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Geotechnical and Environmental Services

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April 24, 2003

Kwang and Eun Oh
26010 Pacific Highway South
Kent, Washington 98032

SUBJECT: Environmental Services
Groundwater Sampling
Oh's Market
26010 Pacific Highway South
King County, Washington

Dear Mr. and Mrs. Oh:

We are pleased to present the results of our environmental groundwater sampling at Oh's Market located at 26010 Pacific Highway South in the unincorporated Woodmont area of King County, Washington. The purpose of our study was to fulfill the Washington Department of Ecology (DOE) requirements for at least four "clean" water samples taken at different quarters of the year before the site is considered to be acceptable for a "No Further Action" status. The scope of our work included collecting water samples from monitoring well Number 3 on the site. This well is located on the down gradient side of the tank cluster and is considered to represent the site's "worst case" groundwater conditions.

## Background

The site was a former Shell Oil Company service station from the 1940s until it ceased operation in 1986. It was remodeled in 1968, including removal of the 1940s underground storage tanks (USTs) and pump islands and the installation of new, larger USTs and pump islands in new locations. When the station closed in 1986, these tanks were removed and replaced with clean fill.

A 1987 environmental assessment performed by Geo Engineers, Inc., detected residual hydrocarbon concentrations in the soil and groundwater in and adjacent to the former tank excavation. Hydrocarbon concentrations in the soil were reported to be below the 100 ppm cleanup limit, but concentrations in the groundwater exceeded acceptable regulatory levels.

In October 1988, Hart Crowser conducted a site study to verify conditions found in the earlier assessment, prior to developing a remediation plan. During February through July 1989, Hart Crowser monitored excavation of petroleum impacted soils on the site. Petroleum-affected soils from the former gasoline tank excavation were treated on-site and returned to the excavation. Oil impacted soils from the waste oil and fuel oil tank locations were exported from the site for disposal. Soil sampling after excavation indicated that hydrocarbon concentrations within the former gasoline tank cluster were below regulatory cleanup limits, except for the southern wall of the excavation. Additional excavation in this area could not be accomplished until the pump islands and canopy were demolished.

In December 1996, Shell Oil requested Hart Crowser conduct additional investigation of the pump island area after demolition of the pump island and canopy had been accomplished. During January 1997, Hart Crowser excavated approximately 750 tons of petroleum-affected soil from this area. The affected soil was exported from the site for disposal and replaced with clean fill. Laboratory results from soil samples from the sidewalls and bottom of the excavation indicated that cleanup standards had been met. During excavation, 23,000 gallons of groundwater were collected from the excavation. Permission was granted for disposal of this water through the sanitary sewer system. The floor of the final excavation was treated with a commercial oxygen-release compound (ORC) to enhance bioremediation of residual petroleum constituents in the groundwater. Groundwater monitoring of three wells around the former tank excavation continued on a periodic basis through May 1998. The summary of the Hart Crowser well monitoring results is appended to this report.

New tanks were installed in the location of the former tank cluster during spring of 1997. This installation conforms to the 1998 required standards and was tightness tested October 31, 1998. Results of this tightness test detected no leakage from the new tanks or distribution lines. A potential buyer and his lender requested additional groundwater sampling of the site due to the site's continued history of Benzene contamination in MW - 3.

Monitoring Well #1 (MW-1) represents the up gradient conditions for the former tank excavation and also the newly installed tanks. Hydrocarbon concentrations in samples from this well have never exceeded cleanup standards. Wells 2 and 3 are on the down gradient side of the existing tank cluster and former excavation. Samples from Monitoring Well #2 (MW-2) had Benzene concentrations exceeding cleanup regulations only in February and May 1998. The concentration in this well decreased from 30.2 ppb in February to 19.7 ppb in May. Subsequent samples have had no detected hydrocarbon concentrations. Samples from Monitoring Well #3 (MW-3) have consistently contained hydrocarbon concentrations exceeding cleanup requirements. The concentrations have appeared to decline through time, except for an increase in the same two February and May 1998 samples.

