-Bromofluorobenzene	100.

ND = Not Detected

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
MATRIX SPIKES

AM TEST Sample Number	92-A018271
Client Identification	MATRIX SPIKE DUP 3

COMPOUNDS	MATRIX SPIKE (mg/l)	AMOUNT SPIKED (mg/l)	RECOVERY (%)
1,1-Dichloroethylene	41.0	50.0	81.
Benzene	51.0	50.0	102.
1,1,2-Trichloroethylene	50.0	50.0	101.
Toluene	48.0	50.0	96.
Chlorobenzene	52.0	50.0	104.

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
MATRIX SPIKES

AM TEST Sample Number	92-A018271
Client Identification	MATRIX SPIKE DUPLICATE DUP 3

COMPOUNDS	MATRIX SPIKE DUPLICATE (mg/l)	AMOUNT SPIKED (mg/l)	RECOVERY (%)
1,1-Dichloroethylene	38.0	50.0	77.
Benzene	52.0	50.0	104.
1,1,2-Trichloroethylene	51.0	50.0	101.
Toluene	51.0	50.0	101.
Chlorobenzene	53.0	50.0	106.

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 624
SPIKE DUPLICATES

AM TEST Sample Number	92-A018271 MS + MSD
Client Identification	DUP 3

COMPOUNDS	MATRIX SPIKE (mg/l)	MATRIX SPIKE DUPLICATE (mg/l)	RELATIVE PERCENT DIFFERENCE (%)
1,1-Dichloroethylene	41.0	38.0	5.0
Benzene	51.0	52.0	2.0
1,1,2-Trichloroethylene	50.0	51.0	0.
Toluene	48.0	51.0	5.0
Chlorobenzene	52.0	53.0	3.0

MS + MSD = Matrix Spike + Matrix Spike Duplicate

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608 - BLANK

AM TEST Sample Number	BLANK
Client Identification	-----

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	6.00
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.00
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50

SURROGATE COMPOUNDS	RECOVERY (%)
Hexabromobenzene	108.

ND = Not Detected

ANALYSIS REPORT AMTEST

RH2 Engineering
Lys Hornsby

Date Received: 08/20/92
Date Reported: 09/04/92
Project: MW Installation Project
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES BY EPA METHOD 608
SPIKE RECOVERY DATA

AM TEST Sample Numbers Client Identification	SPIKE #1 --------	SPIKE #2 --------	
COMPOUNDS	Recovery (%)		AMOUNT SPIKED (ug)
Lindane	90.	89.	0.40
Heptachlor	93.	89.	0.40
Aldrin	85.	86.	0.40
Dieldrin	85.	86.	1.00
Endrin	84.	86.	1.00
p,p'-DDT	78.	83.	1.00
Surrogate Compound			
Hexabromobenzene	82.	89.	1.00

REPORTED BY Mark A. Fugiel

MAF/pb

RH2 Engineering, P.S.
RECEIVED

AMTEST

AmTest Inc. 1992

Professional Analytical Services

14603 N.E. 87th St.
Redmond, WA 98052

Fax: 206 883 3495

Tel: 206 885 1664

File No.

Route To:

MS

October 9, 1992

RH2 Engineering
attn. Mark Semrau
8383 158th Ave. NE, suite 200
Redmond, WA 98052

Dear Mark,

On the 15th of September 1992, Am Test received a single water sample from the Renton Monitoring Well Installation project (# S1312.00) for chemical analysis.

The sample was received in good condition. A total of eight sample containers were received. At the time of receipt, the sample was logged in, stored, and handled according to the protocols of the USEPA.

The sample was prepared and analyzed in accordance with the methods described in either the "Methods for Chemical Analysis of Water and Wastes", or in the "Standard Methods for the Examination of Water and Wastewater". A detailed listing of the analytical methods can be found in the quality control summary, which follows the data section of the report. The majority of the metals were analyzed by ICP. With the exception of Mercury (Cold Vapor), the remaining metals were analyzed by Graphite Furnace Atomic Absorption (GFAA) using Zeeman Background Correction. As a result of the relatively high conductivity of the samples, the major anions (chloride, nitrate, nitrite and sulfate) were analyzed by conventional chemical procedures as opposed to ion chromatography.

All of the analyses included the control elements (initial calibration, continuing calibration verification, reagent blanks etc.) documented in the respective methods. The analyses of Total Coliform, Nitrite and ortho-Phosphate were all performed within 24 hours of sample receipt. There were no major problems associated with any of the analyses.

AMTEST

Following the analytical data you will find the quality control summary. The information in this section includes the method references, analysis dates, and the results of the blanks, matrix spikes and matrix spikes duplicates where they were analyzed specific to your single sample. The QC data was well within the control limits of the laboratory, as well as the guidelines described by the analytical methods.

Included in the report package you will find the original chain of custody form that was submitted with the sample sets.

All of the data has been reviewed for completeness, accuracy and release. Please forward the report and invoice to the City of Renton after your review. Feel free to contact me if you have any questions.

Respectfully submitted,

Mark C. Fugiel

Mark A. Fugiel
Am Test Inc.

