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ROZAK ENGINEERING

Civil, Construction & Environmental Consulting

P.O. Box 350

Kenai, Alaska 99611

(907) 283-5640

Fax (907) 283-0747

June 30, 2005

Don Seagren, Environmental Specialist
Alaska Department of Environmental Conservation
Spill Prevention and Response Program
43335 Kalifornsky Beach Road, Suite 11
Soldotna, Alaska 99669

RECEIVED

JUL 1 2005

ADEC
Kenai Area Office

Re: Report of Groundwater Sampling Events 5, 6, 7 & 8
Former Doyle's Fuel Storage Facility, Spill #1998230128901
SE ¼ B.L.M. Lot 51, S34, T6S, R11W, City of Kenai

Dear Mr. Seagren:

This report describes the installation of additional monitoring wells MW-5 and MW-6, installed August 2001, and provides results from groundwater sampling events 5 through 8 done in August 2001, May 2002, December 2002 and April 2005. For reference, the tables in this report also include the results from sample events 1 through 8. The analytical results show the is soil and groundwater contamination at the subject property and the contamination in groundwater has migrated off the property.

This completes the program for groundwater monitoring presented in the Interim Site Characterization Plan dated October 7, 1999 and the additional work proposed in the Interim Site Characterization Report dated December 20, 1999. We will continue to evaluate the site data, investigate for possible off-site contamination sources, model the groundwater contamination plume, evaluate whether additional site assessment and or corrective action is needed, and present our results to the management at Doyle's Fuel Service. During July and August 2005, we will prepare a report to ADEC with our conclusions and recommendations to address the soil and groundwater contamination associated with this site.

BACKGROUND

Rozak Engineering conducted the initial environmental investigation at this property on September 21, 1998. During October 1998, fuel contaminated soil was encountered near the former location of two 15,000 gallon aboveground tanks that stored diesel fuels. Field and analytical testing of soil samples from 19 soil borings indicated that soil and groundwater in the southeast portion of the property was contaminated with diesel range organics (DRO). Based on the site characterization information, four groundwater monitor wells were installed October 25-26, 1999. The wells were 2-inch diameter PVC well pipe with screened section at groundwater table. The first round of groundwater samples and static water elevations were taken on October 27, 1999. The results of the well installation, soil sampling, and groundwater sampling, were presented in the Interim Characterization Report dated December 20, 1999. Conclusions of the Interim Report are restated below:

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- It appeared there were two major fuel releases at the site. One release near the former 15,000-gallon aboveground tanks and another on the concrete slab approximately 40 feet to the south. Analytical testing showed the contamination from these releases was middle distillate (diesel) fuel. This was consistent with site history that showed diesel fuels were stored at the site.
- Low levels of gas range organics (GRO) and DRO were detected in water sampled at MW-1. This was not expected because MW-1 was 90 feet up-gradient the two tanks (the closest spill site). Aerial photographs taken in 1986 showed, what appeared to be, several fuel tanks or tank trucks in the vicinity of MW-1. One explanation for the low levels of contamination at MW-1 could be a small release from a tank or tank truck parked in close proximity to the MW-1 location.
- Concentrations of soil contamination at the site exceeded the regulated levels by many times. It was unclear to what degree the soil contamination at the site was impacting groundwater.
- Groundwater at the site was contaminated and the contamination migrated beyond the east property boundary. Comparing the contaminant levels found during 1998 with the 1999 investigations, it was unclear whether the contaminant levels and groundwater plume were stable, increasing, or decreasing. There also appeared to be significant changes in groundwater flow direction. Additional groundwater sampling was recommended to determine the status of the groundwater contamination plume.

In 1999, Jim Doyle sold the property and buildings to David Yragui, owner of Redoubt Plumbing and Heating, and Mr. Yragui began operating his commercial plumbing business from this property. Responsibility for the site assessment and corrective action work was not transferred. Mr. Yragui has subdivided several small lots at this location into one lot containing 1.58 acres.

Additional groundwater sampling was performed May 23, 2000, September 12, 2000, and January 4, 2001. After evaluating these three sample events with the first event, it was still not clear whether the contaminant plume was stable, increasing, or decreasing. GRO was detected, especially at MW-4, the well located off-site along the east side of the Candlelight Drive right-of-way (ROW). The presence of GRO indicated another contamination source, possibly off-site. As concluded in the March 18, 2001 report to ADEC, additional groundwater sampling points were needed to investigate the source of GRO and to define the groundwater contamination plume.

INSTALLATION OF MONITORING WELLS MW-5 AND MW-6

On August 24, 2001, Rozak Engineering supervised Hughes Drilling installing two additional monitoring wells. MW-5, on east side of Candlelight Drive ROW, is 90 feet east of the former AST site. MW-6, near the northeast corner of the property, is 100 feet north of the former AST site. The Groundwater Monitoring Map shows the former AST site and the six monitoring well locations. Construction of the new monitoring wells was similar to the other wells. While boring the holes for MW-5 and MW-6, soil samples were collected with a 2-inch diameter split-spoon sampler and field screened, including testing with photoionization detector (PID).

Samples were collected from MW-5 at 7-9 feet and 9-11 feet below ground surface (bgs). Soil was medium to fine sand. No hydrocarbon odors were detected. At time of drilling, groundwater was observed at 9 feet bgs. Samples were collected from MW-6 at 7-9 feet and 9-11 feet bgs. Soil was medium to coarse sand. No hydrocarbon odor was detected. At time of drilling, groundwater was observed at 8.8 feet bgs. Soil samples were not analytically tested.

Monitor well sampling

This report documents the results of groundwater sampling events on August 27, 2001, May 1, 2002 and April 15, 2005. The field activities for these events, similar to the previous sampling events, consisted of measuring the static water level (SWL) for a groundwater survey at each (6) monitoring well, purging (bailing) each well, and collecting groundwater samples for analytical testing from each well. SWL was measured using a Solinst electrical water level meter to accuracy of 0.01 foot. After each SWL measurement, the probe and tape were decontaminated with phosphate-free soap solution and rinsed with distilled water.

Bailing generally consisted of removing a minimum of three times the standing well volume, or until the water was substantially free of sediment. A disposable, one-liter polyethylene bailer and cord was designated for each monitor well. During bailing, water was collected in five gallon buckets. The amount of water bailed varied from 4 to 8 gallons per well, except for the initial development of MW-5 and MW-6, on August 27, 2001, when 12 to 15 gallons were bailed. Water evacuated during bailing was characterized by visual and odor inspection. When no evidence of petroleum hydrocarbon (PHC) contamination was detected the purged water was discharge over the ground at the site or the paved part of Candlelight Drive.

Water samples were sent to SGS Environmental Services in Anchorage, formally CT&E Environmental Services, Inc. Water samples were analyzed for GRO, aromatic compounds (BTEX), and DRO. Analytical results are summarized in tables in this report. In-situ measurements of pH, electrical conductivity (eC), temperature (T), and dissolved oxygen (DO), taken during the first four water sample events, were not taken during the last four events.

