GW - 80

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DANIEL B. STEPHENS & ASSOCIATES, INC.
ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Summary of Hydrogeological Investigations Conducted at the Thoreau Compressor Station July 1991 Through February 1994

Prepared for
ENRON Corp.
Houston, Texas

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EXECUTIVE SUMMARY

Daniel B. Stephens & Associates, Inc. conducted a regional and site hydrogeologic investigation at the Thoreau compressor station in 1989, based on reconnaissance and available literature. Subsequently, DBS&A conducted several more detailed site-specific hydrogeological investigations at the station from July 1991 through February 1994. The objectives of these additional investigations were to further define the extent of impacts to soil and ground water and to evaluate potential remedial actions. This report summarizes the more recent of these additional investigations, including abandonment of selected wells, a bioremediation pilot test, installation of additional soil borings and monitor wells, routine ground-water monitoring, and soil vapor extraction pilot tests. The additional soil borings and monitor wells, along with routine ground-water monitoring, defined the downgradient extent of impacted ground water. Also, information gathered from the pilot tests indicated that soil vapor extraction and enhanced bioremediation are viable technologies for remediation of the impacted soil and ground water at the Thoreau compressor station.

1. INTRODUCTION

Daniel B. Stephens & Associates, Inc. (DBS&A) was retained by ENRON Corporation in 1989 to conduct a hydrogeological investigation at the Transwestern Pipeline Company (Transwestern) Compressor Station No. 5 near Thoreau, New Mexico (subsequently referred to as the Thoreau compressor station). The objective of the initial investigation was to perform monitoring activities in accordance with a Toxic Substances Control Act (TSCA) Consent Decree (Consent Decree) between Transwestern Pipeline Company and the U.S. Environmental Protection Agency (EPA) Region VI. The primary objective of the ground-water portion of the Consent Decree was to test for the existence of PCBs. However, Transwestern expanded the work to include evaluation of the quality of ground water downgradient of a former waste disposal area.

A *Ground-Water Assessment Report* (GAR) was submitted in July 1991 in accordance with the Consent Decree. The scope of activities reported in the GAR included completion of 13 monitor wells, 11 exploratory borings, field and laboratory tests for hydrologic properties characterization, 2 geophysical surveys, and several special investigations pertaining to ground-water flow and transport. Details regarding these investigations can be found in the GAR (DBS&A, 1991). Also, results of an earlier investigation at the Thoreau site, which included installation of 11 monitor and test wells, had been previously reported by DBS&A (1990).

A number of additional investigations have been undertaken since the GAR was issued, primarily for the purpose of further characterizing impacts to ground water and obtaining information to assess the need for and assist with design of a remedial system. The purpose of this report is to summarize all hydrogeologic investigations completed at the Thoreau compressor station since the GAR was submitted. The additional activities performed at the site include:

- abandonment of deep regional test wells
- a bioremediation pilot test
- installation of additional exploratory borings and monitor wells
- ongoing evaluation of water levels, hydraulic gradients, and water quality

- soil vapor extraction pilot tests on several wells

Sections 2 through 6 of this report summarize each of these activities, respectively.

1.1 Site Description

The Thoreau compressor station is located approximately 1.5 miles north-northwest of Thoreau, New Mexico in McKinley County, as shown on Figure 1. The area investigated includes both the Transwestern property and Navajo Tribal land that borders the station on its south and east sides. All monitor wells and soil borings that have been completed by DBS&A at the station are shown on Figure 2, and a summary of completion information for monitor wells and soil borings is included as Table 1.

The land surface at the station slopes gently to the south and is sparsely vegetated with native grasses, juniper, and piñon pine. The land surface elevation is about 7300 feet above mean sea level (fmsl). The station is located on the north side of a broad east-west trending valley just east of the continental divide. The Zuni Mountains to the south rise to about 9100 feet, and the prominent cliffs of the Owl Rock escarpment define the northern edge of the valley. No well defined surface drainages cross the station.

1.2 Site Hydrogeology

The station is situated on the southern end of the San Juan Structural Basin within the Colorado Plateau physiographic province. The area is within the Zuni uplift element of the basin, a northwest-southeast trending, forested upland where Precambrian rocks are exposed and the Permian and younger strata dip to the north away from the uplift.

The Chinle Formation is the principal bedrock underlying the station. The Chinle Formation is comprised mostly of red claystones and mudstones and is roughly 1000 to 1300 feet thick. In addition, there is a middle Chinle Formation member, called the Sonsela sandstone, that is approximately 90 to 130 feet thick at a depth of approximately 650 feet below the station. The Sonsela sandstone is the shallowest aquifer that is used as a water supply in the Thoreau area.

The upper part of the Chinle Formation in the vicinity has been eroded so that its surface generally slopes southward and nearly opposite to the dip of the formation. The Chinle Formation is overlain by 30 to more than 75 feet of alluvium over most of the station and surrounding area.

The alluvium consists of reddish brown, silty sand that is fine- to very fine-grained, moderately to well sorted, with thin silty interbeds. Approximately 1 to 5 feet of weathered, sandy clay mark the transition between the surficial alluvium and underlying Chinle Formation.

Perched ground water is present in the alluvium on top of the Chinle Formation. The perched zone is approximately 10 to 15 feet thick over most of the site, with the thickness increasing locally due to the presence of paleochannels that eroded the top of the Chinle Formation. The depth to perched ground water is approximately 45 to 50 feet below ground surface (bgs) at the southern part of the Thoreau compressor station and increases to the south to approximately 65 feet bgs in monitor well 5-58B (Figure 2). Results of previous hydraulic testing at the site indicated that the perched ground water has an average hydraulic conductivity of approximately 10^{-4} centimeters per second (cm/sec). The average hydraulic gradient at the site is approximately 0.04 feet per foot (ft/ft) to the south. Assuming an effective porosity of 0.12, ground water flows at an average velocity of approximately 3.3×10^{-5} cm/sec or 34 feet per year.

2. WELL ABANDONMENT

In March 1992, several dry monitor wells (5-7B, 5-8B, 5-25B, 5-26B, and 5-27B) and two deep test wells (5-1A and 5-3A) that were installed under the terms of the EPA Consent Decree were abandoned. The deep test and shallow alluvial wells were originally installed in the Chinle Formation to evaluate potential impacts to ground water resulting from potential release of PCBs in the former waste pit (Figure 2). Routine ground-water sampling revealed that subsurface impacts were limited to the perched water on top of the Chinle Formation (DBS&A, 1991); thus, continued monitoring of the deep test wells was deemed unnecessary. Accordingly, the deep test wells and the dry shallow monitor wells were abandoned to eliminate potential pathways for migration of ground water from the perched system to the underlying bedrock aquifers.

Following completion of field abandonment activities in May 1992, DBS&A submitted a report to the New Mexico Oil Conservation Division (OCD) documenting abandonment procedures. A copy of the report is included in Appendix A. The following paragraphs provide a brief summary of the well abandonments, which were performed by Ward Drilling Company of Capitan, New Mexico, with technical supervision provided by DBS&A.

The deep test wells were installed in April 1989 by Salazar Drilling Company of Grants, New Mexico under the supervision of Ground Water Resource Consultants of Tucson, Arizona. The test wells were constructed of 6-inch-diameter steel casing within a 10-inch surface casing. The 10-inch surface casing was grouted to approximately 80 feet bgs to prevent unconsolidated alluvium from sloughing into the open holes during drilling. Test well 5-3A was completed with a gravel pack from the bottom of the screened interval to the ground surface, while 5-1A was completed without a gravel pack.

The general approach for abandonment of test wells 5-1A and 5-3A involved perforating the 6-inch-diameter steel casing at 25-foot intervals with a mechanical cutting tool. A cement-bentonite grout was then pumped into the well casing and annulus through a tremie pipe set near the bottom of the zone to be grouted.

Predetermined volumes of grout were pumped into the casing until the grout reached the ground surface. Grouting was performed in several grout lifts to minimize the pressure head on the grouted interval, thus avoiding excessive grout loss to the formation. After each lift, the grout was allowed sufficient time to set up. The top of the grout surface was determined prior to adding each grout lift to the well. After the abandonment was completed, a steel plate containing the well number and the date of abandonment was welded onto the top of each casing.

Shallow monitor wells 5-7B, 5-8B, 5-25B, 5-26B, and 5-27B extended into the top of Chinle Formation but did not encounter ground water. These dry monitor wells were abandoned by filling the 2-inch polyvinyl chloride (PVC) casing with a bentonite-cement grout from the bottom up using a 1-inch PVC tremie pipe. The steel monitor well vault cover was welded in place, and a steel identification plate with the well number and abandonment date was welded to the vault cover.

3. BIOREMEDIATION PILOT TEST

A pilot test was conducted from April through December of 1992 for the purpose of investigating the feasibility of nitrate-enhanced bioremediation at the Thoreau site. Details regarding the theory of nitrate-enhanced bioremediation, the test design, and results are included in Appendix B. Lithologic logs and well completion diagrams for the pilot test wells are included in Appendix C. Summaries of soil and water chemistry data collected during the pilot test are included as Tables 2 and 3, respectively.

As discussed in Appendix B, the well configuration for the pilot test included closely spaced injection and extraction wells with a monitor well in between. Nitrate and bromide (as a tracer) were added into the injection well and were subsequently captured with the extraction well. The extraction well was pumped at a sustainable low volume rate.