[redacted]-ST

[redacted] Analytical Services

[redacted] 14600 [redacted] 87th S[redacted] Fax: 206 [redacted] 95
Redmond, WA 98052
Tel: 206 885 1664

EW

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
51312.00	Monitoring Well Installation Project

SAMPLERS: *(Signature)*
Mark Semrau Mark Semrau
Cliff Nelson

Client Name: City of Renton
Client Address: 200 Mill Ave. N.
Client Phone: Renton, WA 98055 (206) 277-5539
Contact Person: Lys Hornsby
P.O. No.:

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS
MW-35D	9/14	9:45		X	MW-35 DEEP	8

19717

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Mark Semrau	9/14 3:35				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	
		[redacted]	9/14/94 3:35		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

ANALYSIS REPORT

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA 98052
Fax: 206 883 3495
Tel: 206 885 1664

City of Renton
200 Mill Ave. N.
Renton, WA 98055
Attention: Lys Hornsby

Date Received: 9/15/92
Date Reported: 10/ 9/92

Project Name: Monitoring Well Inst
Project #: 51312.00

WATER SAMPLES

AM TEST Identification Number	92-A019797
Client Identification	MW-35 DEEP
Sampling Date	9/14/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (CFU/100 ml)	2.		1
Conventionals			
pH	8.1		
Alkalinity (mg/l as CaCO3)	120		1.0
Chloride (mg/l)	< 1		1.0
Conductivity (umhos/cm)	190		0.5
Fluoride (mg/l)	0.11		0.02
Nitrate + Nitrite Nitrogen (mg/l)	< 0.01		0.01
Nitrite Nitrogen (mg/l)	0.002		0.001
Ortho-Phosphate (mg/l)	0.17		0.005
Total Dissolved Solids (mg/l)	100		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	2.3		1.0
Total Metals			
Arsenic (mg/l)	0.007		0.001
Boron (mg/l)	0.23		0.10
Barium (mg/l)	0.013		0.003
Calcium (mg/l)	11.		0.10
Cadmium (mg/l)	0.002		0.002
Chromium (mg/l)	0.050		0.006
Iron (mg/l)	3.0		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	2.5		1.0
Magnesium (mg/l)	2.9		0.10
Manganese (mg/l)	0.047		0.002
Sodium (mg/l)	31.		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	0.011		0.001
Silicon (mg/l)	7.8		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.080		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 9/15/92
Date Reported: 10/ 9/92

WATER SAMPLES

AM TEST Identification Number	92-A019797
Client Identification	MW-35 DEEP
Sampling Date	9/14/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	1.0	B	1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	99.0		
D8-Toluene	100.		
4-Bromofluorobenzene	99.0		

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 9/15/92
Date Reported: 10/ 9/92

WATER SAMPLES

AM TEST Identification Number	92-A019797
Client Identification	MW-35 DEEP
Sampling Date	9/14/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	98.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/15/92
Date Reported: 10/09/92
Project: Monitoring Well
Project No.: 51312.00

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 624

AM TEST Sample Number: VOA BLANK 09/22/92
Client Identification: ---

COMPOUNDS	CONCENTRATION (ug/l)	DETECTION LIMIT (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethylene	ND	1.0
Acetone	ND	20.
Carbon Disulfide	ND	1.0
Methylene Chloride	1.0	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	4.0	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0
Surrogate Recoveries (%)		
D4-1,2-Dichloroethane	106.	
D8-Toluene	97.	
4-Bromofluorobenzene	97.	

ND = Not Detected

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

ANALYTE	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
AM TEST IDENTIFICATION NUMBER 92-A019797 CLIENT ID MW-35 DEEP				
Pesticides and PCB's	608	EPA	0.03-5.0	10/ 2/92
Volatile Organics	624	EPA	1.0-10	9/22/92
Total Coliforms	9222B	SM	1	9/15/92
pH	150.1	EPA		9/21/92
Alkalinity (as CaCO3)	310.1	EPA	1	9/16/92
Chloride	325.2	EPA	1.0	9/30/92
Conductivity	120.1	EPA	0.10	9/21/92
Fluoride	340.2	EPA	0.02	9/28/92
Nitrate + Nitrite	353.2	EPA	0.010	9/15/92
Nitrite Nitrogen	354.1	EPA	0.001	9/16/92
Ortho-Phosphate	365.2	EPA	0.005	9/16/92
Total Dissolved Solids	160.1	EPA	1.0	9/17/92
Sulfide	376.1	EPA	1.0	9/21/92
Sulfate	375.4	EPA	1.0	9/21/92
Silver	200.7	EPA	0.01	9/17/92
Arsenic	206.2	EPA	0.001	9/23/92
Boron	200.7	EPA	0.1	9/17/92
Barium	200.7	EPA	0.003	9/17/92
Calcium	200.7	EPA	0.10	9/17/92
Cadmium	200.7	EPA	0.002	9/17/92
Chromium	200.7	EPA	0.006	9/17/92
Iron	200.7	EPA	0.01	9/17/92
Mercury	245.1	EPA	0.0002	9/18/92
Potassium	200.7	EPA	1.0	9/17/92
Magnesium	200.7	EPA	0.10	9/17/92
Manganese	200.7	EPA	0.002	9/17/92
Sodium	200.7	EPA	0.5	9/17/92
Lead	239.2	EPA	0.001	9/29/92
Selenium	270.2	EPA	0.001	9/28/92
Silicon	200.7	EPA	0.1	9/17/92
Strontium	200.7	EPA	0.003	9/17/92
Acid Dig.(Tot Metals)	3010	EPA		9/16/92
Sep. Funnel Ext. (608)	3510	EPA 3510		9/21/92

ANALYSIS REPORT

AMTEST

City of Renton
Lys Hornsby

Date Received: 09/15/92
Date Reported: 10/09/92
Project: Monitoring Well
Project No.: 51312.00

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608 - BLANK

AM TEST Sample Number		BLANK
Client Identification		-----
COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	1.0
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.0
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50
Surrogate Recoveries (%)		
Hexabromobenzene	103.	