August 27, 2001. Weather was overcast, calm, and temperatures in low 60's. No apparent damage to wells. Measured SWL, bailed to purge wells, then collected groundwater samples in the order of least to most contaminated based on previous analytical testing results: 1, 6, 3, 5, 4, and 2.

May 1, 2002. Weather was clear, calm, and temperatures in low 40's. No apparent damage to wells. MW-2 PVC riser was obstructed with ice at 3-5 feet bgs. Other wells were not obstructed. Measured SWL, bailed to purge wells, then collected groundwater samples in the order of least to most contaminated based on previous analytical testing results: 1, 6, 5, 4, 3, and 2.

December 4, 2002. Weather was partly clear, calm, with frost and temperatures in low 30's. No apparent damage to wells. Measured SWL and bailed to purge wells during afternoon of the previous day. On December 4, collected groundwater samples in the order of least to most contaminated based on previous analytical testing results: 1, 6, 5, 4, 3, and 2.

April 13, 2005. Weather was clear, light breeze, and temperature in the low 40's. No apparent damage to wells. At MW-2, the silica sand between the PVC riser and the security casing had heaved above top of the riser. Excess sand was removed. Also at MW-2, iced formed inside the PVC riser, obstructing the bailer entry. This was remedied by pouring several gallons of hot city water down the riser until the bailer and water meter probe could reach the groundwater table. Measured SWL, bailed to purge wells, then collected groundwater samples in the order of least to most contaminated based on previous analytical testing results: 1, 6, 5, 3, 4, and 2.

GROUNDWATER SURVEY

Once during each year of groundwater sampling, the top of PVC riser for each monitoring well was surveyed. The elevation survey was conducted to an accuracy of 0.01 foot. Elevations were referenced to an assumed elevation of 100.00 feet at the top of the PVC casing at MW-1. Before the monitoring wells were bailed, the depth to groundwater in wells was measured to the nearest 0.01 foot. Groundwater elevations were determined by subtracting the measured depth to water from the elevation surveyed to the top of PVC casing. The groundwater flow direction was then determined graphically. Elevation contours and arrow depicting direction of flow derived from the April 13, 2005 survey are shown on the Groundwater Monitoring Map. We evaluated the groundwater surveys for the eight sampling events and found the groundwater:

- Flow direction was more uniform than reported March 2001. Flow is southeast across the site, varying less than 10 degrees from a line between the former ASTs and MW-4.
- Gradient averaged 0.0033 ft/ft, calculated from the average difference of 0.71 feet between the highest (at MW-1) and the lowest (at MW-4) measured groundwater level.
- Levels at the six wells fluctuated 1.15 to 1.22 feet between highest and lowest measurements.

ANALYTICAL RESULTS

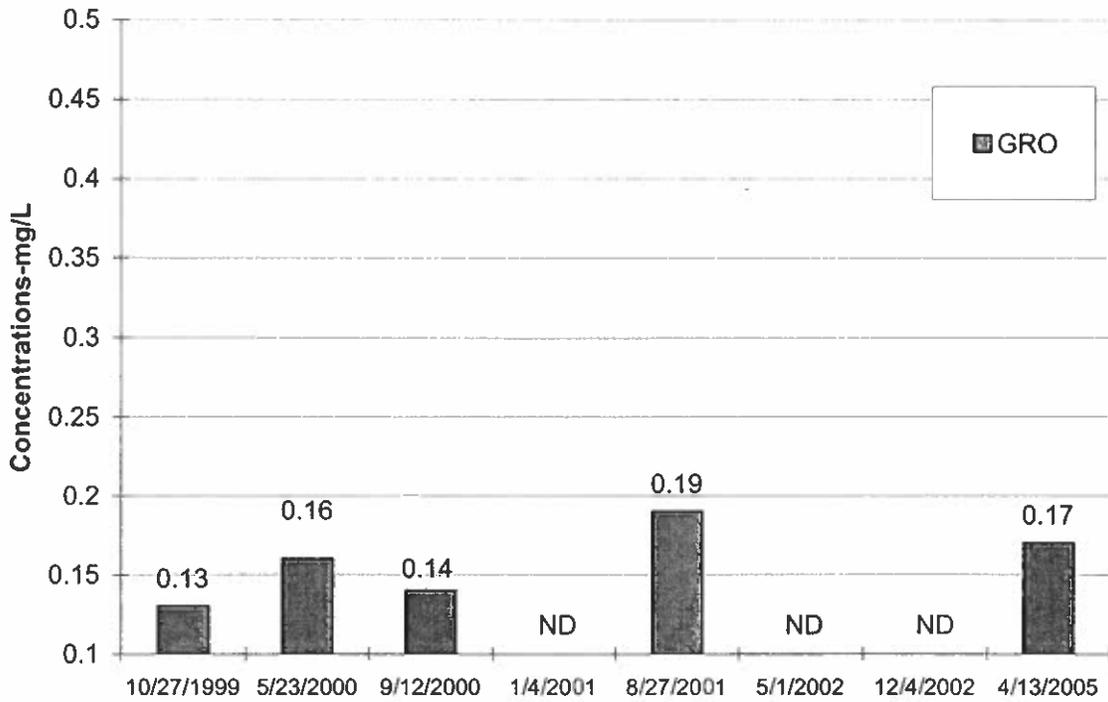
Water samples were analyzed using test methods AK101 (GRO), AK102 (DRO), and 8021b for benzene, toluene, ethylbenzene, and xylenes (BTEX). Analytical testing showed one or more compounds exceeded the groundwater cleanup levels at MW-2, MW-3 and MW-4. Analytical chromatography showed the contamination at MW-1, MW-2 and MW-3 was consistent with middle distillate (diesel) fuel. The chromatography for MW-4 showed the contamination at that location was consistent with weathered gasoline—instead of diesel—for the first through fourth sample events. No fuel type was noted for the fifth, sixth and eighth events, and weathered diesel was noted for the seventh event. Contamination has not been detected at MW-5 and MW-6.

The chain of custody, laboratory data reports and analysis reports are attached. Analytical test results of all water samples are summarized in tables on the following pages. The following notes apply to the tables:

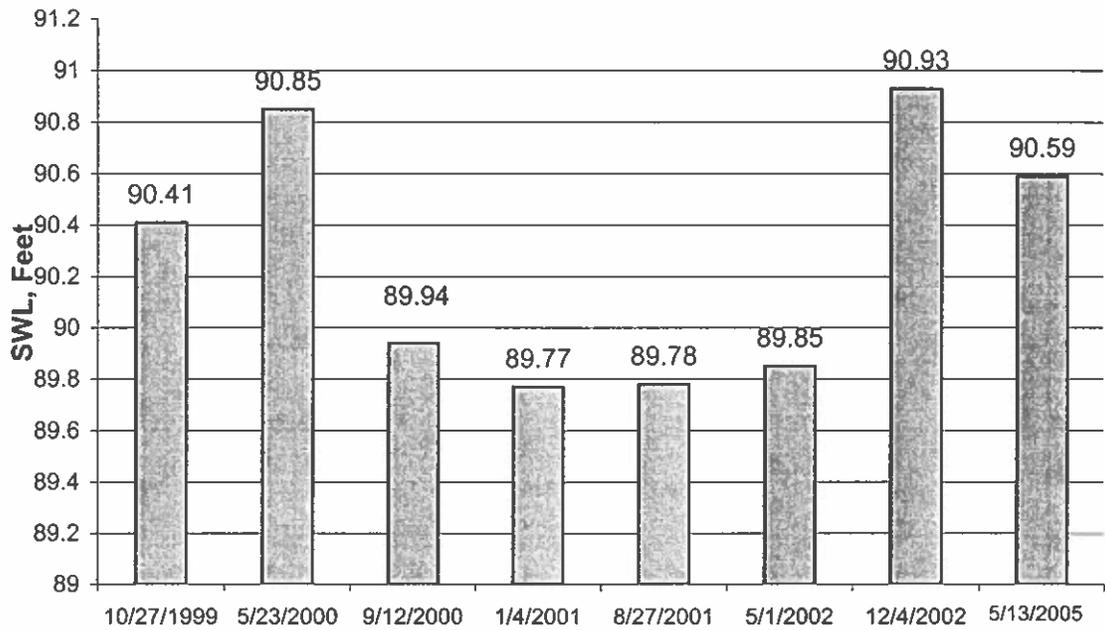
- N/A – designates sample was not analytically tested by the laboratory
- shading indicates that analytical value exceeds the cleanup level
- U – indicates analyte was not detected during analysis at the value shown
- 1 – lab chromatography indicated “DRO Pattern consistent with weathered middle distillate”
- 2 – lab chromatography indicated “DRO Pattern consistent with weathered gasoline”

MW-1

GAS RANGE ORGANICS



STATIC WATER LEVEL (SWL)



MW-1 This well is approximately 110 feet upgradient from the site of the two 15,000-gallon tank aboveground tanks suspected to be the primary source of the contamination. Petroleum hydrocarbons (PHC) contamination was not expected at this location, however, PHC were detected during six of the eight sample events. The concentrations have been relatively stable and less than the cleanup levels.

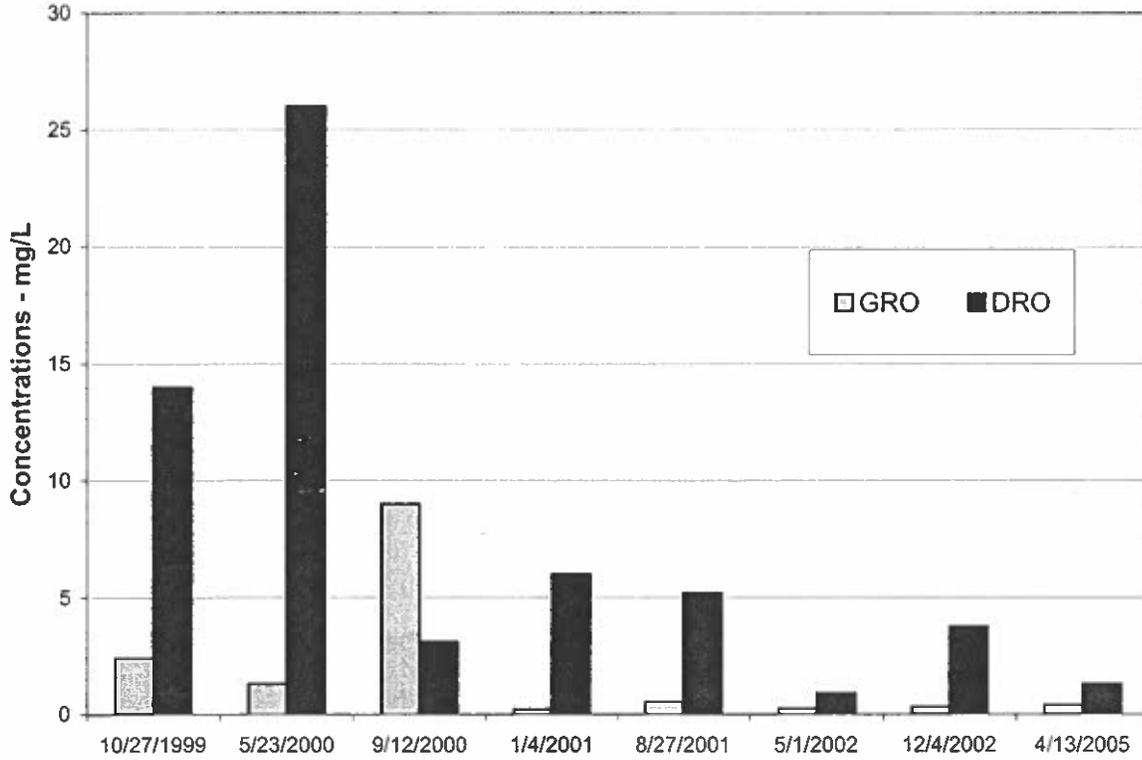
- GRO concentrations of 0.13 to 0.19 mg/L were detected in 5 of 8 groundwater sample events. GRO in the last groundwater sample was 0.17 mg/L, which is 0.04 mg/L less than the first groundwater sample collected 5 ½ years earlier.
- DRO was detected three times: 0.32 mg/L in the first sampling event, 0.68 mg/L in the second sampling event, and 0.50 mg/L in the seventh event.
- Benzene was detected twice: 0.0006 mg/L (0.0001 mg/L above the detection level) in the second and the fifth sampling events.
- The difference from lowest to highest measured groundwater level is 1.15 feet.
- There is no apparent correlation between the PHC concentrations and the groundwater level.