During pumping, a small amount of non-aqueous phase liquid (NAPL) began pooling in the well, although NAPL had not been detected elsewhere in the site previously or subsequently. A sample of the NAPL was collected and sent to Core Laboratories in Houston, Texas for analysis. The results of the analysis, which are included in Appendix B, indicate that the NAPL sample is a complex mixture that includes approximately 170 identifiable hydrocarbons ranging from C_4 through C_{21}, with 95 percent of the hydrocarbons lying in the C_7 to C_{14} range.

The pilot test resulted in reductions in concentrations of toluene, xylene, and ethylbenzene. However, no significant reduction in benzene was observed. Consequently, the system was subsequently altered to allow for addition of oxygen (by air injection). Air injection was initiated on October 7, 1992, and proceeded until the end of the test in December 1992. The preliminary results indicated that there was an apparent reduction of benzene following the addition of air, although the test did not proceed long enough to positively evaluate the combined effects of nitrate and air addition on benzene degradation. Nevertheless, since benzene was not reduced solely by the addition of nitrate, a decision was made to pursue bioremediation that is based on aerobic degradation rather than denitrification.

4. SUPPLEMENTAL DRILLING PROGRAMS

Previous field investigations described in the GAR identified soil and ground-water impacts downgradient of the former waste disposal areas; however, the western and southern extent of the impacted area remained to be defined. Therefore, DBS&A conducted supplemental exploratory drilling and sampling programs in July through August 1992 and March 1993 to define the areal extent of hydrocarbons in the perched ground water. The location of each exploratory boring and monitor well installed during the two supplemental investigations is depicted on Figure 2. All off-site drilling locations were cleared by the Navajo Nation Archeology Department prior to commencement of drilling activities (Francisco, 1992).

The July/August 1992 program included the drilling of 19 exploratory borings in the alluvium, from which soil and ground-water samples were collected for chemical analysis. Monitor wells were installed in 3 of the 19 exploratory borings. In March 1993, 2 additional monitor wells were installed outside the downgradient plume boundary.

The 19 exploratory borings used for the collection of soil and ground-water samples in July through August 1992 were installed by Stewart Brothers Drilling Company using a Failing F-10 hollow-stem auger rig. Soil samples were collected for geologic descriptions by driving a split-spoon sampler into the undisturbed soil ahead of the borehole or by collecting samples of drill cuttings. Samples were used for geologic descriptions (Appendix C) and checked for the presence of volatile organic compounds (VOCs) using an organic vapor meter equipped with a photoionization detector (PID). All sampling equipment was decontaminated prior to use by washing with Liquinox® followed by a deionized water rinse. Drilling equipment was thoroughly steam-cleaned and inspected by on-site DBS&A personnel between each boring.

The first four borings (5-SB38, 5-SB39, 5-SB40, and 5-SB41) were drilled at predetermined locations to define the western and southern extent of BTEX and the extent of PCBs in ground water southeast of the former waste pit. Additional borings were installed to define the extent of source areas and the southern and east-west extent of organic constituents. The spacing between borings was determined based upon the measured concentrations of hydrocarbons in prior borings. For example, if ground-water concentrations were near standards, then the next boring was placed within 100 feet; conversely, if hydrocarbon concentrations were high, then a greater spacing was used.

When the augers reached the top of the water table, a split-spoon sample was collected for chemical analysis. Split-spoon samples were collected in brass rings sealed with Teflon caps, placed on ice, and delivered to Analytical Technologies, Inc. (ATI) in Phoenix for analysis. Each sample was analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH) by EPA methods 8020 and 8015 modified. Soils from exploratory borings 5-SB40 and 5-SB49 were also analyzed for polychlorinated biphenyls (PCBs) by EPA method 8080. Table 4 provides a summary of the TPH, BTEX, and PCB concentrations measured in soils submitted for chemical analysis. In addition, soil samples were collected from several exploratory borings outside the area of hydrocarbon impacts to determine natural total organic carbon content (Table 4).

After the split-spoon sample was collected from each boring, a ground-water sampling device, referred to as the *HydroPunch* by the manufacturer, was inserted into the boring to facilitate acquisition of a ground-water sample. The HydroPunch consists of a steel housing containing a disposable PVC screen. The steel housing was attached to the auger rig center rods and driven into the upper 3 to 5 feet of the saturated soils ahead of the lead auger. The sampler housing was then retracted to expose the PVC intake screen.

Ground-water samples were collected by hand with disposable Teflon bailers provided with the HydroPunch sampler. The water samples were shipped to ATI for immediate analyses for possible BTEX and TPH (C_6-C_{36}) constituents by EPA methods 8020 and 8015 modified, respectively. ATI provided DBS&A with verbal and facsimile copies of the analytical results within 24 hours of the sample collection time. Ground-water samples from 5-SB40 and 5-SB49 were also analyzed for the presence of PCBs. Table 5 provides a summary of the analytical results for the ground-water samples collected during the exploratory drilling program.

Following completion of the drilling program, 16 of the exploratory borings were abandoned by filling the hole with a cement-bentonite slurry. Three monitor wells (5-41B, 5-47B, and 5-48B) were constructed in the other three borings (those with the same numeric identification) to permit continued ground-water monitoring. The monitor wells were constructed using 15 feet of 2-inch 0.010-slot PVC screen, flush-threaded 2-inch PVC blank casing, 10-20 silica sand filter pack to about 1 foot above the screen, followed by 1 foot of 16-40 silica sand filter pack. A bentonite seal was emplaced on top of the filter pack, followed by a cement-bentonite grout to the ground surface. Two additional monitor wells (5-57B and 5-58B) of similar design were installed in March 1993 farther to the south and west of the exploratory borings (Figure 2). Construction details for all monitor wells are given in Table 1 and Appendix C.

Following well completion, each well was developed by the surge and bail method until field parameters (pH, temperature, and electrical conductivity) stabilized and the well yielded relatively sediment-free ground water. Prior to sampling, each monitor well was purged of at least three additional casing volumes to ensure that samples were representative of the perched system. Ground-water samples were then collected from the newly installed wells and analyzed for BTEX (EPA method 8020).

5. GROUND-WATER MONITORING

In addition to the hydrogeologic investigations described in the previous sections, monitoring of ground-water levels and ground-water quality is routinely conducted at the Thoreau compressor station. Ground-water monitoring was conducted on a monthly or bimonthly basis from late 1989 to April 1992. Beginning in April 1992, monitoring was conducted on a semiannual basis. However, DBS&A was not able to complete the semiannual monitoring scheduled for October 1993 because access was not granted by the Navajo Nation. This section summarizes both ground-water level and ground-water quality data.

5.1 Water Level Data

Ground-water elevation data are summarized in Table 6, and hydrographs showing ground-water elevations for each of the Thoreau monitor wells are shown in Appendix D. Because of extreme localized variations in water levels due to pumping, hydrographs from the pilot test injection and extraction wells are not included. Ground-water levels for the perched system in April 1993 are shown as Figure 3.

The ground-water elevations were determined by measuring the depth to water from a surveyed measuring point elevation (Table 1). At the same time that new monitor wells were being surveyed in September 1992, all measuring point elevations at the Thoreau station were resurveyed in order to investigate some potential discrepancies in elevations. The new survey, which tied into the nearest benchmark, indicated measuring point elevations that were slightly different than those used previously. Consequently, the ground-water elevations shown in this report vary slightly from those presented in the GAR (DBS&A, 1991). Elevations presented in this report, including the ground and measuring point elevations shown in Table 1 and the ground-water elevations shown in Figure 3 and Appendix D, are referenced to the September 1992 survey (except as noted on Table 1).

All of the hydrographs (Appendix D) show fluctuations in ground-water elevations of approximately 2 to 4 feet since the monitor wells were installed. Water levels followed a general decreasing trend until the winter of 1991 and have been increasing since that time.

5.2 Ground-Water Quality

As discussed previously, samples are currently collected at the Thoreau compressor station semiannually. Normally, BTEX samples are collected from all existing monitor wells in October and from selected wells in April. Routine ground-water monitoring also includes annual analyses for PCBs at selected wells. Additionally, selected inorganic parameters were analyzed in April 1993. The BTEX and PCB results from all sampling events are summarized in Table 7, and the results of the April 1993 inorganic analyses are summarized in Table 8. Copies of actual sample laboratory data sheets, quality assurance/quality control blank and replicate data sheets, sampling procedures, chain of custody forms, field parameters, and other supporting information are available on request.

BTEX concentrations are decreasing in many of the monitor wells at the Thoreau compressor station (Table 7). This may be due in part to natural biodegradation of BTEX in ground water. The distribution of BTEX and PCBs in ground water from the most recent sampling event (April 1993) are shown as Figures 4 though 8. Since all of the wells were not sampled in April 1993, October 1992 data are shown for the wells for which April 1993 data are not available. Figures 4 through 7 show that most of the area where BTEX concentrations exceed EPA maximum contaminant levels (MCLs) is within or just south of the compressor station boundary. However, benzene concentrations slightly in excess of MCLs extend farther to the south (Figure 4). PCB concentrations above MCLs have only been detected in two wells in the southeastern corner of the compressor station property (Figure 8).

6. SOIL VAPOR EXTRACTION PILOT TESTS

In November 1993, DBS&A conducted several short-term soil vapor extraction (SVE) pilot tests to evaluate design parameters for an SVE system. The specific objectives of the SVE pilot tests were to

- Evaluate the effective radius of influence for future SVE wells
- Determine operational flow rates and vacuum pressures
- Estimate the hydrocarbon mass removal rates
- Assess the occurrence of natural in-situ biodegradation of hydrocarbons by comparing fixed-gas ratios, such as CO_2/O_2
- Evaluate the need for future emission control systems and emission permits

The pilot SVE tests consisted of one 24-hour test (monitor well 5-34B), one 3-hour test (monitor well 5-35B), two 2-hour tests (monitor wells 5-4B and 5-5B), and one 1-hour test (monitor well 5-6B).