ND = Not Detected

ANALYSIS REPORT AMTEST

City of Renton
Lyn Hornsby

Date Received: 09/15/92
Date Reported: 10/09/92
Project: Monitoring Well
Project No.: 51312.00

QUALITY CONTROL - PESTICIDES BY EPA METHOD 608
METHOD SPIKE RECOVERIES

AM TEST Sample Numbers	SPIKE #1	SPIKE #2	
Client Identification	09/21/92 --------	09/21/92 --------	
COMPOUNDS	Recovery (%)		AMOUNT SPIKED (ug)
Lindane	80.	86.	0.40
Heptachlor	87.	93.	0.40
Aldrin	76.	85.	0.40
Dieldrin	92.	98.	1.00
Endrin	91.	103.	1.00
p,p'-DDT	95.	109.	1.00
Surrogate Recoveries (%)			
Hexabromobenzene	96.	111.	1.00

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/15/92
Date Reported: 10/09/92
Project: Monitoring Well
Project No.: 51312.00

QUALITY CONTROL - BLANKS - CONVENTIONALS

AM TEST Sample Number Client Identification	BLANK -----
ANALYTES	**RESULTS (mg/l)**
Alkalinity	<1.
Chloride	<1.0
Fluoride	<0.02
Nitrate + Nitrite Nitrogen	<0.01
Nitrite Nitrogen	<0.001
Ortho - Phosphate	0.005
Total Dissolved Solids	1.0
Sulfate	<1.0
Sulfide	<1.0

< = less than

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/15/92
Date Reported: 10/09/92
Project: Monitoring Well
Project No.: 51312.00

QUALITY CONTROL - BLANKS - METALS

AM TEST Sample Number Client Identification	BLANK -----
ANALYTES	RESULTS (mg/l)
Silver	<0.01
Arsenic	0.001
Boron	<0.1
Barium	<0.003
Calcium	<0.1
Cadmium	<0.002
Chromium	<0.006
Iron	<0.01
Mercury	<0.0002
Potassium	<1.0
Magnesium	<0.1
Manganese	<0.002
Sodium	<0.1
Lead	<0.001
Selenium	<0.001
Silicon	<0.10
Strontium	<0.003

< = less than

REPORTED BY Mark C. Fugiel

MAF/pb

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

October 26, 1992

RH2 Engineering
attn. Mark Semrau
8383 158th Ave. NE, suite 200
Redmond, WA 98052

Dear Mark,

On the 30th of September 1992, Am Test received a water sample from the Renton Monitoring Well Installation project (# S1312.00) for chemical analysis.

The sample was received in good condition. A total of eight sample containers were received. At the time of receipt, the sample was logged in, stored, and handled according to the protocols of the USEPA.

The sample was prepared and analyzed in accordance with the methods described in either the "Methods for Chemical Analysis of Water and Wastes", or in the "Standard Methods for the Examination of Water and Wastewater". A detailed listing of the analytical methods can be found in the quality control summary, which follows the data section of the report. The majority of the metals were analyzed by ICP. With the exception of Mercury (Cold Vapor), the remaining metals were analyzed by Graphite Furnace Atomic Absorption (GFAA) using Zeeman Background Correction. As a result of the relatively high conductivity of the samples, the major anions (chloride, nitrate, nitrite and sulfate) were analyzed by conventional chemical procedures as opposed to ion chromatography. The total solids content of the sample was 1.6 %. The apparent disparity between the conductivity and the total dissolved solids is the result of the inability to measure the TDS as a result of the high TSS.

All of the analyses included the control elements (initial calibration,

AMTEST

continuing calibration verification, reagent blanks etc.) documented in the respective methods. The analyses of Total Coliform, Nitrite and ortho-Phosphate were performed the day of sample receipt. In spite of the high total solids, there were no major problems associated with any of the analyses.

Following the analytical data you will find the quality control summary. The information in this section includes the method references, analysis dates, and the results of the blanks, duplicates and matrix spikes where they were analyzed. The QC data was well within the control limits of the laboratory, as well as the guidelines described by the analytical methods.

Included in the report package you will find the original chain of custody form that was submitted with the sample sets.

All of the data has been reviewed for completeness, accuracy and release. Please forward the report and invoice to the City of Renton after your review. Feel free to contact me if you have any questions.

Respectfully submitted,

Mark A. Fugiel
Am Test Inc.

AMTEST

Professional Analytical Services

[redacted] 4603 [redacted] 8th St. [redacted] 206 [redacted] 5
Redmond, WA
98052
Tel: 206 885 1664

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
51312.00	MONITORING WELL INSTALLATION PROJECT

SAMPLERS: *(Signature)*
MARK SEMRAU Mark Semrau
CLIF NELSON

Client Name: CITY OF RENTON
Client Address: 200 MILL AVE S RENTON, WA 98055
Client Phone: (206) 277-5539
Contact Person: LYS HORNSBY
P.O. No.:

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	SEE QUALITY ASSURANCE PROJECT PLAN FOR ANALYSES
MW-34S	9/30	11:00A		X	MW-34S	8	

Q/CS-1X

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Mark Semrau	9/30/92 3:30				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)*	Date/Time	Remarks	
		Georgi Moses	9/30/92 3:30		

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

ANALYSIS REPORT AMTEST

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA 98052
Fax: 206 883 3495
Tel: 206 885 1664

City of Renton
200 Mill Ave. S
Renton, WA 98055
Attention: Lys Hornsby

Date Received: 9/30/92
Date Reported: 10/26/92

Project Name: MW Installation Proj
Project #: S1312.00

WATER SAMPLES

AM TEST Identification Number	92-A020852
Client Identification	MW-34S
Sampling Date	9/30/92