Water samples collected in February 1999 from Monitoring Wells 2 and 3 contained no hydrocarbon concentrations that exceeded regulatory limits. A water sample from MW-3 taken in October 1999, January 2000, and May 2000, contained 85, 90, and 320 ppb Benzene, which exceeds groundwater cleanup limits. Samples collected in July and October 2002, and January and April 2003, are non detect for gasoline fractions or are acceptable under current clean up limits. Benzene concentrations increased after reported surface spills during tank filling.

**Methodology**

We sampled Monitoring Well 3 on April 14, 2003 as the last of a quarterly monitoring program conducted during 2002 and 2003. Prior to sampling, at least three well casing volumes of water were purged from the well, using a clean disposable bailer. The sample was collected using a new bailer. The water sample was transferred directly from the bailer into specially-cleaned laboratory provided glassware. The sample was stored in an iced chest at the site and during transport to the project laboratory in order to preserve the volatile fractions of the sample. EPA environmental sample protocol including chain-of-custody was maintained. The project laboratory is On Site Environmental, Inc., which is located at 14848 Northeast 95th Street in Redmond, Washington.

The water sample was submitted for laboratory analysis by Northwest Method NWTPH-G for total petroleum hydrocarbons in the gasoline range, and EPA Method 8020 for Benzene, Toluene, Ethyl Benzene, and Xylenes (BTEX), specific compounds within gasoline. Lower detection limits for these methods are on the order of 0.5 parts per billion (ppb) in water.

This analytical approach is intended to provide a basis for comparing the site environment to regulatory standards offered in the Model Toxics Control Act (MTCA), Chapter 173-340 Washington Administrative Code, and to recommended analyses offered in the October 1992 amended "Guidance for Site Checks and Site Assessments for Underground Storage Tanks," Washington Department of Ecology Document 90-52.

**Findings**

The water level in MW-3 was found consistently to be about 6 feet below the ground surface. Purging the well lowered the water surface to about 12 feet below the ground surface. Purged water was clear. Laboratory analysis of this April sample detected no residual concentrations of Benzene, Toluene, Ethyl Benzene, Xylene or Gasoline TPH.

A summary of the laboratory results is presented below in Table A. The laboratory reports and quality control data are appended to this report.

# TABLE A

## NWTPH-GASOLINE LABORATORY RESULTS In PPB

**Monitoring Well #2**

| Date | Benzene | Toluene | Ethyl Benzene | Xylene | TPH | MTBE |
|---|---|---|---|---|---|---|
| 2 - 8 - 99 | ND | ND | ND | ND | ND | |
| 12 - 10 - 99 | ND | ND | ND | ND | ND | |
| **Monitoring Well #3** | | | | | | |
| 2 - 8 - 99 | 4.5 | ND | ND | ND | ND | |
| 10 - 22 - 99 | **85** | ND | ND | ND | 120 | 79 |
| 1 - 20 - 00 | **90** | 1.3 | ND | ND | 150 | 67 |
| 5 -17 - 00 | **320** | **61** | 5.1 | 14.6 | 580 | |
| 7 - 9 - 02 | 1.2 | ND | ND | ND | ND | |
| 10 - 25 - 02 | ND | ND | ND | ND | ND | |
| 1 - 17 - 03 | ND | ND | ND | ND | ND | |
| 4 - 14 - 03 | ND | ND | ND | ND | ND | |
| Cleanup limits | 5 | 40 | 30 | 20 | 1000 | 20 |

ND indicates Not Detected
Bold face numbers exceed groundwater cleanup limits

## Discussion

The Independent Remedial Action Report by Hart Crowser states that a total of 1,300 cubic yards of petroleum impacted soil was excavated on the site. Soil from the initial remediation of the former gasoline tank cluster was treated on-site and replaced in the excavation. About 750 tons of soil from the south wall of the excavation and old pump island area were exported from the site for disposal. After soil removal, the conditions within the excavation were confirmed by laboratory analysis of soil samples collected from the side walls and the bottom of the excavation. A commercial oxygen-release compound (ORC) was placed in the bottom of the excavation in an attempt to enhance the bioremediation of the affected groundwater after the contaminated source soils had been removed. The site remediation appears to have been conducted properly and is verified by laboratory results.