The pilot testing was conducted with assistance from AcuVac Remediation (AcuVac) of Houston, Texas. AcuVac transported a mobile internal combustion engine vapor treatment unit to the site and operated the unit under DBS&A's direction. The internal combustion engine draws a vacuum on the SVE wells while at the same time achieving nearly complete hydrocarbon destruction. Appendix E contains AcuVac's report on the SVE pilot tests.

During the tests, soil vapor concentrations were measured with a hand-held gas chromatograph and a Horiba auto emissions analyzer provided by AcuVac. Once soil vapor extraction rates and pressures stabilized, soil vapor samples were collected for chemical analyses. Tedlar bags were filled inside a specially designed vacuum box and delivered to Hall Environmental Analysis Laboratory of Albuquerque, New Mexico and analyzed for TPH and BTEX. Additional samples were collected in stainless steel canisters and shipped to Core Laboratories (Core) in Houston, Texas for analysis of extended refinery gasses, TPH, and BTEX.

Table 9 summarizes the concentrations of BTEX measured in the vapor samples by the two laboratories and the hand-held gas chromatograph; complete laboratory results and Horiba measurements are summarized in Appendix E. The large discrepancies among measured concentrations may result from varying collection and analysis procedures. The highest concentrations of total hydrocarbon vapors were extracted during the 3-hour SVE test conducted on monitor well 5-34B. The Horiba analyzer provided by AcuVac consistently measured total hydrocarbon concentrations of approximately 30,000 parts per million vapor during the 5-34B test.

The analytical results provided by Core were used to determine the maximum uncontrolled emissions resulting from future vapor extraction from 5-34B. The calculations suggest that the maximum uncontrolled emissions of all hydrocarbon vapors would not exceed the 10-pound per hour permitting criterion contained in the New Mexico Air Quality Control Regulations. Appendix E contains the calculated maximum emission rates from one SVE well operating at the pilot test flow rate of 22 cubic feet per second (cfm).

The results from the SVE pilot tests indicated that SVE is a viable means to remove hydrocarbon vapors from the impacted soil. The vacuum response seen in wells approximately 50 feet from the SVE test well indicate that the radii of influence are relatively large at the operational flow rates of 20 to 25 cfm. In addition, the tests indicated that natural in situ biodegradation of hydrocarbons is occurring, as evidenced by the elevated CO_2 concentrations. The operation of an SVE system should stimulate natural biodegradation of the impacted soils.

7. SUMMARY AND CONCLUSIONS

Several hydrogeologic investigations have been conducted at the Thoreau compressor station since the previous investigations were reported in July 1991. The purpose of the additional investigations was to define the extent of impacted soils and ground water and to evaluate potential remedial actions. These hydrogeologic investigations can be summarized as follows.

- Three deep test wells and four dry monitor wells were successfully abandoned in order to eliminate the potential for chemical migration within the boreholes.

- A pilot test of nitrate-enhanced bioremediation was successful in reducing concentrations of toluene, ethylbenzene, and xylene but was unsuccessful in reducing concentrations of benzene. Consequently, it was decided that air injection would be a more viable method of reducing benzene concentrations in ground water.

- Additional exploratory borings and monitor wells drilled at the site defined the downgradient and lateral extent of impacted soils and ground water. Most of the impacted area is within or just downgradient of the Thoreau compressor station boundary, but benzene concentrations slightly in excess of EPA MCLs extend further to the south.

- Routine ground-water monitoring conducted at the site indicated that BTEX concentrations are dropping in many of the monitor wells. Routine monitoring also indicated that PCBs in ground water are limited to a small area in the southeast corner of the compressor station.

- A SVE pilot test indicated that soil vapor extraction is feasible for removing hydrocarbon vapors from the vadose zone at the Thoreau compressor station.

8. REFERENCES

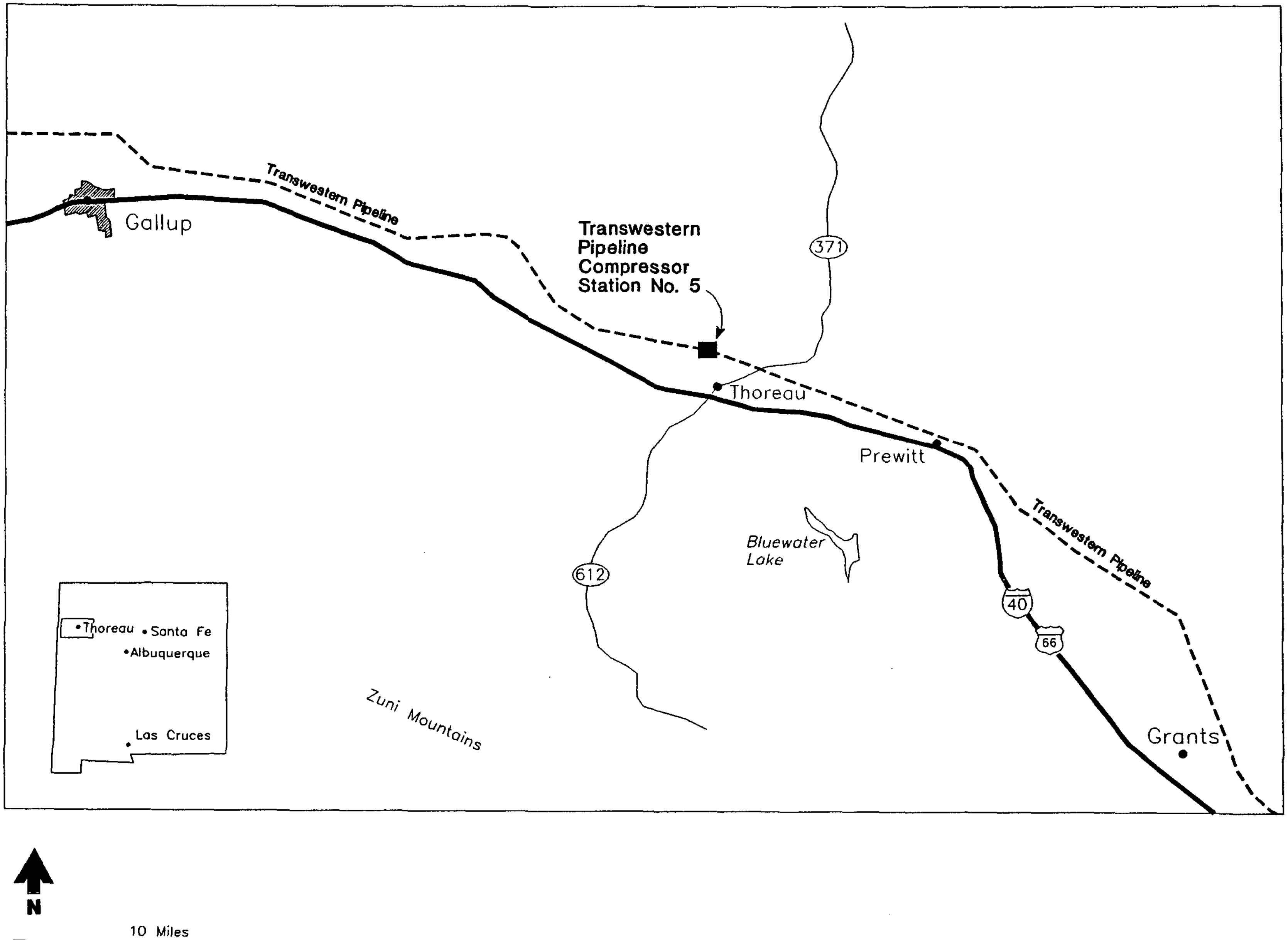
Daniel B. Stephens & Associates, Inc. (DBS&A). 1990. Hydrogeology at the Transwestern Pipeline Compressor Station No. 5, Thoreau, New Mexico. Prepared for Transwestern Pipeline Company, Houston, Texas, February 1990.

DBS&A. 1991. Ground-Water Assessment Report for Compressor Station No. 5, Thoreau, New Mexico. Prepared for Transwestern Pipeline Co., Houston, Texas, July 26, 1991.

Francisco, A.J. 1992. An Archaeological Survey of Water Testing Units at the Thoreau Compressor Station at Thoreau, McKinley County, New Mexico for the Transwestern Pipeline Company. Prepared for Edwin R. Peck, Jr., Director, Right-of-Way Agent, Transwestern Pipeline Company, Houston, Texas, December 1992.

New Mexico Oil Conservation Division (OCD). 1993. Unlined Surface Impoundment Closure Guidelines, February 1993.