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	46.		2
Conventionals			
pH	8.1		
Alkalinity (mg/l as CaCO3)	92.		1.0
Chloride (mg/l)	1.2		1.0
Conductivity (umhos/cm)	330		0.5
Fluoride (mg/l)	0.12		0.02
Nitrate + Nitrite Nitrogen (mg/l)	2.2		0.01
Nitrite Nitrogen (mg/l)	0.023		0.001
Ortho-Phosphate (mg/l)	0.12		0.005
Total Dissolved Solids (mg/l)	3000		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	15.		10
Total Metals			
Arsenic (mg/l)	0.036		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	1.4		0.003
Calcium (mg/l)	82.		0.10
Cadmium (mg/l)	0.004		0.002
Chromium (mg/l)	0.066		0.006
Iron (mg/l)	110		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	19.		1.0
Magnesium (mg/l)	36.		0.10
Manganese (mg/l)	1.8		0.002
Sodium (mg/l)	160		0.1
Lead (mg/l)	0.006		0.001
Selenium (mg/l)	< 0.002		0.001
Silicon (mg/l)	46.		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	1.7		0.003

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 9/30/92
Date Reported: 10/26/92

WATER SAMPLES

AM TEST Identification Number 92-A020852
Client Identification MW-34S
Sampling Date 9/30/92

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	84.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 9/30/92
Date Reported: 10/26/92

WATER SAMPLES

AM TEST Identification Number	92-A020852
Client Identification	MW-34S
Sampling Date	9/30/92

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)			(ug/l)
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	5.0		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	112.		
D8-Toluene	105.		
4-Bromofluorobenzene	101.		

Reported by: Mark A. Fugiel

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

AM TEST IDENTIFICATION NUMBER 92-A020852
CLIENT ID MW-34S

ANALYTE	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
Pesticides and PCB's	608	EPA	0.03-5.0	10/21/92
Volatile Organics	624	EPA	1.0-10	10/ 1/92
Total Coliforms	9221 B	SM	2	9/30/92
pH	150.1	EPA		10/ 2/92
Alkalinity (as CaCO3)	310.1	EPA	1	10/ 5/92
Chloride	325.2	EPA	1.0	10/ 6/92
Conductivity	120.1	EPA	0.10	10/ 2/92
Fluoride	340.2	EPA	0.02	10/15/92
Nitrate + Nitrite	353.2	EPA	0.010	10/13/92
Nitrite Nitrogen	354.1	EPA	0.001	10/ 2/92
Ortho-Phosphate	365.2	EPA	0.005	10/ 1/92
Total Dissolved Solids	160.1	EPA	1.0	10/ 9/92
Sulfide	376.1	EPA	1.0	10/ 1/92
Sulfate	375.4	EPA	1.0	10/14/92
Silver	200.7	EPA	0.01	10/12/92
Arsenic	206.2	EPA	0.001	9/30/92
Boron	200.7	EPA	0.1	10/12/92
Barium	200.7	EPA	0.003	10/12/92
Calcium	200.7	EPA	0.10	10/12/92
Cadmium	200.7	EPA	0.002	10/12/92
Chromium	200.7	EPA	0.006	10/12/92
Iron	200.7	EPA	0.01	10/12/92
Mercury	245.1	EPA	0.0002	10/12/92
Potassium	200.7	EPA	1.0	10/12/92
Magnesium	200.7	EPA	0.10	10/12/92
Manganese	200.7	EPA	0.002	10/12/92
Sodium	200.7	EPA	0.5	10/12/92
Lead	239.2	EPA	0.001	10/ 2/92
Selenium	270.2	EPA	0.001	10/ 2/92
Silicon	200.7	EPA	0.1	10/12/92
Strontium	200.7	EPA	0.003	10/12/92
Acid Dig.(Tot Metals)	3010	EPA		10/ 7/92
Sep. Funnel Ext. (608)	3510	EPA 3510		10/ 6/92

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/30/92
Date Reported: 10/26/92
Project: NW Installation Proj
Project No.: S1312.00

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 8260

AM TEST Sample Number: VOA BLANK 10/01/92
Client Identification: ---

COMPOUNDS	CONCENTRATION (ug/l)	DETECTION LIMIT (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethylene	ND	1.0
Acetone	ND	20.
Carbon Disulfide	ND	1.0
Methylene Chloride	5.0	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	3.0	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0
Surrogate Recovery (%)		
D4-1,2-Dichloroethane	107.	
D8-Toluene	104.	
4-Bromofluorobenzene	97.	

ND = Not Detected

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/30/92
Date Reported: 10/26/92
Project: NW Installation Proj
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 8260
MATRIX SPIKE RECOVERIES

AM TEST Sample Number	92-A020852
Client Identification	MW-34S

COMPOUNDS	MATRIX SPIKE RECOVERY (%)	MATRIX SPIKE DUPLICATE RECOVERY (%)	RELATIVE PERCENT DIFFERENCE (%)
1,1-Dichloroethylene	97.	93.	4.
Benzene	100.	99.	0.
1,1,2-Trichloroethylene	105.	104.	2.
Toluene	97.	99.	2.
Chlorobenzene	103.	104.	0.

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/30/92
Date Reported: 10/26/92
Project: NW Installation Proj
Project No.: S1312.00

QUALITY CONTROL - BLANK
PESTICIDES & PCB'S IN WATER BY EPA METHOD 608

AM TEST Sample Number		BLANK
Client Identification		-----
COMPOUNDS	**RESULTS (ug/l)**	**DETECTION LIMITS (ug/l)**
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	6.00
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.00
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50
Surrogate Recovery (%)		
Hexabromobenzene	101.	