SUMMARY OF ANALYTICAL RESULTS AT MW-1

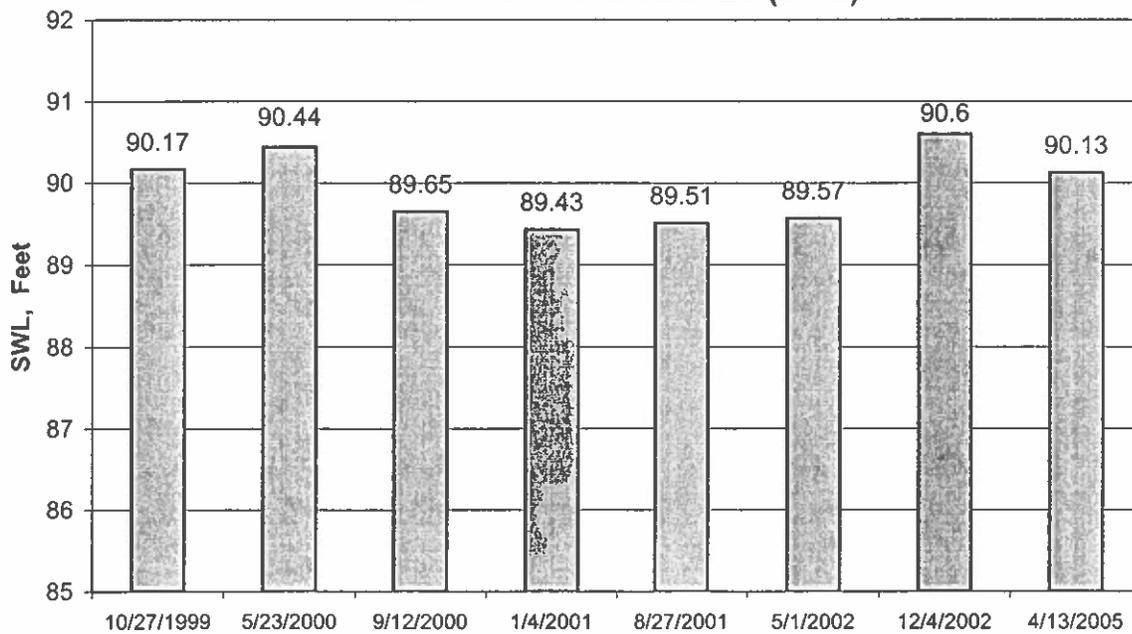
DATE SAMPLED	SWL Feet	Temp °C	pH	eC µS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99 ¹	90.41	4.1	6.1	95	1.9	0.13	0.32	0.002U
5-23-00 ¹	90.85	13.1	6.1	43	0.9	0.16	0.68	0.0006
9-12-00	89.94	5.4	5.8	51	1.1	0.14	0.3U	0.0005U
1-04-01	89.77	5.3	4.6	63	1.4	0.09U	0.3U	0.0005U
8-27-01	89.78	N/T	N/T	N/T	N/T	0.19	0.495U	0.0006
5-1-02	89.85	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
12-04-02 ¹	90.93	N/T	N/T	N/T	N/T	0.09U	0.5	0.0005U
4-13-05	90.59	N/T	N/T	N/T	N/T	0.17	0.3U	0.0005U
ADEC METHOD TWO CLEANUP STANDARDS						1.3	1.5	0.005

MW-2

GAS & DIESEL RANGE ORGANICS



STATIC WATER LEVEL (SWL)



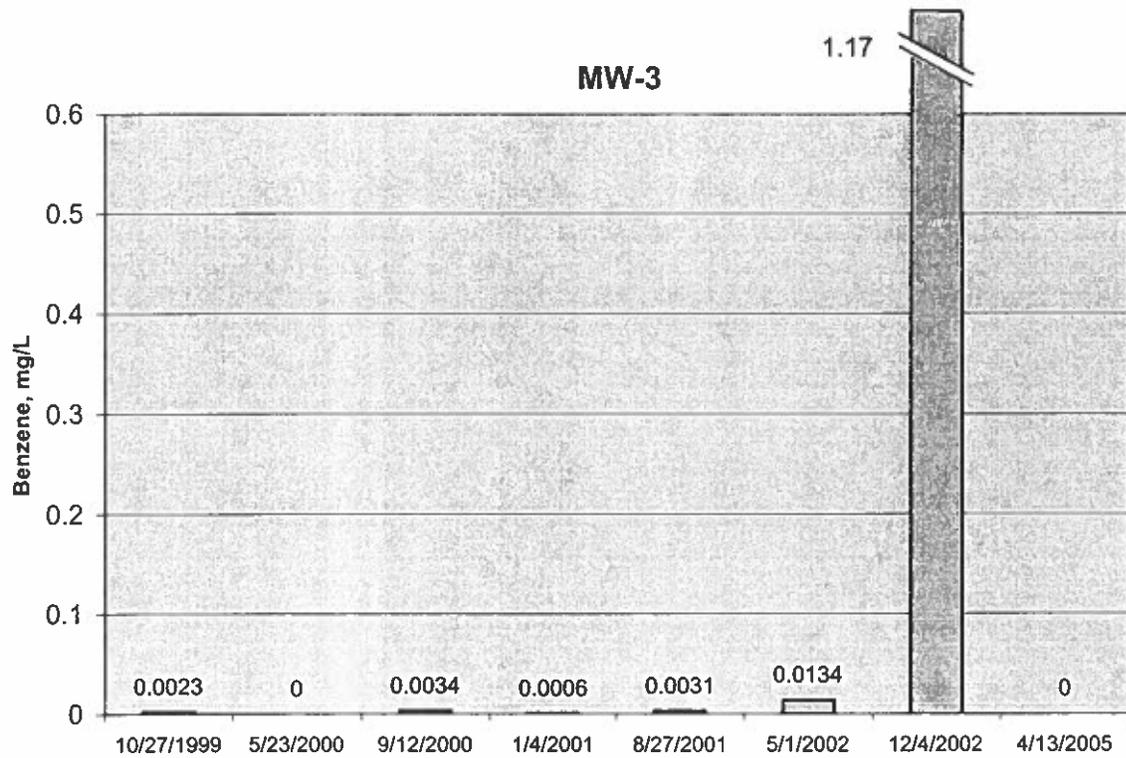
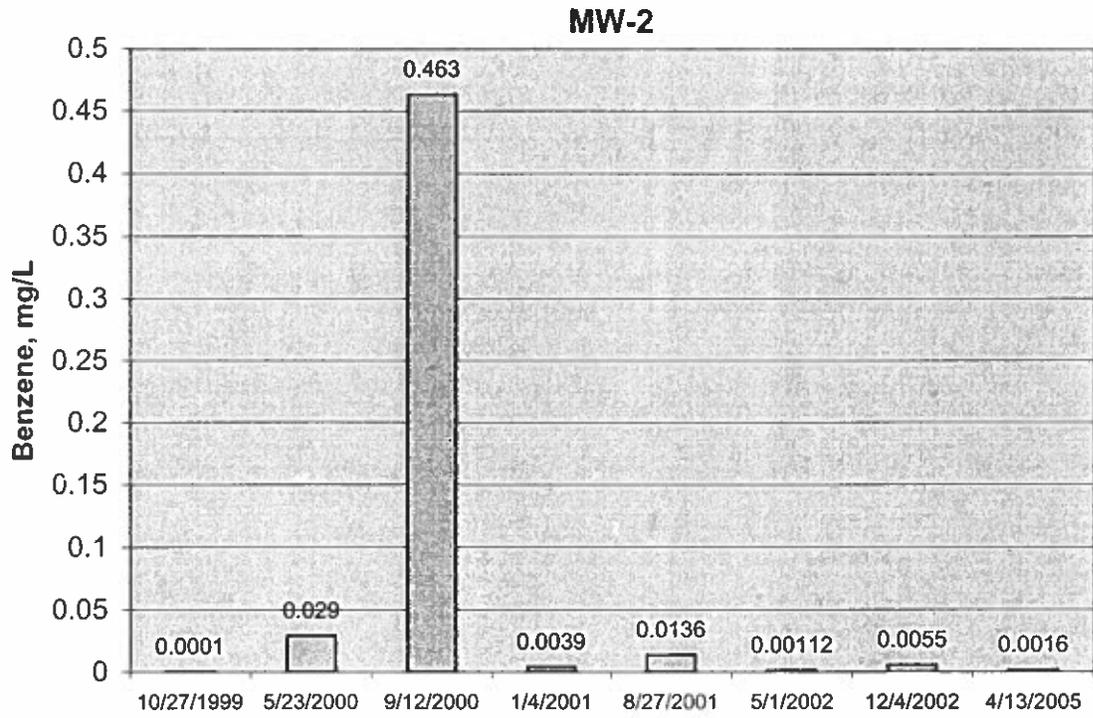
MW-2 This monitoring well is located 20 feet north of the former above ground tank site. Elevated PHC concentrations in groundwater were expected because the soil samples collected during the soil boring for this monitor well exhibited PHC odor from 3 feet to 11 feet bgs. PHC concentrations in groundwater have shown a stable or declining trend since the unexplained spike in GRO and BTEX detected in the third sample event (May 2000).