FIGURES



THOREAU COMPRESSOR STATION
Regional Location Map

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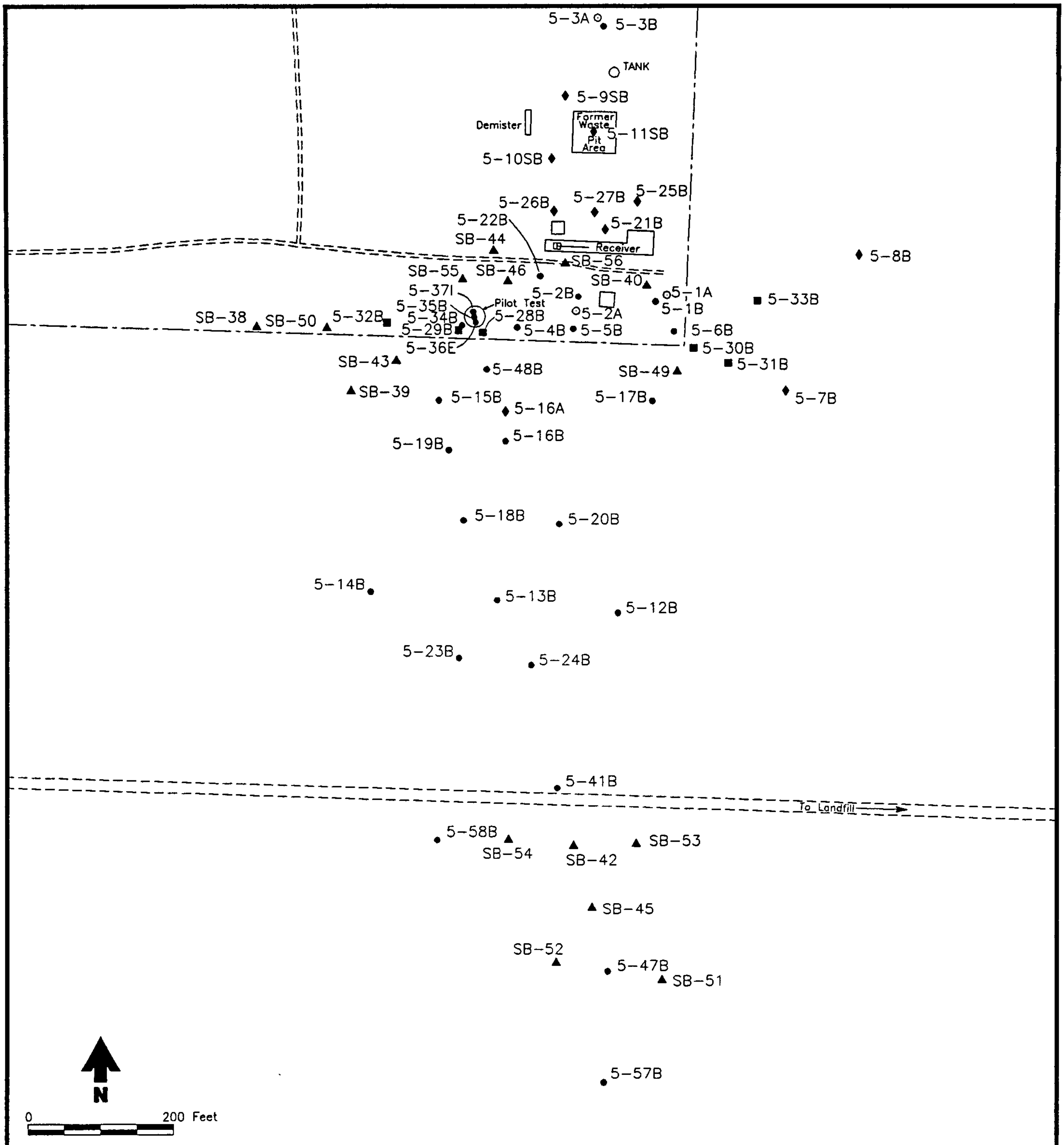
Figure 1



Explanation

- ● Monitor Well
- ==== Road
- —-— Compressor Station Boundary
- ○ Abandoned Regional Test Well
- ◆ Abandoned Monitor Wells/Exploratory Boring Drilled 1989/1990
- ■ Abandoned Exploratory Boring Drilled May 1991
- ▲ Abandoned Exploratory Boring Drilled July/August 1992

THOREAU COMPRESSOR STATION

Locations of Monitor Wells and Exploratory Borings

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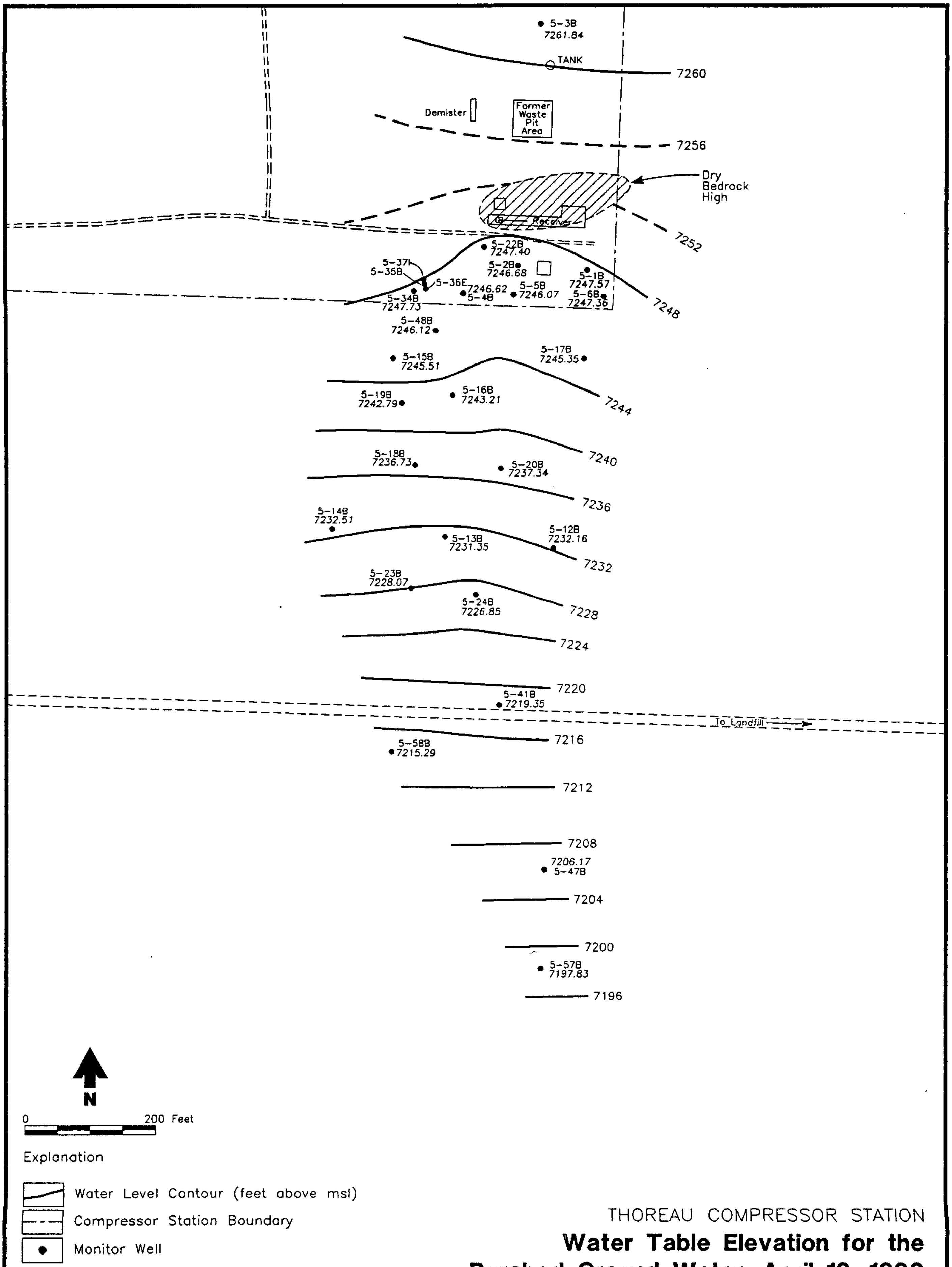
Figure 2



THOREAU COMPRESSOR STATION

Water Table Elevation for the Perched Ground Water, April 19, 1993

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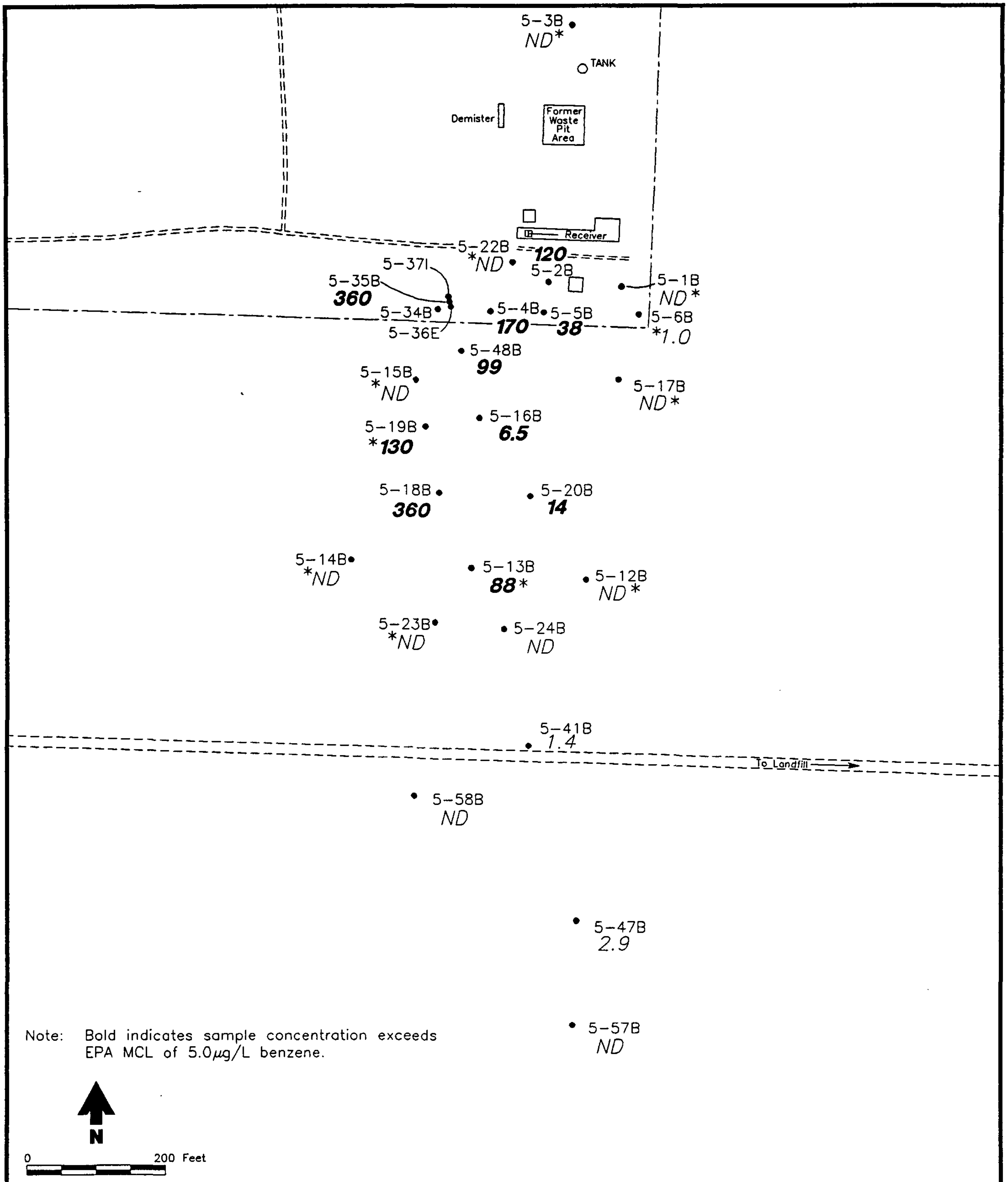
Figure 3