ND = Not Detected

ANALYSIS REPORT AMTEST

City of Renton
Lys Hornsby

Date Received: 09/30/92
Date Reported: 10/26/92
Project: NW Installation Proj
Project No.: S1312.00

QUALITY CONTROL - SPIKE RECOVERIES
PESTICIDES IN WATER BY EPA METHOD 608

AM TEST Sample Numbers	SPIKE
Client Identification	-----

COMPOUNDS	Recovery (%)	AMOUNT SPIKED (ug)
Lindane	96.	0.40
Heptachlor	100.	0.40
Aldrin	85.	0.40
Dieldrin	94.	1.00
Endrin	91.	1.00
p,p'-DDT	100.	1.00
Surrogate Recovery (%)		
Hexabromobenzene	112.	1.00

REPORTED BY _____
Mark A. Fugiel

MAF/pb

AMTEST

RH2 ENGINEERING, P.S.

Date RECEIVED MAR 2 6 1993

File No.

Route To:

MS	

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA
98052
Fax: 206 883 3495
Tel: 206 885 1664

March 23, 1993

RH2 Engineering
attn. Mark Semrau
8383 158th Ave. NE, suite 200
Redmond, WA 98052

Dear Mark,

On the 8th of March 1993, Am Test received two water samples from the Renton Monitoring Well Installation project (# S1312.00) for chemical analysis.

The samples were received in good condition. A total of 16 sample containers were received. At the time of receipt, the sample was logged in, stored, and handled according to the protocols of the USEPA.

The samples were prepared and analyzed in accordance with the methods described in either the "Methods for Chemical Analysis of Water and Wastes", or in the "Standard Methods for the Examination of Water and Wastewater". A detailed listing of the analytical methods can be found in the quality control summary, which follows the data section of the report. The majority of the metals were analyzed by ICP. With the exception of Mercury (Cold Vapor), the remaining metals were analyzed by Graphite Furnace Atomic Absorption (GFAA) using Zeeman Background Correction. As a result of the relatively high conductivity of the samples, the major anions (chloride, nitrate, nitrite and sulfate) were analyzed by conventional chemical procedures as opposed to ion chromatography.

All of the analyses included the control elements (initial calibration, continuing calibration verification, reagent blanks etc.) documented in the respective methods. The analyses were performed within their respective holding times. There were no major problems associated with any of the analyses.

AMTEST

Following the analytical data you will find the quality control summary. The information in this section includes the method references, analysis dates, and the results of the blanks, duplicates and matrix spikes where they were analyzed. The QC data was well within the control limits of the laboratory, as well as the guidelines described by the analytical methods.

Included in the report package you will find the original chain of custody form that was submitted with the sample sets.

All of the data has been reviewed for completeness, accuracy and release. Please forward the report and invoice to the City of Renton after your review. Feel free to contact me if you have any questions.

Respectfully submitted,

Mark A. Fugiel
Am Test Inc.

AMTEST

A[redacted] Inc.
Professional
Analytical
Services

[redacted] 14603 N.E. 87th St. Fax: 206 883 3495
Redmond, WA
98052 Tel: 206 885 1664

CHAIN OF CUSTODY RECORD

PROJ. NO. 51312-00

PROJECT NAME CITY OF RENTON MONITORING WELL INSTALLATION PROJECT

SAMPLERS: *(Signature)*
MARK SEMRAU Mark Semrau
CLIFF NELSON

Client Name: CITY OF RENTON
Client Address: 200 MILL AVE S.
Client Phone: (206) 277-6207
Contact Person: RON OLSEN
P.O. No.:

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS		
MW-28RD	3/8	9:00		X	CEDAR RIVER PARK	8	DO LABORATORY ADD FIELD/LAB ANALYSES ON ATTACHED SHEET	REPLACEMENT MW-28RD
MW-28RS	3/8	9:30		X	CEDAR RIVER PARK	8		REPLACEMENT MW-28RS

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Mark Semrau	3/8 11:30				
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date/Time	Received for Laboratory by: *(Signature)* Tony Mroz	Date/Time 3/8/93 11:30	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

ANALYSIS REPORT

AM TEST

AmTest Inc.
Professional Analytical Services
14603 N.E. 87th St.
Redmond, WA 98052
Fax: 206 883 3495
Tel: 206 885 1664

City of Renton
200 Mill Ave S.
Renton , WA 98055
Attention: Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

Project Name: Monitor Well Install
Project #: S1312.00

WATER SAMPLES

AM TEST Identification Number	93-A003268
Client Identification	MW-28RD
Sampling Date	3/ 8/93

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.0		
Alkalinity (mg/l as CaCO3)	48.		1.0
Chloride (mg/l)	< 1		1.0
Conductivity (umhos/cm)	96.		0.5
Fluoride (mg/l)	0.03		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.43		0.01
Nitrite Nitrogen (mg/l)	0.010		0.001
Ortho-Phosphate (mg/l)	0.037		0.005
Total Dissolved Solids (mg/l)	66.		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	7.3		1.0
Total Metals			
Arsenic (mg/l)	0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	0.007		0.003
Calcium (mg/l)	12.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.77		0.01
Mercury (mg/l)	< 0.0002		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	3.6		0.10
Manganese (mg/l)	0.072		0.002
Sodium (mg/l)	4.6		0.1
Lead (mg/l)	0.001		0.001
Selenium (mg/l)	0.002		0.001
Silicon (mg/l)	7.6		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.052		0.003