- GRO concentrations during the first three sample events exceeded the cleanup level. GRO for the last five events has been less than the cleanup level.
- DRO concentrations during sample events 1 through 5 and 7 exceeded the cleanup level. Since May 2000, the levels have shown a declining trend.
- Benzene concentrations exceeded the cleanup level four times. Except for the spike in September 2000, the levels have fluctuated from below the cleanup level to three times the cleanup level.
- The difference from lowest to highest measured groundwater level is 1.17 feet.
- Except for the spike on September 2000, higher DRO concentrations generally occur with higher groundwater levels.

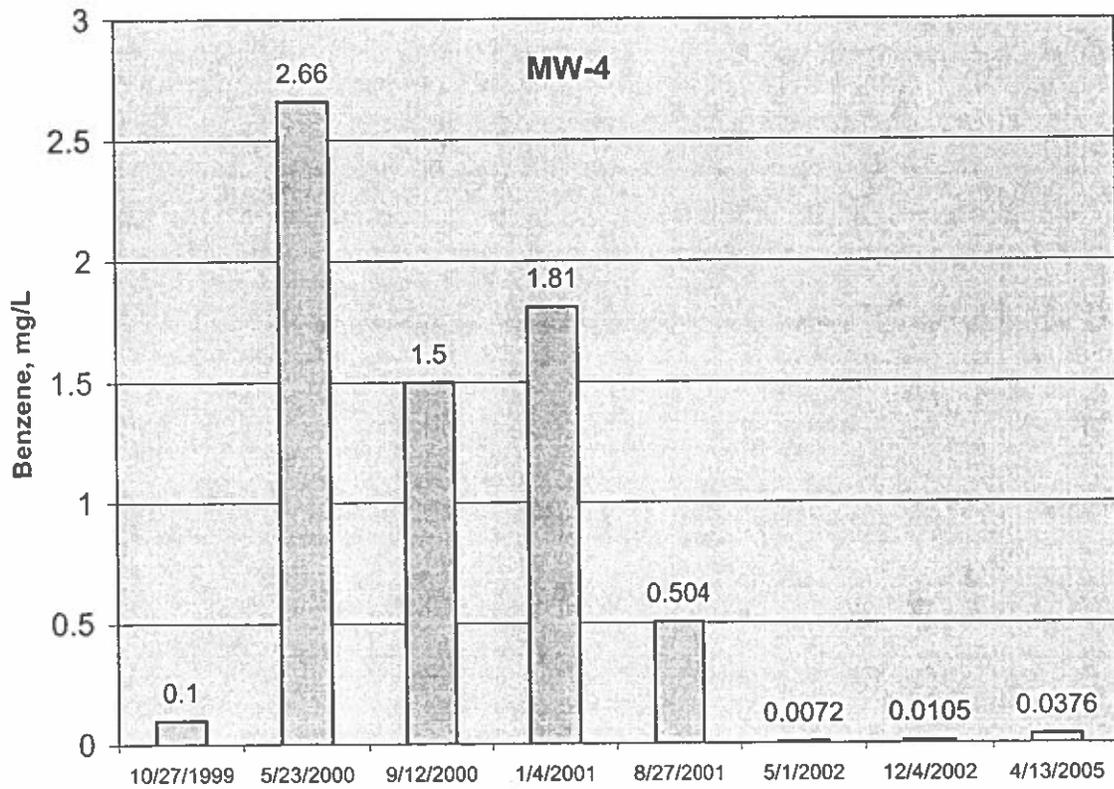
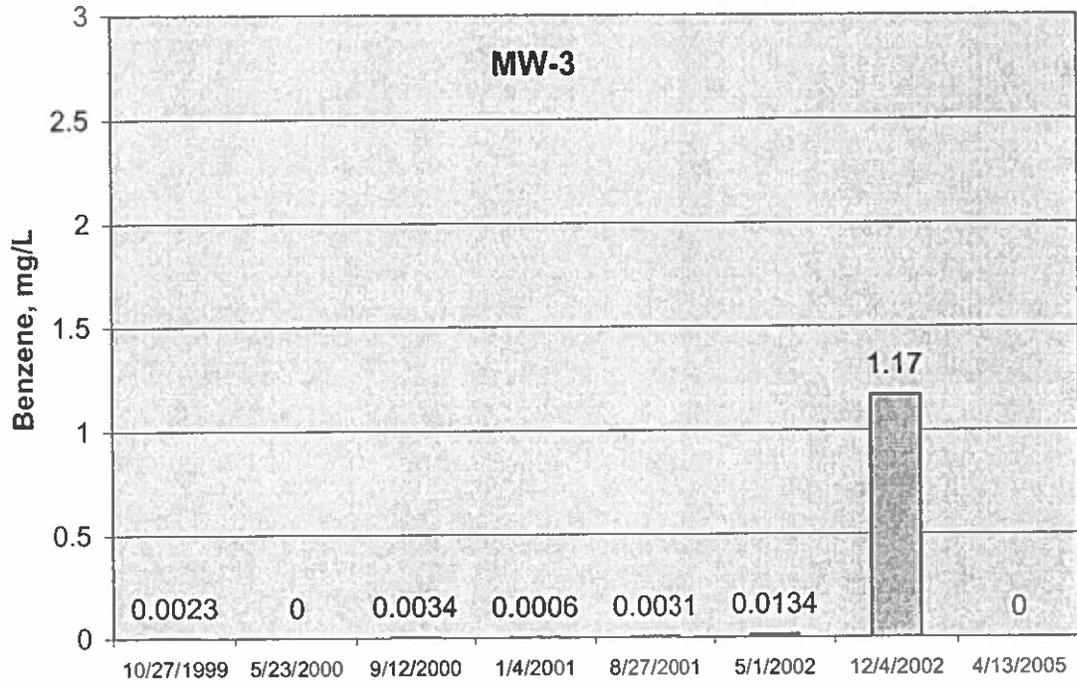
SUMMARY OF ANALYTICAL RESULTS AT MW-2