Note: Bold indicates sample concentration exceeds EPA MCL of 5.0µg/L benzene.

Explanation

• 82	Monitor Well Showing Benzene Concentration (µg/L) Sampled 4/93
*	Sampled 10/92
ND	Not Detected
- - -	Compressor Station Boundary

THOREAU COMPRESSOR STATION
Benzene Concentrations in Ground Water, 1992/1993

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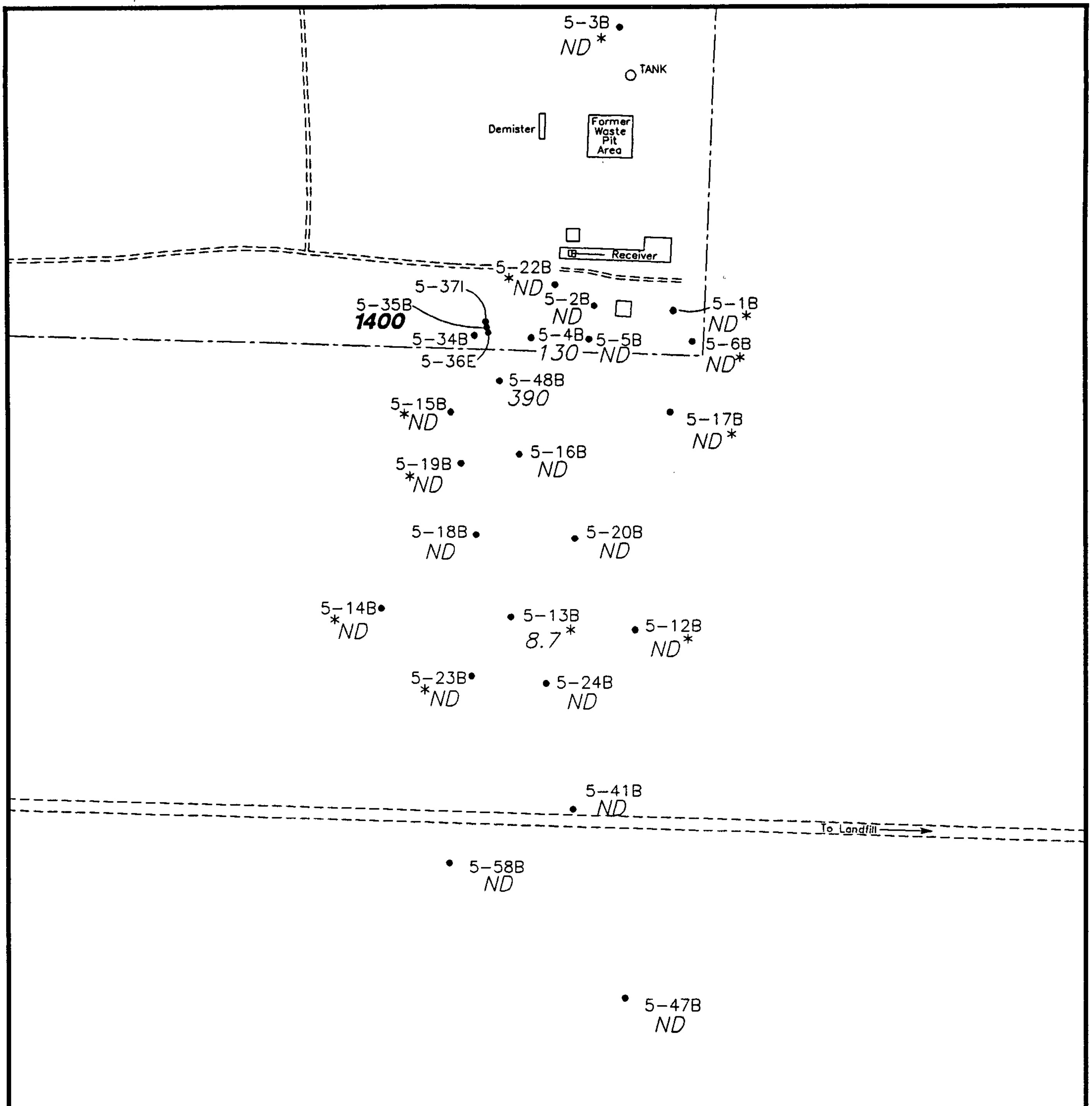
Figure 4



Note: Bold indicates sample concentration exceeds EPA MCL of 1,000 µg/L toluene.

N

0 200 Feet

Explanation

• 82	Monitor Well Showing Toluene Concentration (µg/L) Sampled 4/93
*	Sampled 10/92
ND	Not Detected
- - -	Compressor Station Boundary

THOREAU COMPRESSOR STATION
Toluene Concentrations in Ground Water, 1992/1993

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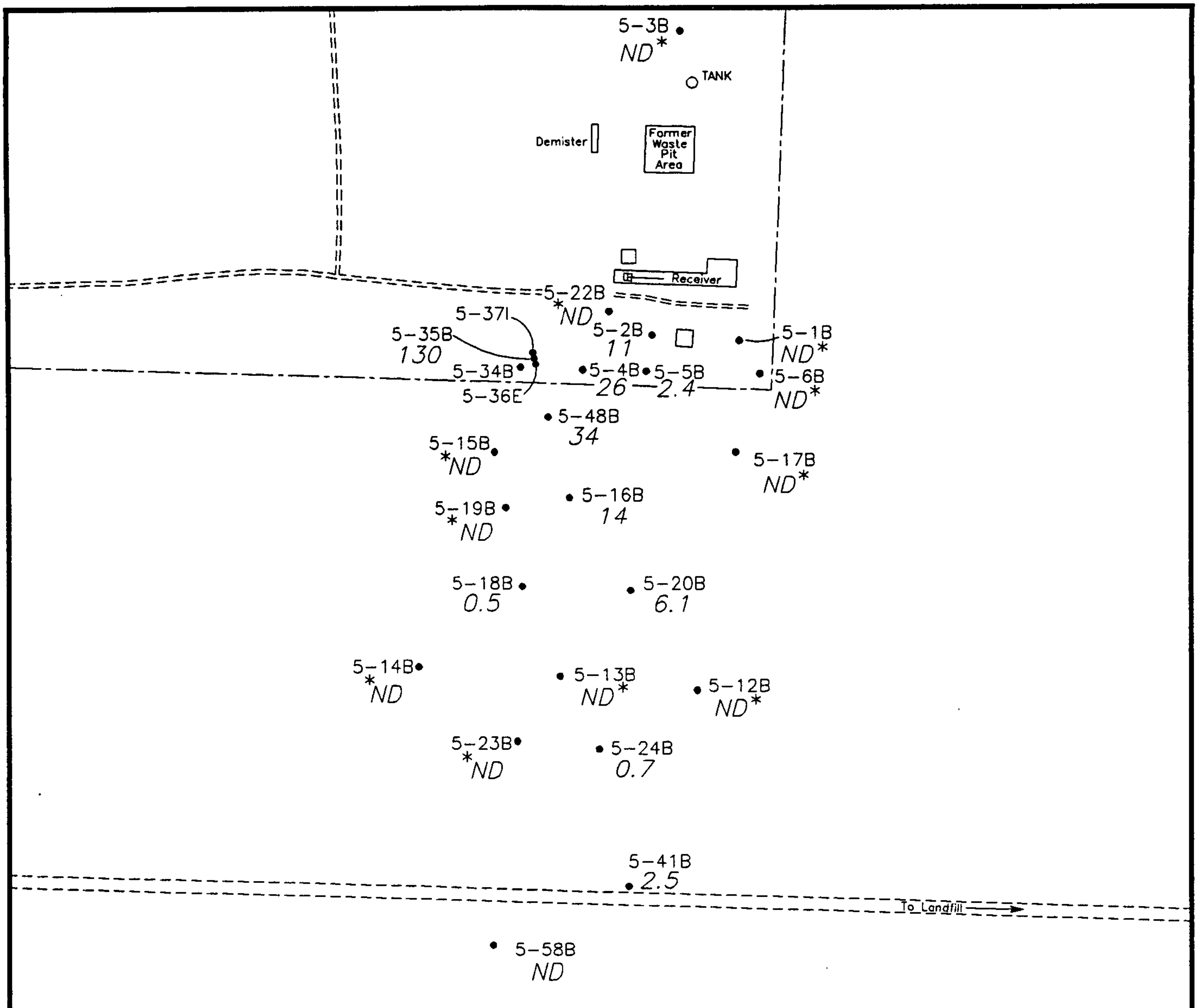
Figure 5



Note: No ethylbenzene concentrations exceed the EPA MCL of 700 μg/L.