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

WATER SAMPLES

AM TEST Identification Number 93-A003268
Client Identification MW-28RD
Sampling Date 3/ 8/93

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	68.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

WATER SAMPLES

AM TEST Identification Number 93-A003268
Client Identification MW-28RD
Sampling Date 3/ 8/93

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)	**(ug/l)**		**(ug/l)**
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	1.2		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	101.		
D8-Toluene	94.0		
4-Bromofluorobenzene	92.0		

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

WATER SAMPLES

AM TEST Identification Number	93-A003269
Client Identification	MW-28RS
Sampling Date	3/ 8/93

PARAMETER	RESULT	Q	D.L.
Bacteriological			
Total Coliforms (MPN)	< 2		2
Conventionals			
pH	7.0		
Alkalinity (mg/l as CaCO3)	49.		1.0
Chloride (mg/l)	< 1		1.0
Conductivity (umhos/cm)	92.		0.5
Fluoride (mg/l)	0.04		0.02
Nitrate + Nitrite Nitrogen (mg/l)	0.47		0.01
Nitrite Nitrogen (mg/l)	< 0.001		0.001
Ortho-Phosphate (mg/l)	0.009		0.005
Total Dissolved Solids (mg/l)	42.		1.0
Sulfide (mg/l)	< 1		1.0
Sulfate (mg/l)	7.8		1.0
Total Metals			
Arsenic (mg/l)	< 0.001		0.001
Boron (mg/l)	< 0.1		0.10
Barium (mg/l)	< 0.003		0.003
Calcium (mg/l)	11.		0.10
Cadmium (mg/l)	< 0.002		0.002
Chromium (mg/l)	< 0.006		0.006
Iron (mg/l)	0.03		0.01
Mercury (mg/l)	0.0003		0.0002
Potassium (mg/l)	< 1		1.0
Magnesium (mg/l)	3.2		0.10
Manganese (mg/l)	0.009		0.002
Sodium (mg/l)	4.5		0.1
Lead (mg/l)	< 0.001		0.001
Selenium (mg/l)	< 0.001		0.001
Silicon (mg/l)	6.1		0.10
Silver (mg/l)	< 0.01		0.01
Strontium (mg/l)	0.051		0.003

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

WATER SAMPLES

AM TEST Identification Number	93-A003269
Client Identification	MW-28RS
Sampling Date	3/ 8/93

PARAMETER	RESULT	Q	D.L.
Pesticides and PCB's (EPA 608)			
Alpha BHC	< 0.03		0.03
Lindane	< 0.03		0.03
Heptachlor	< 0.02		0.02
Aldrin	< 0.03		0.03
Beta-BHC	< 0.04		0.04
Delta-BHC	< 0.05		0.05
Heptachlor Epoxide	< 0.03		0.03
Endosulfan I	< 0.04		0.04
pp-DDE	< 0.04		0.04
Dieldrin	< 0.04		0.04
Endrin	< 0.05		0.05
pp-DDD	< 0.05		0.05
Endosulfan II	< 0.03		0.03
pp-DDT	< 0.1		0.1
Endrin Aldehyde	< 0.1		0.1
Endosulfan Sulfate	< 0.08		0.08
Methoxychlor	< 0.2		0.2
Toxaphene	< 1		1.
Chlordane	< 0.5		0.5
PCB's			
Arochlor 1016	< 0.5		0.50
Arochlor 1221	< 2		2.0
Arochlor 1232	< 0.5		0.50
Arochlor 1242	< 0.5		0.50
Arochlor 1248	< 0.5		0.50
Arochlor 1254	< 0.5		0.50
Arochlor 1260	< 0.5		0.50
SURROGATE (% Recovery)			
Hexabromobenzene	66.0		

All values are in ug/l (ppb).

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 3/ 8/93
Date Reported: 3/23/93

WATER SAMPLES

AM TEST Identification Number 93-A003269
Client Identification MW-28RS
Sampling Date 3/ 8/93

PARAMETER	RESULT	Q	D.L.
Volatile Organic Compounds (EPA 624)	**(ug/l)**		**(ug/l)**
Chloromethane	< 5		5.0
Vinyl Chloride	< 5		5.0
Bromomethane	< 5		5.0
Chloroethane	< 5		5.0
Trichlorofluoromethane	< 1		1.0
1,1-Dichloroethylene	< 1		1.0
Acetone	< 20		20.
Carbon Disulfide	< 1		1.0
Methylene Chloride	1.5		1.0
1,2-Dichloroethylene	< 1		1.0
1,1-Dichloroethane	< 1		1.0
Vinyl Acetate	< 10		10.
2-Butanone (MEK)	< 10		10.
Chloroform	< 1		1.0
1,1,1-Trichloroethane	< 1		1.0
Carbon Tetrachloride	< 1		1.0
Benzene	< 1		1.0
1,2-Dichloroethane	< 1		1.0
1,1,2-Trichloroethene	< 1		1.0
Bromodichloromethane	< 1		1.0
1,2-Dichloropropane	< 1		1.0
4-Methyl-2-Pentanone	< 10		10.
Toluene	< 1		1.0
Cis-1,3-Dichloropropene	< 1		1.0
1,1,2-Trichloroethane	< 1		1.0
Tetrachloroethylene	< 1		1.0
2-Hexanone	< 10		10.
Chlorodibromomethane	< 1		1.0
Chlorobenzene	< 1		1.0
Ethyl Benzene	< 1		1.0
Total Xylenes	< 1		1.0
Styrene	< 1		1.0
Bromoform	< 1		1.0
1,1,2,2-Tetrachloroethane	< 1		1.0
Trans-1,3-Dichloropropene	< 1		1.0
p-Dichlorobenzene	< 1		1.0
SURROGATE (% Recovery)			
D4-1,2-Dichloroethane	98.0		
D8-Toluene	95.0		
4-Bromofluorobenzene	93.0		

Reported by: _____
Mark A. Fugiel

AMTEST

AmTest Inc.