Native soils at the site consist of silty sand with gravel described as glacial till. Till is typically poorly permeable. Groundwater would be expected to be concentrated within the relatively loose backfill soils and within a few feet of the excavation limits. The persistent low hydrocarbon concentrations encountered in MW-3 may represent leaching of impacted but regulatorially acceptable soils within the tank cluster prior to February 1998, the result of the two reported filling spills, or the gasoline within the turbine compartment of the closest tank, discovered by Ace Tank personnel during a maintenance call.

Water samples from MW - 3 taken after installation of the new tanks in late 1997 show a sharp increase of Benzene in the groundwater, along with MTBE. Benzene is one of the most soluble of the fractions of gasoline, and MTBE is a highly soluble additive only recently used in gasoline. Because the recent analysis detected Benzene and MTBE with low concentrations of Gasoline TPH, the source appears to be from a recent spill rather than from original site contamination. Benzene is a relatively small molecule that is generally the first component of gasoline that bacteria can destroy. Aged Gasoline contains little or no Benzene or Toluene and relatively high levels of Xylene and TPH.

An attempt to activate local bacteria by the addition of hydrogen peroxide and a little fertilizer was performed after pumping MW-3 January 20, 2000. A one percent solution of hydrogen peroxide was introduced into both the gravel backfill around the gasoline affected turbine confinement structure and into Mw-3.

Pumping less than 50 gallons of water from MW-3 January 20, 2000 indicated that there is no direct connection to the highly permeable pea gravel backfill within the tank cluster. The identified hydrocarbon concentrations appear to represent a filtered product with only the most soluble and smaller size molecules appearing in the well.

Potential sources for the Benzene concentration in Monitoring Well #3 include:

- residue from a reported spill during initial tank filling in January 1998 and a repeated spill in January 2000.
- leakage from fuel within the turbine containment of the nearest tank where aged fuel was removed in Spring 1999.

Soils in the planter area were impacted by gasoline spills flowing through a weep hole in the curbing adjacent to MW - 3. The soil overlies gravel fill extending from the canopy pad. The gravel communicates with MW -3. The weep hole was filled and the impacted soil removed by the station owner.

**Conclusions**

The filling of the weep hole prevents future surface spills from access to the permeable soils adjacent to MW - 3. Removal of impacted soil adjacent to MW - 3 appears to have been effective in stopping continued leaching of Benzene into the well.

We appreciate the opportunity to be of service on this project. If you have any questions, or if we may be further service, please do not hesitate to contact us.