N

0 200 Feet

Explanation

- • 82 Monitor Well Showing Ethylbenzene Concentration (μg/L) Sampled 4/93
- * Sampled 10/92
- ND Not Detected
- Compressor Station Boundary

THOREAU COMPRESSOR STATION
Ethylbenzene Concentrations In Ground Water, 1992/1993

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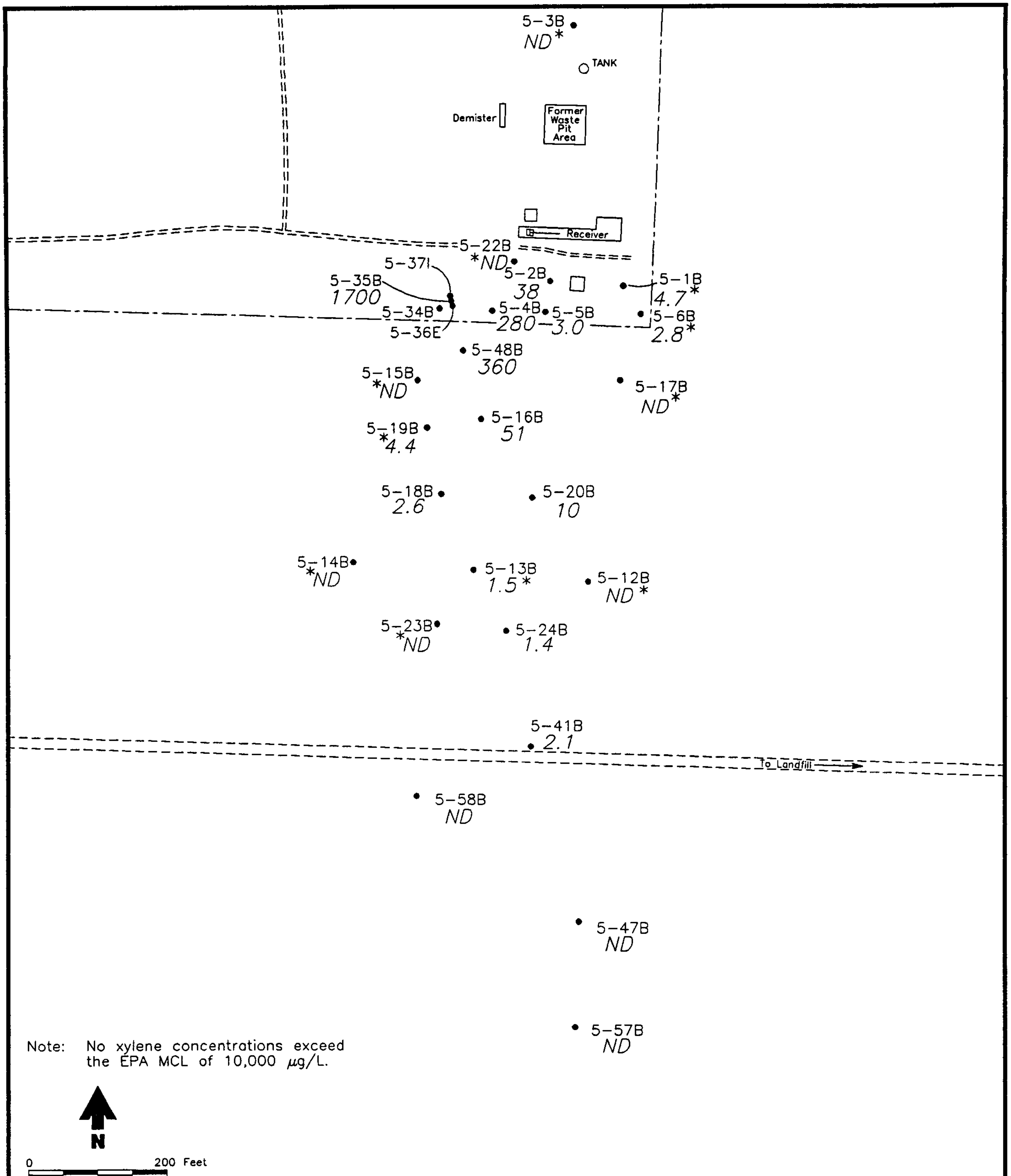
2-94 JN 2105

Figure 6



Note: No xylene concentrations exceed the EPA MCL of 10,000 μg/L.

Explanation

• 82	Monitor Well Showing Xylene Concentration (μg/L) Sampled 4/93
*	Sampled 10/92
ND	Not Detected
— - —	Compressor Station Boundary

THOREAU COMPRESSOR STATION

Xylene Concentrations in Ground Water, 1992/1993

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2-94

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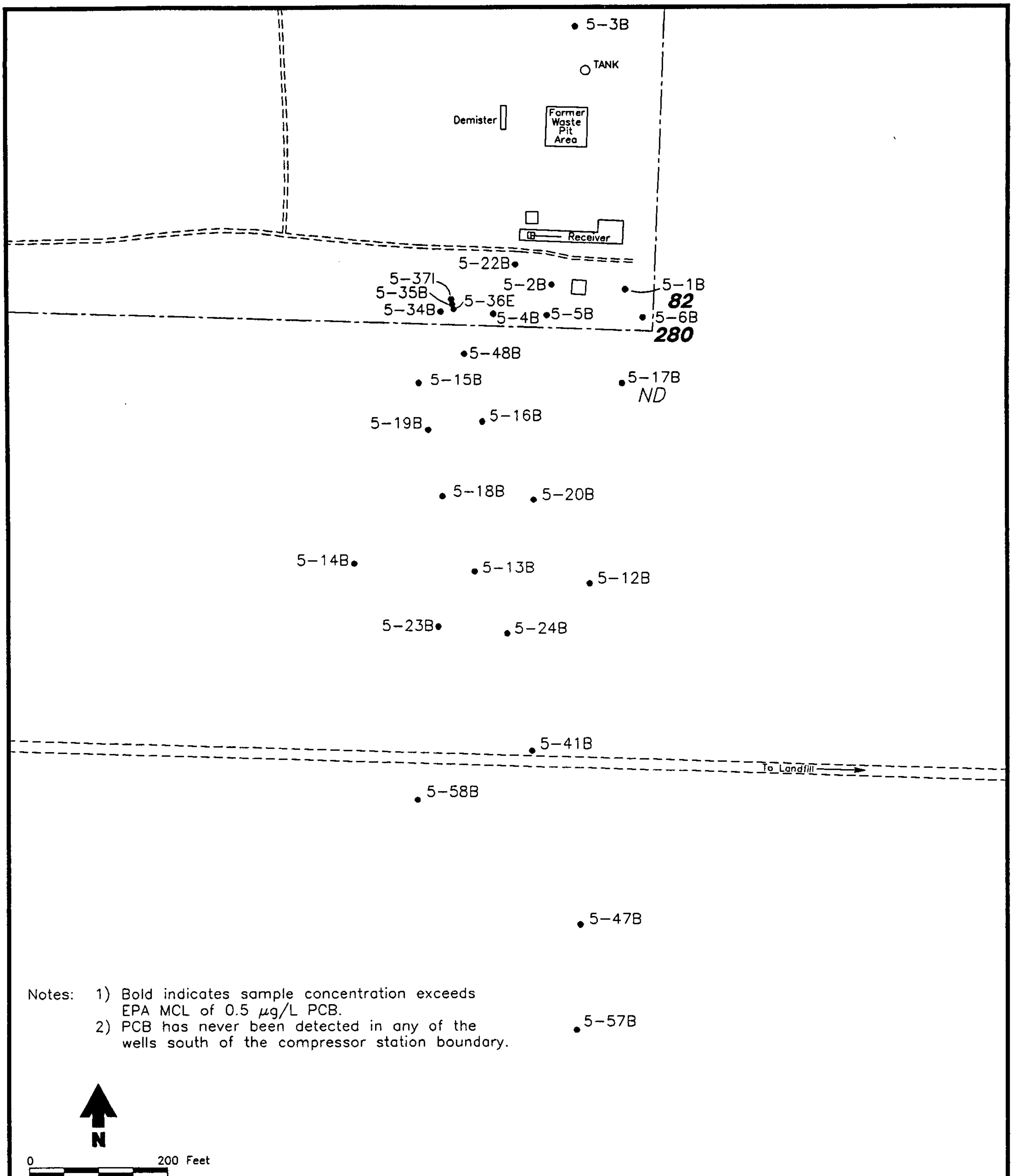
Figure 7



Notes: 1) Bold indicates sample concentration exceeds EPA MCL of 0.5 μg/L PCB.
2) PCB has never been detected in any of the wells south of the compressor station boundary.