DATE SAMPLED	SWL Feet	T °F	pH	eC μS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99 ¹	90.17	4.8	6.1	210	0.6	2.4	14	0.001U
5-23-00 ¹	90.44	10.1	6.5	219	0.8	1.3	26	0.029
9-12-00 ¹	89.65	5.5	5.8	231	0.6	9.0	3.1	0.463
1-04-01 ¹	89.43	4.0	5.1	77	0.6	0.2	6.0	0.0039
8-27-01	89.51	N/T	N/T	N/T	N/T	0.5	5.2	0.0136
5-01-02	89.57	N/T	N/T	N/T	N/T	0.3	0.9	0.0012
12-04-02 ¹	90.60	N/T	N/T	N/T	N/T	0.3	3.74	0.0055
4-13-05	90.31	N/T	N/T	N/T	N/T	0.4	1.3	0.0016
ADEC METHOD TWO CLEANUP LEVELS						1.3	1.5	0.005

BENZENE COMPARISON



BENZENE COMPARISON

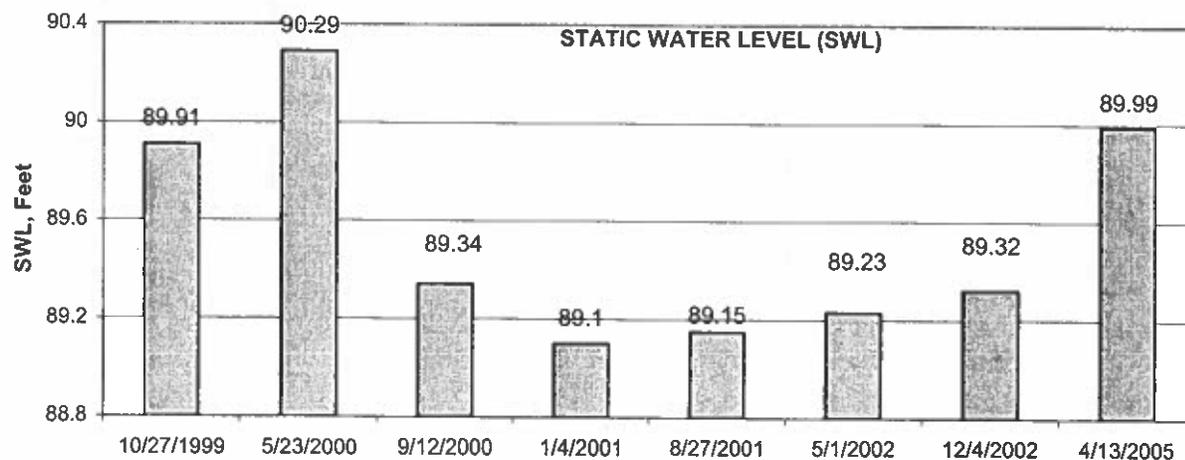


MW-3 This well is located near the southeast corner of the property, 120 feet south of the former storage tank site. Low levels of PHC concentrations, if any, were expected at this location. That has generally been the case except for an unexplained benzene and GRO spike in December 2002.

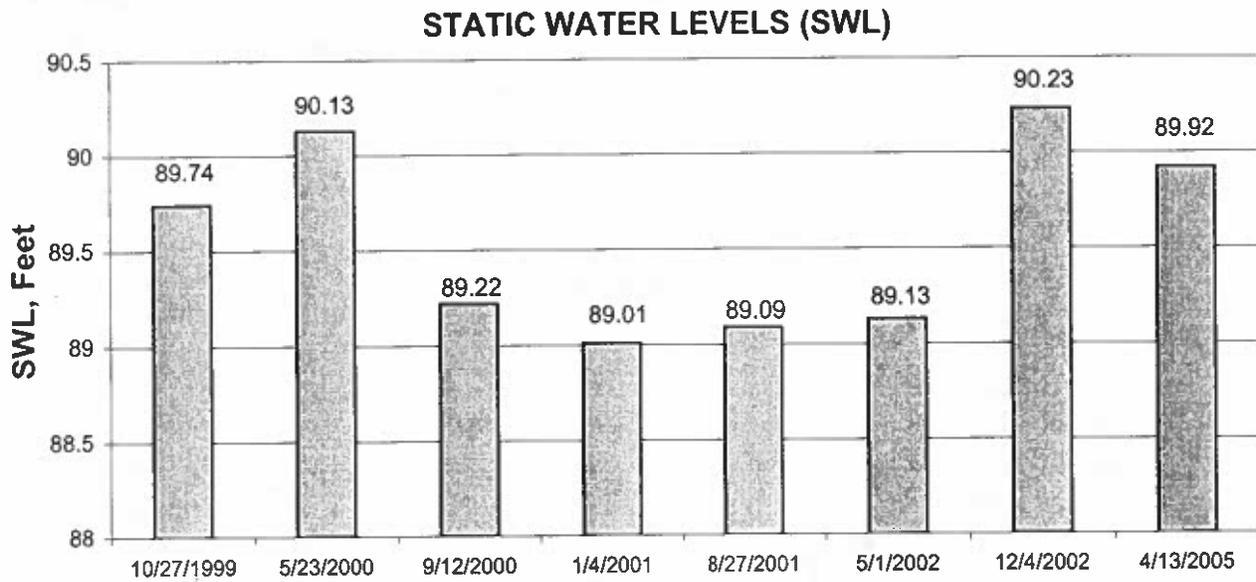
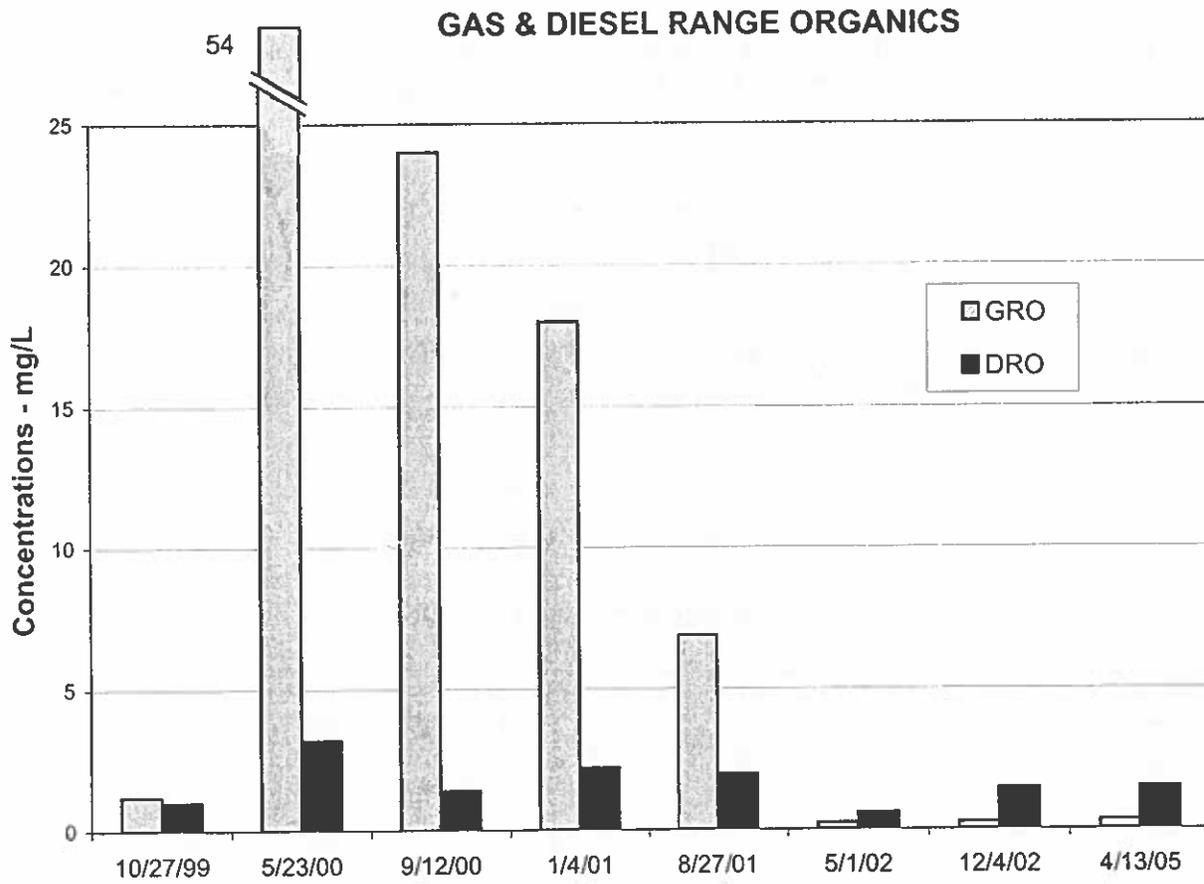
- GRO was detected twice: the sixth sampling event was below the cleanup level and the seventh event was 26 times the cleanup level.
- DRO was detected once, during the third sampling event, less than the cleanup level.
- Benzene was detected six sampling events. Benzene was relatively low except the sixth event (December 2002) was 87 times the second highest sampling event (May 2002) and 234 times the cleanup level.
- The difference from lowest to highest measured groundwater level is 1.19 feet.
- There is no apparent correlation between the PHC concentrations and the groundwater level.