Professional
Analytical
Services

14603 N.E. 87th St.
Redmond, WA
98052

Fax: 206 883 3495

Tel: 206 885 1664

METHODOLOGY REPORT

AM TEST IDENTIFICATION NUMBER 93-A003268
CLIENT ID MW-28RD

ANALYTE	METHOD	METHOD REFERENCE	DETECTION LIMIT	DATE ANALYZED
Pesticides and PCB's	608	EPA	0.03-5.0	3/12/93
Volatile Organics	624	EPA	1.0-10	3/10/93
Total Coliforms	9221 B	SM	2	3/ 8/93
pH	150.1	EPA		3/ 9/93
Alkalinity (as CaCO3)	310.1	EPA	1	3/11/93
Chloride	325.2	EPA	1.0	3/17/93
Conductivity	120.1	EPA	0.10	3/ 9/93
Fluoride	340.2	EPA	0.02	3/15/93
Nitrate + Nitrite	353.2	EPA	0.010	3/12/93
Nitrite Nitrogen	354.1	EPA	0.001	3/ 9/93
Ortho-Phosphate	365.2	EPA	0.005	3/ 9/93
Total Dissolved Solids	160.1	EPA	1.0	3/10/93
Sulfide	376.1	EPA	1.0	3/10/93
Sulfate	375.4	EPA	1.0	3/19/93
Silver	200.7	EPA	0.01	3/11/93
Arsenic	206.2	EPA	0.001	3/15/93
Boron	200.7	EPA	0.1	3/11/93
Barium	200.7	EPA	0.003	3/11/93
Calcium	200.7	EPA	0.10	3/11/93
Cadmium	200.7	EPA	0.002	3/11/93
Chromium	200.7	EPA	0.006	3/11/93
Iron	200.7	EPA	0.01	3/11/93
Mercury	245.1	EPA	0.0002	3/16/93
Potassium	200.7	EPA	1.0	3/11/93
Magnesium	200.7	EPA	0.10	3/11/93
Manganese	200.7	EPA	0.002	3/11/93
Sodium	200.7	EPA	0.5	3/11/93
Lead	239.2	EPA	0.001	3/13/93
Selenium	270.2	EPA	0.001	3/13/93
Silicon	200.7	EPA	0.1	3/11/93
Strontium	200.7	EPA	0.003	3/11/93
Acid Dig.(Tot Metals)	3010	EPA		3/10/93
Sep. Funnel Ext. (608)	3510	EPA 3510		3/10/93

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - BLANK - VOLATILE ORGANICS BY EPA METHOD 8260

AM TEST Sample Number	VOA BLANK 03/10/93
Client Identification	---

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Chloromethane	ND	5.0
Vinyl Chloride	ND	5.0
Bromomethane	ND	5.0
Chloroethane	ND	5.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethylene	ND	1.0
Acetone	ND	20.
Carbon Disulfide	ND	1.0
Methylene Chloride	2.0	1.0
1,2-Dichloroethylene	ND	1.0
1,1-Dichloroethane	ND	1.0
Vinyl Acetate	ND	10.
2-Butanone (MEK)	ND	10.
Chloroform	ND	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon Tetrachloride	ND	1.0
Benzene	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,2-Trichloroethylene	ND	1.0
1,2-Dichloropropane	ND	1.0
Bromodichloromethane	ND	1.0
Cis-1,3-Dichloropropene	ND	1.0
4-Methyl-2-Pentanone (MIBK)	ND	10.
Toluene	ND	1.0
Trans-1,3-Dichloropropene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
Tetrachloroethylene	ND	1.0
2-Hexanone	ND	10.
Chlorodibromomethane	ND	1.0
Chlorobenzene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Styrene	ND	1.0
Bromoform	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
1,4-Dichlorobenzene	ND	1.0
SURROGATE RECOVERIES (%)		
D4-1,2-Dichloroethane	100.	
D8-Toluene	96.	
4-Bromofluorobenzene	92.	

ND = Not Detected

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - VOLATILE ORGANICS BY EPA METHOD 8260
SPIKE RECOVERIES

AM TEST Sample Number 93-A003269
Client Identification MW-28RS

COMPOUNDS	MATRIX SPIKE (%)	MATRIX SPIKE DUPLICATE (%)	RELATIVE PERCENT DIFFERENCE (%)
1,1-Dichloroethylene	89.	85.	5.
Benzene	104.	101.	2.
1,1,2-Trichloroethylene	105.	101.	4.
Toluene	100.	98.	4.
Chlorobenzene	104.	103.	0.

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES & PCB'S BY EPA METHOD 608 - BLANK

AM TEST Sample Number	BLANK
Client Identification	-----

COMPOUNDS	RESULTS (ug/l)	DETECTION LIMITS (ug/l)
Pesticides		
Alpha BHC	ND	0.03
Lindane	ND	0.03
Heptachlor	ND	0.02
Aldrin	ND	0.03
Beta BHC	ND	0.04
Delta BHC	ND	0.05
Heptachlor Epoxide	ND	0.03
Endosulfan I	ND	0.04
p,p'-DDE	ND	0.04
Dieldrin	ND	0.04
Endrin	ND	0.05
p,p'-DDD	ND	0.05
Endosulfan II	ND	0.05
p,p'-DDT	ND	0.10
Endrin Aldehyde	ND	0.10
Endosulfan Sulfate	ND	0.08
Methoxychlor	ND	0.20
Toxaphene	ND	6.00
Chlordane	ND	0.50
PCB's		
Arochlor 1016	ND	0.50
Arochlor 1221	ND	2.00
Arochlor 1232	ND	0.50
Arochlor 1242	ND	0.50
Arochlor 1248	ND	0.50
Arochlor 1254	ND	0.50
Arochlor 1260	ND	0.50
SURROGATE RECOVERY (%)		
Hexabromobenzene	102.	