Explanation

- 5-18 Monitor Well
- 5-18 **82** Monitor Well Showing Total PCB Concentration (μg/L) Sampled 10/92
- *ND* Not Detected
- Compressor Station Boundary

THOREAU COMPRESSOR STATION

Total PCB Concentrations In Ground Water, October 1992

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Figure 8

TABLES

Table 1. Inventory of Monitor Wells and Soil Borings
Thoreau Compressor Station
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Boring Number	Boring Type[1]	Location[2] X (feet)	Location[2] Y (feet)	Surface Elevation[3] (fmsl)	Measuring Point Elevation (fmsl)	Date of Completion	Total Depth (feet)	Casing Diameter (inches)	Formation of Completion[4]	Screened Interval (feet bgs)
5-01A	ATW	-20.48	60.72	7289.72*	7289.72*	04/11/89	690.0	6	TRC	627.1 - 667.1
5-01B	MW	-35.22	52.73	7290.82	7290.53	05/16/89	53.0	2	QAL	38.0 - 51.5
5-02A	ATW	-147.51	45.61	7290.40*	7290.40*	04/18/89	450.0	6	TRC	415.2 - 435.2
5-02B	MW	-145.02	58.60	7292.41	7292.06	05/12/89	55.5	2	QAL	37.5 - 51.0
5-03A	ATW	-117.91	451.79	7301.84*	7301.84*	04/17/89	450.0	6	TRC	423.8 - 443.8
5-03B	MW	-109.97	440.30	7303.98	7303.76	05/11/89	58.0	2	QAL	41.0 - 54.5
5-04B	MW	-231.56	15.05	7292.80	7292.39	09/18/89	58.8	2	QAL	38.7 - 57.2
5-05B	MW	-152.20	12.86	7291.20	7290.83	09/19/89	59.5	2	QAL	39.5 - 58.0
5-06B	MW	-10.62	9.38	7289.70	7289.30	09/18/89	57.5	2	QAL	37.5 - 56.0
5-07B	AMW	139.61	-63.50	7277.23*	NA	09/27/89	32.8	2	QAL	12.8 - 32.8
5-08B	AMW	240.44	124.65	7282.39*	NA	09/25/89	37.0	2	QAL	16.2 - 36.2
5-09SB	ASB	NS	NS	NS	NA	06/21/90	46.5	NA	QAL	NA
5-10SB	ASB	NS	NS	NS	NA	06/22/90	55.5	NA	QAL	NA
5-11SB	ASB	NS	NS	NS	NA	07/06/90	26.0	NA	QAL	NA

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Table 1. Inventory of Monitor Wells and Soil Borings
Thoreau Compressor Station
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Boring Number	Boring Type[1]	Location[2] X (feet)	Location[2] Y (feet)	Surface Elevation[3] (fmsl)	Measuring Point Elevation (fmsl)	Date of Completion	Total Depth (feet)	Casing Diameter (inches)	Formation of Completion[4]	Screened Interval (feet bgs)
5-12B	MW	–89.37	–387.48	7280.13	7279.61	06/28/90	65.0	2	QAL	45.0 - 65.0
5-13B	MW	–261.04	–369.35	7283.14	7282.43	06/28/90	69.4	2	QAL	49.3 - 69.4
5-14B	MW	–441.25	–357.23	7286.42	7285.76	06/27/90	72.3	2	QAL	42.3 - 72.3
5-15B	MW	–344.34	–87.47	7293.51	7292.92	06/29/90	65.6	2	QAL	45.6 - 65.6
5-16A	ASB	–244.80	–91.72	7288.40*	NA	07/05/90	64.8	NA	QAL	NA
5-16B	MW	–248.38	–145.56	7289.26	7288.82	07/05/90	64.6	2	QAL	34.6 - 64.6
5-17B	MW	–40.96	–88.53	7285.19	7284.75	07/03/90	63.9	2	QAL	33.9 - 63.9
5-18B	MW	–309.06	–256.43	7287.05	7286.41	07/09/90	69.9	2	QAL	49.9 - 69.9
5-19B	MW	–330.24	–157.69	7291.01	7290.52	07/10/90	63.3	2	QAL	43.3 - 63.3
5-20B	MW	–172.12	–261.92	7285.21	7284.60	07/11/90	64.0	2	QAL	33.9 - 63.9
5-21B	ASB	–107.59	159.62	7289.32*	NA	09/19/90	26.0	NA	QAL	NA
5-22B	MW	–198.69	88.16	7293.72	7292.74	09/13/90	55.8	2	QAL	45.8 - 55.8
5-23B	MW	–315.67	–450.52	7283.42	7282.63	09/21/90	80.1	2	QAL	50.1 - 80.1
5-24B	MW	–211.48	–460.67	7280.19	7279.18	09/25/90	75.5	2	QAL	45.5 - 75.5

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Table 1. Inventory of Monitor Wells and Soil Borings
Thoreau Compressor Station
Page 3 of 5

Boring Number	Boring Type[1]	Location[2] X (feet)	Location[2] Y (feet)	Surface Elevation[3] (fmsl)	Measuring Point Elevation (fmsl)	Date of Completion	Total Depth (feet)	Casing Diameter (inches)	Formation of Completion[4]	Screened Interval (feet bgs)
5-25B	AMW	–63.87	198.71	7289.19*	NA	12/07/90	36.0	2	QAL	26.0 - 36.0
5-26B	AMW	–177.89	185.40	7292.47*	NA	12/06/90	38.0	2	QAL	28.0 - 38.0
5-27B	AMW	–121.95	183.69	7291.28*	NA	12/11/90	54.0	2	QAL	24.0 - 54.0
5-28B	ASB	–262.30	16.40	7290.00*	NA	05/08/91	81.5	2	QAL	43.0 - 76.5
5-29B	ASB	–311.11	19.40	7291.40*	NA	05/09/91	75.5	2	QAL	45.5 - 75.5
5-30B	ASB	13.50	–5.00	7284.60*	NA	05/13/91	56.0	2	QAL	41.0 - 56.0
5-31B	ASB	60.70	–25.90	7282.80*	NA	05/14/91	51.5	2	QAL	38.5 - 51.5
5-32B	ASB	–410.00	24.90	7293.20*	NA	05/14/91	83.0	2	QAL	38.0 - 83.0
5-33B	ASB	100.40	59.60	7283.60*	NA	05/15/91	59.0	2	QAL	34.0 - 59.0
5-34B	MW	–306.80	25.97	NS	7294.71	03/31/93	65.7	4	QAL	34.0 - 64.0
5-35B	MW	–289.09	37.30	NS	7296.11	04/05/92	70.0	4	QAL	31.3 - 61.3
5-36E	MW	–287.13	30.28	NS	7296.56	04/09/92	67.5	4	QAL	47.7 - 62.3
5-37I	MW	–290.76	44.48	NS	7296.31	04/16/92	72.5	4	QAL	52.1 - 59.8
5-SB-38	ASB	–589.69	23.88	7299.75†	NA	07/21/92	50.5	NA	QAL	NA

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Table 1. Inventory of Monitor Wells and Soil Borings
Thoreau Compressor Station
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Boring Number	Boring Type[1]	Location[2] X (feet)	Location[2] Y (feet)	Surface Elevation[3] (fmsl)	Measuring Point Elevation (fmsl)	Date of Completion	Total Depth (feet)	Casing Diameter (inches)	Formation of Completion[4]	Screened Interval (feet bgs)
5-SB-39	ASB	–459.65	–64.14	7295.35†	NA	07/22/92	48.5	NA	QAL	NA
5-SB-40	ASB	–50.89	80.90	7292.27†	NA	07/23/92	43.5	NA	QAL	NA
5-41B	MW	–174.07	–603.88	7280.00	7279.73	07/24/92	77.0	2	QAL	55.0 - 72.0
5-SB-42	ASB	–151.13	–690.85	7276.47†	NA	07/28/92	62.0	NA	QAL	NA
5-SB-43	ASB	–397.32	–22.88	7295.49†	NA	07/29/92	47.0	NA	QAL	NA
5-SB-44	ASB	–262.11	130.06	7297.27†	NA	07/30/92	49.5	NA	QAL	NA
5-SB-45	ASB	–125.42	–775.63	7271.06†	NA	07/31/92	63.0	NA	QAL	NA
5-SB-46	ASB	–241.72	87.42	7294.40†	NA	08/03/92	58.5	NA	QAL	NA
5-47B	MW	–104.00	–862.86	7268.55	7268.35	08/04/92	80.0	2	QAL	59.5 - 76.5
5-48B	MW	–271.94	–34.33	7292.85	7292.64	08/05/92	63.7	2	QAL	43.0 - 60.0
5-SB-49	ASB	–9.04	–37.51	7287.05†	NA	08/06/92	44.0	NA	QAL	NA
5-SB-50	ASB	–493.09	19.91	7298.05†	NA	08/06/92	49.5	NA	QAL	NA
5-SB-51	ASB	–29.51	–874.81	7266.64†	NA	08/10/92	63.0	NA	QAL	NA
5-SB-52	ASB	–175.04	–850.80	7270.16†	NA	08/11/92	60.0	NA	QAL	NA

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Table 1. Inventory of Monitor Wells and Soil Borings
Thoreau Compressor Station
Page 5 of 5