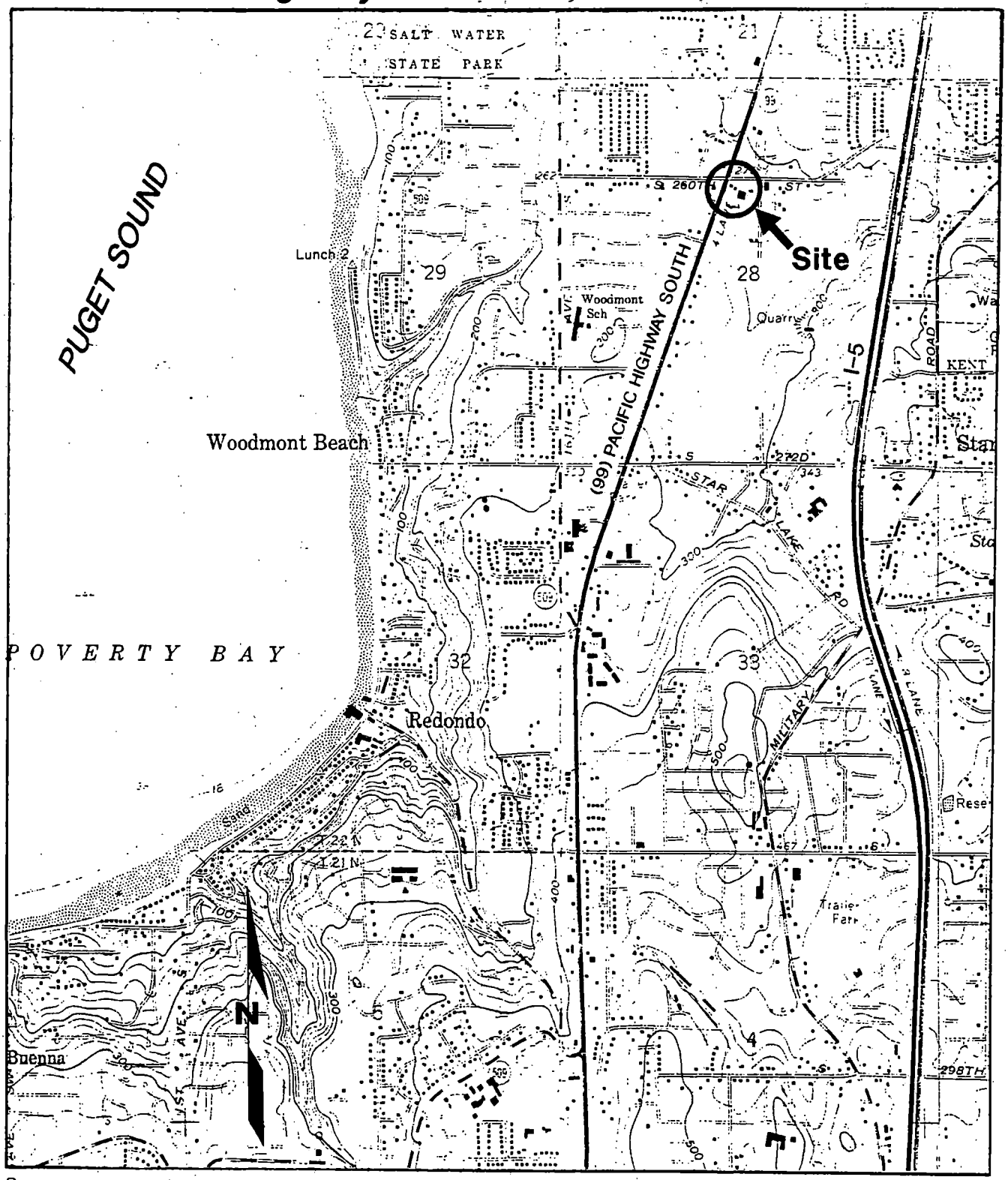
Respectfully submitted,

John F. Cole
Principal

Attachment Vicinity Map
Hart Crowser Water Sample Results
Laboratory Reports

# Vicinity Map

## 26010 Pacific Highway South




Base map prepared from USGS 7.5 minute quadrangle entitled "Poverty Bay", Washington, photorevised 1981.