SUMMARY OF ANALYTICAL RESULTS AT MW-3

DATE SAMPLED	SWL Feet	T °F	pH	eC µS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99	89.91	4.5	5.1	70	0.8	0.10U	0.3U	0.0023
5-23-00	90.29	11.7	6.1	245	1.4	0.09U	0.3U	0.0005U
9-12-00 ¹	89.34	6.6	5.6	63	1.2	0.09U	0.60	0.0034
1-04-01	89.10	5.3	4.6	63	1.4	0.09U	0.3U	0.0006
8-27-01	89.15	N/T	N/T	N/T	N/T	0.09U	0.5U	0.0031
5-01-02	89.23	N/T	N/T	N/T	N/T	0.21	0.5U	0.0134
12-04-02 ²	89.32	N/T	N/T	N/T	N/T	34.0	0.6	1.17
4-13-05	89.99	N/T	N/T	N/T	N/T	0.09U	0.3U	0.0005U
ADEC METHOD TWO CLEANUP STANDARDS						1.3	1.5	0.005



MW-4



MW-4 This well is on the east side of Candlelight Drive ROW, 73 feet east of MW-3 and approximately 120 feet down gradient from the 15,000-gallon tank site. Low levels of PHCs—less than cleanup levels—were expected at this location.

- Analysis results for the first sample event were a little higher than expected but were not inconsistent with other site data.
- The second groundwater sample event (5/23/00) produced much higher concentrations than were expected and the contamination was not consistent with other site data or analysis results of the first groundwater sample event. The laboratory checked the chain of custody and quality control for the second sample round, reexamined the analysis results to verify the GRO and BTEX were from a gasoline or diesel fuel source, and reported, “The sample in question does not appear to be significantly contaminated with a middle distillate fuel [diesel]. The DRO pattern indicates a significantly, 50-80%, weathered gasoline.”
- For the next three sample events the laboratory continued to report “DRO pattern consistent with weathered gasoline.” This was different than the laboratory reports for samples from the other wells, which stated, “DRO pattern consistent with weathered middle distillate.”
- GRO was detected every sample event and exceeded the cleanup level at events 2 thru 5. Concentrations declined since event two and were relatively stable the last three events.
- Benzene was detected and exceeded the cleanup level during every sample event.
- DRO was detected during each sample event and exceeded the cleanup level three times.
- The difference from lowest to highest measured groundwater level is 1.22 feet.
- There is no apparent correlation between PHC concentrations and the groundwater level.

SUMMARY OF ANALYTICAL RESULTS AT MW-4

DATE SAMPLED	SWL Feet	T °F	pH	eC µS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99	89.74	4.8	5.9	286	6.5	1.2	1.0	0.10
5-23-00 ²	90.13	10.2	6.4	295	1.1	54	3.2	2.66
9-12-00 ²	89.22	6.1	5.8	378	0.6	24	1.4	1.50
1-04-01 ²	89.01	4.0	5.2	377	0.9	18	2.2	1.81
8-27-01 ²	89.09	N/T	N/T	N/T	N/T	6.9	2.0	0.504
5-01-02	89.13	N/T	N/T	N/T	N/T	0.23	0.6	0.0072
12-04-02 ¹	90.23	N/T	N/T	N/T	N/T	0.25	1.46	0.0105
4-13-05	89.92	N/T	N/T	N/T	N/T	0.33	1.47	0.0376
4-13-05 Duplicate	89.92	N/T	N/T	N/T	N/T	0.31	3.3	0.0365
ADEC METHOD TWO CLEANUP STANDARDS						1.3	1.5	0.005

MW-5 This well is on the east side of Candlelight Drive ROW, 90 feet east of the former tank site. The well was first sampled on August 27, 2001, which was the fifth sample event for monitoring wells MW-1 through MW-4. PHC contamination was not expected at this location.

- GRO has not been detected.
- DRO has not been detected.
- Benzene was detected once, the first sampling event, at slightly more than the cleanup level.
- The difference from lowest to highest measured groundwater level is 1.15 feet.

SUMMARY OF ANALYTICAL RESULTS AT MW-5

DATE SAMPLED	SWL ELEV.	T °F	pH	eC µS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
8-27-01	89.23	N/T	N/T	N/T	N/T	0.09U	0.495U	0.00058
5-01-02	89.35	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
12-04-02	90.38	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
4-13-05	90.07	N/T	N/T	N/T	N/T	0.09U	0.300U	0.0005U
ADEC METHOD TWO CLEANUP STANDARDS						1.3	1.5	0.005

MW-6 This well is approximately 100 feet north of the former tank site. The well was first sampled on August 27, 2001, which was the fifth sample event for monitoring wells MW-1 through MW-4. PHC contamination was not expected at this location and none has been detected.

- The difference from lowest to highest measured groundwater level is 1.15 feet.