ND = Not Detected

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - PESTICIDES BY EPA METHOD 608
SPIKE RECOVERIES

AM TEST Sample Numbers Client Identification	BLANK SPIKE ----------	BLANK SPIKE DUPLICATE ----------	
COMPOUNDS	Recovery (%)		AMOUNT SPIKED (ug)
Lindane	91.	85.	0.40
Heptachlor	95.	89.	0.40
Aldrin	85.	80.	0.40
Dieldrin	95.	93.	1.00
Endrin	91.	92.	1.00
p,p'-DDT	84.	90.	1.00
SURROGATE COMPOUND			
Hexabromobenzene	90.	97.	1.00

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS - DUPLICATES

AM TEST Sample Number 93-A003268
Client Identification MW-28RD

ANALYTES	SAMPLE VALUE (mg/l)	DUPLICATE VALUE (mg/l)	RELATIVE PERCENT DIFFERENCE (%)
Alkalinity	48.	49.	2.1
Chloride	<1.	<1.	-
Conductivity	96.	96.	0.
Fluoride	0.03	0.04	29.
Nitrate + Nitrite Nitrogen	0.43	0.44	2.3
Ortho - Phosphate	0.037	0.039	5.3
Total Dissolved Solids	66.	58.	13.
Sulfide	<1.0	<1.0	-
Sulfate	7.3	7.8	6.6
Nitrite Nitrogen	0.010	0.010	0.

< = less than

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - TOTAL METALS - DUPLICATES

AM TEST Sample Number	93-A003268
Client Identification	MW-28RD

ELEMENTS	SAMPLE VALUE (mg/l)	DUPLICATE VALUE (mg/l)	RELATIVE PERCENT DIFFERENCE (%)
Arsenic	0.001	<0.001	-
Boron	<0.1	<0.1	-
Barium	0.007	0.009	25.
Calcium	12.	12.	0.
Cadmium	<0.002	<0.002	-
Chromium	<0.006	<0.006	-
Iron	0.77	0.88	13.
Mercury	<0.0002	<0.0002	-
Potassium	<1.	<1.	-
Magnesium	3.6	3.7	2.7
Manganese	0.072	0.080	11.
Sodium	4.6	4.9	6.3
Lead	0.001	<0.001	-
Selenium	0.002	0.002	0.
Silver	<0.01	<0.01	-
Strontium	0.052	0.054	3.8

< = less than

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS - MATRIX SPIKES

AM TEST Sample Number: 93-A003269
Client Identification: MW-28RS

ANALYTES	SAMPLE VALUE (mg/l)	SAMPLE + SPIKE (mg/l)	SPIKE CONCENTRATION (mg/l)	RECOVERY (%)
Chloride	<1.	26.	25.	104.
Fluoride	0.04	1.1	1.0	106.
Nitrate + Nitrite Nitrogen	0.47	0.74	0.25	108.
Ortho - Phosphate	0.009	0.11	0.10	101.
Sulfate	7.8	18.	10.	102.
Nitrite Nitrogen	<0.001	0.027	0.025	108.

< = less than

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - TOTAL METALS - MATRIX SPIKES

AM TEST Sample Number: 93-A003269
Client Identification: MW-28RS

ELEMENTS	SAMPLE VALUE (mg/l)	SAMPLE + SPIKE (mg/l)	SPIKE CONCENTRATION (mg/l)	RECOVERY (%)
Arsenic	<0.001	0.024	0.025	96.
Barium	<0.003	0.80	1.0	80.
Cadmium	<0.002	0.46	0.50	92.
Chromium	<0.006	0.91	1.0	91.
Iron	0.03	0.45	0.50	84.
Mercury	0.0003	0.0052	0.005	98.
Lead	<0.001	0.026	0.025	104.
Selenium	<0.001	0.024	0.025	104.
Manganese	0.009	0.88	1.0	87.

< = less than

ANALYSIS REPORT AMTEST

City of Renton
Ron Olsen

Date Received: 03/08/93
Date Reported: 03/23/93
Project: Monitor Well Install
Project No.: S1312.00

QUALITY CONTROL - CONVENTIONALS & METALS - BLANK

AM TEST Sample Number	BLANK
Client Identification	-----

ANALYTES	RESULTS (mg/l)
Alkalinity	1.0
Total Dissolved Solids	4.0
Arsenic	<0.001
Barium	<0.003
Boron	<0.1
Cadmium	<0.002
Calcium	<0.10
Chloride	<1.0
Chromium	<0.006
Fluoride	<0.02
Iron	<0.01
Lead	<0.001
Magnesium	<0.10
Manganese	<0.002
Mercury	<0.0002
Nitrate Nitrogen	<0.01
Nitrite Nitrogen	<0.001
Ortho - Phosphate	<0.005
Potassium	<1.0
Selenium	<0.001
Silicon	<0.1
Silver	<0.01
Sodium	<0.5
Strontium	<0.003
Sulfate	<1.
Sulfide	<1.

< = less than

REPORTED BY Mark A. Fugiel

MAF/pb