0 2000 4000

Scale in Feet

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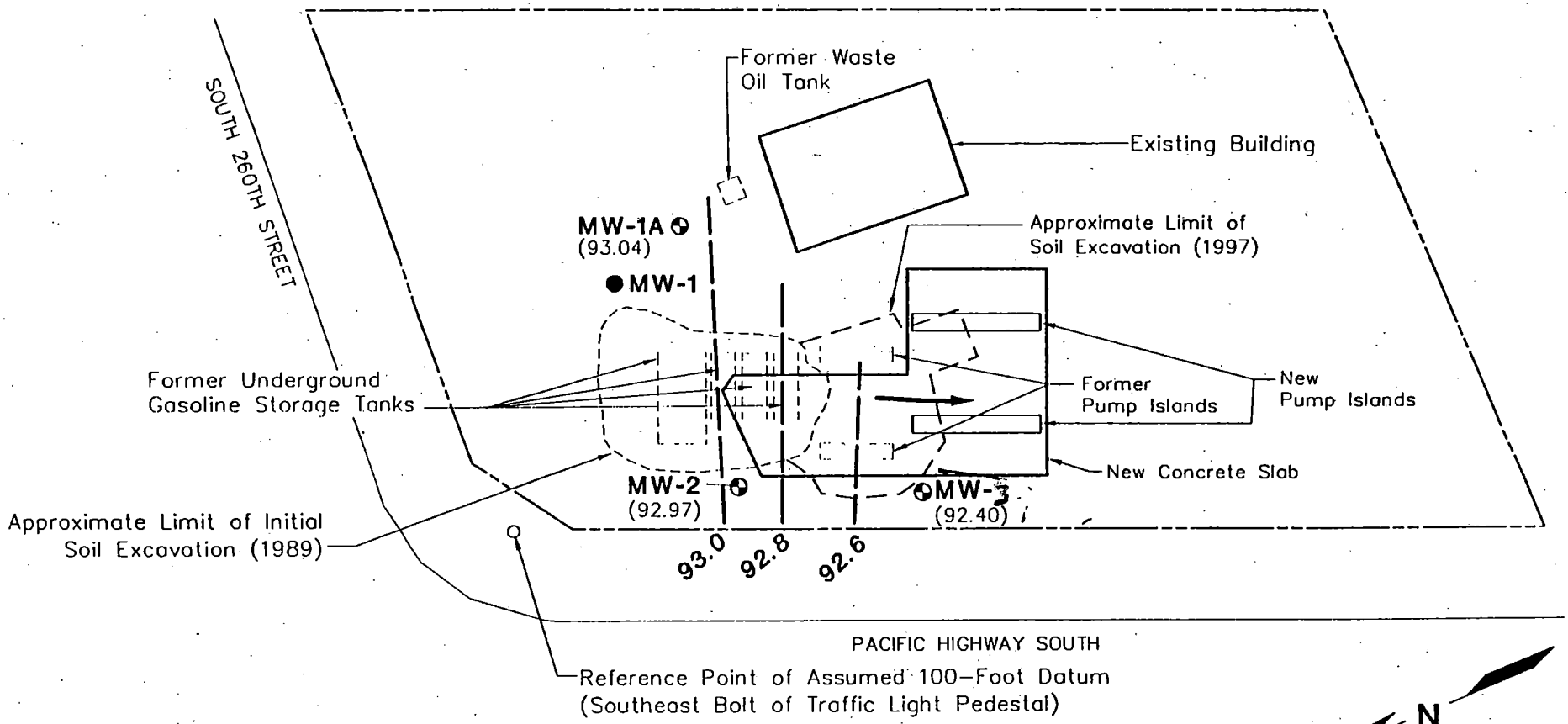
CVD 7/1/98 1:40 wdstk pc2 22240012

# Groundwater Elevation Contour Map
## 26010 Pacific Highway South
## Kent, Washington




| | |
|---|---|
| ⊕MW-2 | Existing Monitoring Well Location and Number |
| — 94.0 — | Groundwater Elevation Contour in Feet |
| (92.97) | Groundwater Elevation in Feet (Measured February 19, 1998) |
| → | Inferred Groundwater Flow Direction |
| ●MW-1 | Abandoned Monitoring Well Location and Number |

Note: Base map prepared from drawing entitled "Site Plan, Figure 2," by Geo Engineers, Inc. for the Windsor Financial Group, dated April 1988.