SUMMARY OF ANALYTICAL RESULTS AT MW-6

DATE SAMPLED	SWL ELEV.	T °F	pH	eC µS	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
8-27-01	89.60	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
5-01-02	89.73	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
12-04-02	90.75	N/T	N/T	N/T	N/T	0.09U	0.495U	0.0005U
4-13-05	90.46	N/T	N/T	N/T	N/T	0.09U	0.3U	0.0005U
ADEC METHOD TWO CLEANUP STANDARDS						1.3	1.5	0.005

QUALITY CONTROL SUMMARY

Each sample was a discrete sample and handled according to approved sampling procedures for the analytical methods used. Samples were stored in a cooler with ice and delivered to SGS/CT&E Environmental Services, Inc. in Anchorage. The laboratory reported the samples were received in good condition and analysis of the trip blanks showed that no contamination was attributable to shipping or field handling. Several surrogate recoveries in rounds 5 and 7 were biased due to matrix interference but the production sample results were not affected. Overall, quality assurance/quality control criteria were in compliance with ADEC and/or the laboratory's Quality Assurance Program Plan.

DISCUSSION

Evaluation of analytical results shows contamination is present in soil and groundwater at the site and the contamination levels exceed the current regulatory standards. The contamination in groundwater extends to the southeast, across Candlelight Drive ROW, at levels that exceed the cleanup standards. In addition to the two diesel fuel releases described in the December 22, 1999 report, analytical results from the last four sample rounds indicate the site was impacted by gasoline release(s). So far, we have not determined whether the gasoline contamination is from an on-site or off-site source.

- The three highest GRO and benzene concentrations were detected at MW-4 in May 2000, September 2000, and January 2001.
- The highest DRO concentration was detected at MW-2 in May 2000.
- The bulk of contamination mass is related to DRO releases, but the highest contaminant concentrations are associated with GRO release(s).
- The elevation contours and flow direction derived from the April 13, 2005 groundwater survey, shown on the Groundwater Monitoring Map, are typical for the eight sample events spanning the past 5 ½ years.

FUTURE WORK

1. Investigate possible source(s) of gasoline contamination on the subject property and up-gradient properties and ROW.
2. Model the benzene, GRO and DRO contamination plume.
3. Evaluate model results relative to the extent of contamination, points of compliance, and corrective action.
4. Present our results and recommendations to management at Doyle's Fuel Service.
5. Prepare a report to ADEC with modeling results, conclusions, and recommendations for additional assessment and corrective action.
6. Meet with ADEC project manager to discuss future work and schedule.
7. Develop plan and implement corrective action as appropriate.

CLOSURE

The findings and conclusions in this report describe the conditions at the time the samples were collected. The work was performed in general accordance with the standards of care and diligence normally practiced by recognized consulting firms in performing services of a similar nature. The information is, to the best of my knowledge and belief, true, accurate, and complete.

Prepared by,



Ronald T. Rozak, PE
Principal Investigator

cc: James Doyle, Doyle's Fuel Service

Attachments:

Aerial View of Vicinity
Groundwater Monitoring Map
Laboratory Analysis Reports

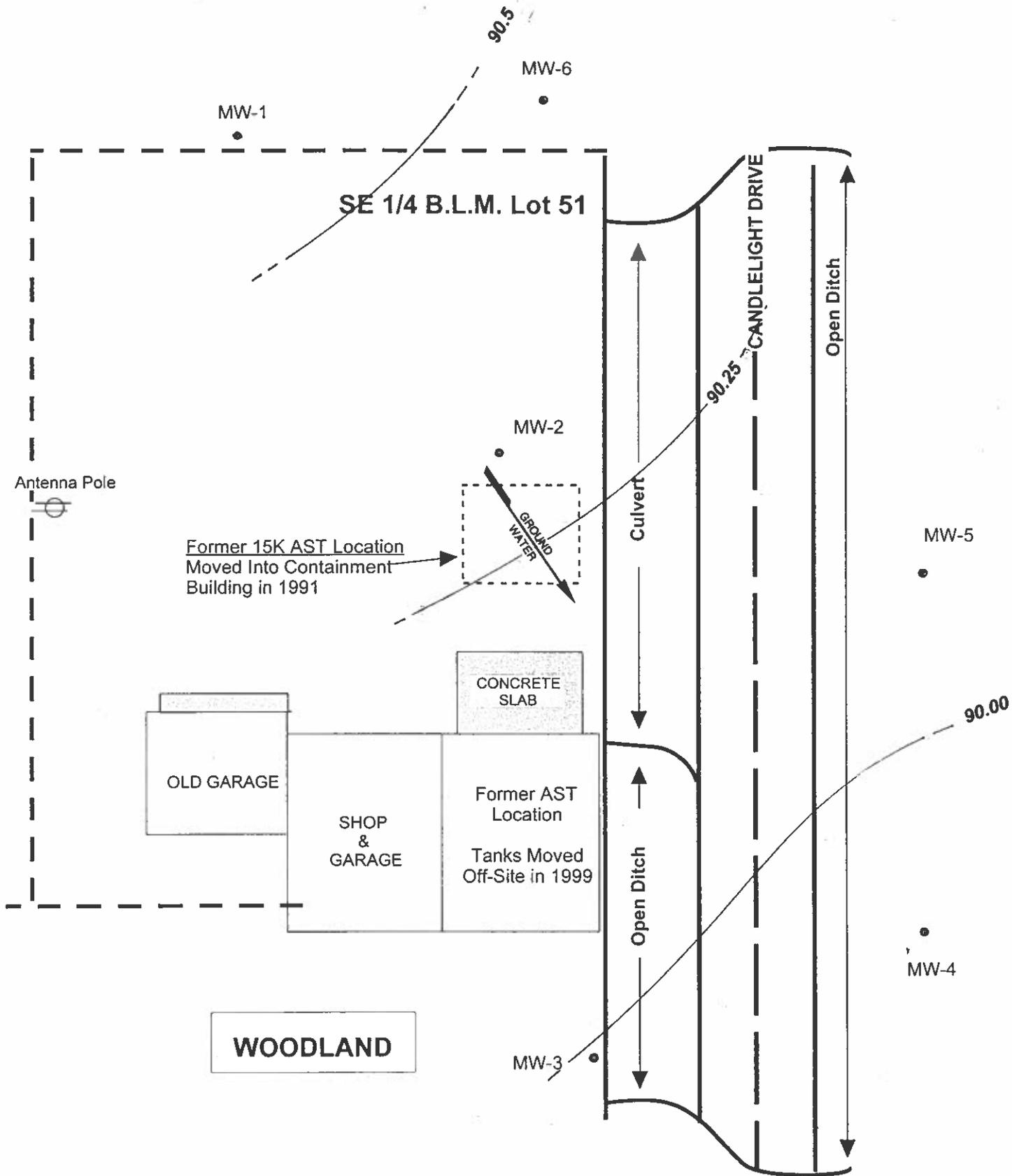


AERIAL VIEW OF VICINITY

Imagery from Quickbird Satellite, Year 2003

FORMER DOYLE'S FUEL SERVICE SITE

Arrow indicates location of former tank site



▲
N
1" = 30'

GROUNDWATER MONITORING MAP
FORMER DOYLE'S FUEL SERVICE SITE
 Groundwater contours derived from survey on April 13, 2005
 "•" at MW-1 indicates location of monitoring well #1