HARTCROWSER
J-2224 7/98
Figure 2

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# Table 1 - Summary of Groundwater Analytical Results
## Former Shell Service Station (WIC 246-4060-1209)
## 26010 Pacific Higway South
## Kent, Washington



| Sample Date | Measured GW Depth in Feet | Corrected GW Elev. in Feet | Concentration in ug/L TPH-G | Benzene | Toluene | Ethyl-benzene | Xylene | MTBE | Dissolved Oxygen in mg/L | Dissolved Oxygen Method |
|---|---|---|---|---|---|---|---|---|---|---|
| **MW-1** | | | | | | | | | | |
| 7/7/89 | 4.45 | 93.97 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 9/15/89 | 6.00 | 92.42 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/11/90 | 4.72 | 93.70 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 4/20/90 | 4.52 | 93.90 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 7/17/90 | 5.15 | 93.27 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 11/6/90 | 6.05 | 92.37 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 2/6/91 | 4.07 | 94.35 | <50.0 | <0.5 | 2 | <0.5 | <1.0 | | | |
| 7/11/91 | 5.09 | 93.33 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/7/92 | 5.01 | 93.41 | | | | | | | | |
| 7/14/92 | 5.57 | 92.85 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/18/93 | 5.57 | 92.85 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 1.39 | Probe (static) |
| 8/11/93 | 5.43 | 92.99 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 0.4 | Probe (static) |
| 2/2/94 | 5.44 | 92.98 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 0.15 | Probe (static) |
| 11/17/96 | Well abandoned | | | | | | | | | |
| **MW-1A** | | | | | | | | | | |
| 08/25/97 | 5.42 | 92.64 | 64.3 | 0.825 | <0.5 | 1.35 | 2.41 | <2.00 | 5.2 | Probe (static) |
| 11/25/97 | 5.34 | 92.72 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | <2.00 | 1.9 | Probe (static) |
| 02/19/98 | 3.72 | 94.34 | <50.0 | 2.16 | 0.932 | <0.5 | <1.0 | <5.00 | | |
| 05/20/98 | 5.02 | 93.04 | <50.0 | 1.92 | <0.5 | <0.5 | <1.0 | <5.00 | 1.0 | Probe (static) |

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**26010 Pacific Higway South**
**Kent, Washington**



| Sample Date | Measured GW Depth in Feet | Corrected GW Elev. in Feet | Concentration in ug/L TPH-G | Benzene | Toluene | Ethyl-benzene | Xylene | MTBE | Dissolved Oxygen in mg/L | Dissolved Oxygen Method |
|---|---|---|---|---|---|---|---|---|---|---|
| **MW-2** | | | | | | | | | | |
| 7/7/89 | 3.85 | 93.47 | | <0.5 | <0.5 | 0.7 | 2.6 | | | |
| 9/15/89 | 5.46 | 91.86 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/11/90 | 4.42 | 92.90 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 4/20/90 | 3.75 | 93.57 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 7/17/90 | 4.62 | 92.70 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 11/6/90 | 5.69 | 91.63 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 2/6/91 | 3.16 | 94.16 | | 1 | <0.5 | 2 | <1.0 | | | |
| 7/11/91 | 4.62 | 92.70 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/7/92 | 4.26 | 93.06 | | | | | | | | |
| 7/14/92 | 4.96 | 92.36 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/18/93 | 4.96 | 92.36 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 8/11/93 | 5.03 | 92.29 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 2/2/94 | 4.85 | 92.47 | | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 10/10/94 | 7.70 | 89.62 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 4.1 | Probe (static) |
| 3/08/95 | 3.75 | 93.57 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 4.6 | Probe (static) |
| 3/14/96 | 3.00 | 94.32 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | 3.6 | Probe (static) |
| 3/14/96DUP | | | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | | | |
| 1/22/97 | 3.05 | 94.27 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | <2.0 | 3.0 | Probe (static) |
| 6/5/97 | 3.78 | 93.54 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | <2.0 | 4.2 | Probe (static) |
| 08/25/97 | 4.67 | 92.65 | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | <2.0 | 4.4 | Probe (static) |
| 11/25/97 | 4.57 | 92.75 | <50.0 | <0.5 | 0.619 | <0.5 | <1.0 | <2.0 | 4.2 | Probe (static) |
| 11/25/97DUP | | | <50.0 | <0.5 | <0.5 | <0.5 | <1.0 | <2.0 | | |
| 02/19/98 | 3.31 | 94.01 | <50.0 | 30.2 | <0.5 | <0.5 | <1.0 | 26.3[1] | | |
| 02/19/98DUP | | | <50.0 | 27.6 | <0.5 | <0.5 | <1.0 | 25.1[1] | | |
| 05/20/98 | 4.35 | 92.97 | <50.0 | 19.7 | <0.5 | <0.5 | <1.0 | 42.6 | 2.25 | Probe (static) |

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## 26010 Pacific Higway South
## Kent, Washington



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|---|---|---|---|---|---|---|---|---|---|---|
| **MW-3** | | | | | | | | | | |
| 7/7/89 | 4.11 | 92.09 | | 630 | 230 | 84 | 328 | | | |
| 9/15/89 | 5.97 | 90.23 | | 430 | 14 | 120 | 136 | | | |
| 1/11/90 | 3.95 | 92.25 | | <0.5 | <0.5 | <0.5 | 2 | | | |
| 4/20/90 | 3.62 | 92.58 | | 250 | 9 | 29 | 48 | | | |
| 7/17/90 | 4.72 | 91.48 | | 250 | <0.5 | <0.5 | <1.0 | | | |
| 11/6/90 | 6.09 | 90.11 | | 3 | <0.5 | 4 | 3 | | | |
| 2/6/91 | 2.93 | 93.27 | | 120 | 8 | 17 | 36 | | | |
| 7/11/91 | 4.57 | 91.63 | | 110 | 2.7 | 61 | 32 | | | |
| 7/14/92 | 5.05 | 91.15 | | 120 | <0.5 | 37 | 14 | | | |
| 1/18/93 | 5.05 | 91.15 | | 45 | <0.5 | 14 | 9.6 | | | |
| 8/11/93 | 5.03 | 91.17 | | 450 | 6.2 | 150 | 22 | | | |
| 2/2/94 | 4.59 | 91.61 | | 68 | 1.5 | 32 | 4.7 | | | |
| 10/10/94 | 8.13 | 88.07 | 2,100 | 120 | 7 | 56 | 15 | | 2.9 | Probe (static) |
| 3/08/95 | 3.50 | 92.70 | 1,100 | 54 | 2.3 | 16 | 8 | | 2.5 | Probe (static) |
| 3/14/96 | 2.80 | 93.40 | 2,100 | 71 | 52 | 58 | 91 | | 2.9 | Probe (static) |
| 1/22/97 | 2.11 | 94.09 | 856 | 21.5 | <0.5 | 20.4 | 1.35 | 6.32 | 0.52 | Probe (static) |
| 6/5/97 | 1.70 | 94.50 | 427 | 2.09 | <0.5 | 1.72 | <1.0 | <2.00 | 4.0 | Probe (static) |
| 8/25/97 | 3.37 | 92.83 | 150 | 1.04 | <0.5 | 0.501 | <1.0 | <2.00 | 3.2 | Probe (static) |
| 8/25/97DUP | 3.37 | 92.83 | 147 | 1.03 | <0.5 | <0.5 | <1.0 | <2.00 | 3.2 | Probe (static) |
| 11/25/97 | 4.06 | 92.14 | 66.2 | <0.5 | <0.5 | <0.5 | <1.0 | <2.00 | 0.6 | Probe (static) |
| 02/19/98 | 2.63 | 93.57 | 153 | 200 | <1.00 | <1.00 | <2.00 | 44.4[1] | | |
| 05/20/98 | 3.80 | 92.40 | <500 | 360 | 18.0 | <5.0 | <10.0 | 108 | 1.0 | Probe (static) |
| 5/20/98DUP | | | <500 | 383 | 19.1 | 8.14 | 31.6 | 106 | | |

Notes : <XXX Not detected at concentration indicated.
(1) The sample was confirmed for MTBE by EPA 8260B.