Boring Number	Boring Type[1]	Location[2] X (feet)	Location[2] Y (feet)	Surface Elevation[3] (fmsl)	Measuring Point Elevation (fmsl)	Date of Completion	Total Depth (feet)	Casing Diameter (inches)	Formation of Completion[4]	Screened Interval (feet bgs)
5-SB-53	ASB	–64.86	–688.26	7273.32†	NA	08/12/92	65.0	NA	QAL	NA
5-SB-54	ASB	–240.89	–682.60	7279.06†	NA	08/13/92	64.0	NA	QAL	NA
5-SB-55	ASB	–304.97	89.74	7295.85†	NA	08/14/92	46.5	NA	QAL	NA
5-SB-56	ASB	–162.03	112.05	7293.39†	NA	08/14/92	47.0	NA	QAL	NA
5-57B	MW	NS	NS	7258.14‡	7257.80‡	03/04/93	76.2	2	QAL	60.0 - 75.0
5-58B	MW	NS	NS	7279.70‡	7279.38‡	03/03/93	78.1	2	QAL	61.2 - 76.2

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Table 2. Summary of Soils Analytical Results from Pilot Bioremediation Test Thoreau Compressor Station

Well No.	Date	Approximate Depth Below Land Surface (feet)	Concentration (mg/kg)									
			TPH (C_5-C_{14} range)	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-34B	03/30/92	51	17000	250	8.3	0.5	190	5	26	0.5	310	5
	03/31/92	66	7800	125	9.3	0.5	94	0.5	13	0.5	130	0.5
5-35B	04/05/92	55	ND	5	ND	0.025	0.11	0.025	ND	0.025	0.20	0.025
	04/05/92	60	650	10	1.2	0.025	9.0	5	1.7	0.025	16	5
	04/05/92	71	200	10	0.13	0.025	0.69	0.025	0.073	0.025	1.2	0.025
5-36E	04/08/92	36	10000	125	ND	0.25	26	0.25	10	0.25	130	0.625
	04/08/92	51	8800	125	0.53	0.25	53	0.25	13	0.25	150	0.25
	04/08/92	59	14000	125	11	0.625	190	1.25	22	0.625	250	1.25

TPH = Total petroleum hydrocarbons
ND = Not detected

Table 3. Summary of Ground-Water Analytical Results from Pilot Bioremediation Test
Thoreau Compressor Station
Page 1 of 3

Well No.	Date	TPH (mg/L)	Hydro-carbon Range	RL (mg/L)	Benzene (µg/L)	RL (µg/L)	Toluene (µg/L)	RL (µg/L)	Ethyl-benzene (µg/L)	RL (µg/L)	Total Xylenes (µg/L)	RL (µg/L)	Bromide (mg/L)	RL (mg/L)	Nitrate as N (mg/L)	RL (mg/L)	Nitrite as N (mg/L)	RL (mg/L)
		Concentration																
5-34B	04/01/92	360	C_5-C_{14}	10	3700	25	13000	250	580	25	6500	25	NA	NA	NA	NA	NA	NA
	08/31/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.1	0.1	.06	0.06	ND	0.06
Mixing Tank	05/12/92	27	C_5-C_{14}	1	910	50	5700	50	ND	50	3800	50	NA	NA	NA	NA	NA	NA
	05/16/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.8	0.06	NA	NA
	05/28/92	21	C_5-C_{14}	1	530	10	5300	125	41	10	3300	10	17	0.1	7.8	0.06	ND	0.06
	06/05/92	24	C_5-C_{22}	1	570	25	5300	25	40	25	2700	25	26	0.1	7.8	0.06	ND	0.06
	06/12/92	14	C_5-C_{14}	1	590	25	5900	50	83	25	2900	25	15	0.1	3.7	0.06	ND	0.06
	06/22/92	26	C_5-C_{16}	1	390	25	5300	25	43	25	2700	25	5.4	0.1	0.06	0.06	ND	0.06
	07/06/92	34	C_6-C_{22}	1	470	10	4200	50	80	10	3000	10	29	0.1	42	0.06	0.22	0.06
	07/13/92	31	C_6-C_{22}	1	410	2.5	4200	25	69	2.5	3100	25	25	0.1	34	0.06	NA	NA
	07/22/92	23	C_6-C_{22}	1	460	10	3300	100	63	10	2600	10	20	0.1	32.8	0.06	1.15	0.06
	08/04/92	38	C_6-C_{22}	1	790	10	3700	50	130	10	3600	10	11	0.1	55	0.06	0.87	0.06
	08/18/92	27	C_6-C_{22}	1	720	10	3300	25	87	10	3400	10	19	0.1	46	0.06	2.86	0.06
	08/31/92	28	C_6-C_{22}	1	610	25	3100	25	81	2.5	2900	25	23	0.1	64	0.06	2.1	0.06
	09/29/92	38	C_6-C_{22}	2	810	12.5	4400	125	230	12.5	3800	12.5	20	0.1	63	0.06	4.7	0.06
	10/07/92	31	C_6-C_{22}	1	970	5	5200	50	280	5	3600	50	20	0.1	48	0.06	4.0	0.06
	10/30/92	18	C_6-C_{22}	1	310	2.5	1300	12.5	54	2.5	1500	12.5	14	0.1	84	0.06	1.5	0.06
	11/17/92	33	C_6-C_{22}	1	610	25	4300	25	190	25	3300	25	30	0.1	40	0.06	4.9	0.06
	12/01/92	13	C_6-C_{22}	1	210	5	1000	5	36	0.5	1100	5	45	0.1	37	0.06	2.5	0.06
	12/10/92	11	C_6-C_{22}	1	130	5	840	5	31	0.5	770	5	37	0.1	40	0.06	0.29	0.06

TPH = Total petroleum hydrocarbons
RL = Reporting limit
NA = Not analyzed
ND = Not detected

Table 3. Summary of Ground-Water Analytical Results from Pilot Bioremediation Test
Thoreau Compressor Station

Well No.	Date	Concentration																
		TPH (mg/L)	Hydro-carbon Range	RL (mg/L)	Benzene (µg/L)	RL (µg/L)	Toluene (µg/L)	RL (µg/L)	Ethyl-benzene (µg/L)	RL (µg/L)	Total Xylenes (µg/L)	RL (µg/L)	Bromide (mg/L)	RL (mg/L)	Nitrate as N (mg/L)	RL (mg/L)	Nitrite as N (mg/L)	RL (mg/L)
5-35B	05/06/92	55	C_5-C_{14}	1	610	25	7600	50	480	25	4400	25	0.6	0.1	ND	0.06	ND	0.06
	05/28/92	30	C_5-C_{14}	1	530	10	6900	125	580	10	4900	10	8	0.1	ND	0.06	ND	0.06
	06/05/92	35	C_5-C_{16}	1	640	25	5900	125	530	25	4900	25	9	0.1	ND	0.06	ND	0.06
	06/12/92	21	C_5-C_{14}	1	600	25	5100	25	530	25	4800	25	8	0.1	ND	0.06	ND	0.06
	06/22/92	33	C_5-C_{16}	1	620	25	4800	25	490	25	4300	25	12	0.1	0.4	0.06	ND	0.06
	07/02/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11	0.06	2.51	0.06
	07/06/92	33	C_6-C_{22}	1	710	5	1400	12.5	170	5	3200	12.5	19	0.1	9	0.06	4.31	0.06
	07/10/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25	0.06	NA	NA
	07/13/92	27	C_6-C_{22}	1	610	25	1300	25	140	2.5	3200	25	23	0.1	19	0.06	NA	NA
	07/22/92	18	C_6-C_{22}	1	620	5	790	5	110	5	2800	5	23	0.1	19.2	0.06	0.78	0.06
	08/04/92	26	C_6-C_{22}	1	880	5	1000	5	160	5	2700	25	13	0.1	24	0.06	1.11	0.06
	08/18/92	20	C_6-C_{22}	1	930	5	1000	5	160	5	2900	5	13	0.1	21.7	0.06	6.10	0.06
	08/31/92	22	C_6-C_{22}	1	810	5	1500	50	180	5	2700	50	16	0.1	30	0.06	1.8	0.06
	09/11/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	28.8	0.06	9.8	0.06
	09/29/92	18	C_6-C_{22}	1	730	5	520	5	76	5	1600	5	19	0.1	37	0.06	4.5	0.06
	10/07/92	16	C_6-C_{22}	1	880	5	840	5	100	5	1900	5	18	0.1	34	0.06	3.8	0.06
	10/30/92	19	C_6-C_{22}	1	560	5	540	5	72	5	1500	5	18	0.1	33	0.06	1.5	0.06
	11/17/92	16	C_6-C_{22}	1	610	5	400	5	67	5	1700	5	15	0.1	27	0.06	2.9	0.06
	12/01/92	16	C_6-C_{22}	1	680	5	620	5	110	5	1600	5	19	0.1	15.8	0.06	3.4	0.06
	12/01/92[†]	16	C_6-C_{22}	1	680	5	630	5	110	5	1600	5	19	0.1	15.8	0.06	3.3	0.06
	12/10/92	15	C_6-C_{22}	1	630	10	770	10	91	10	1700	10	25	0.1	20.0	0.06	0.29	0.06

TPH = Total petroleum hydrocarbons
RL = Reporting limit

NA = Not analyzed
ND = Not detected

† Fictitious replicate

Table 3. Summary of Ground-Water Analytical Results from Pilot Bioremediation Test
Thoreau Compressor Station
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Well No.	Date	Concentration																
		TPH (mg/L)	Hydro-carbon Range	RL (mg/L)	Benzene (µg/L)	RL (µg/L)	Toluene (µg/L)	RL (µg/L)	Ethyl-benzene (µg/L)	RL (µg/L)	Total Xylenes (µg/L)	RL (µg/L)	Bromide (mg/L)	RL (mg/L)	Nitrate as N (mg/L)	RL (mg/L)	Nitrite as N (mg/L)	RL (mg/L)
5-36E	05/06/92	56	C_5-C_{14}	1	1200	25	9800	125	300	25	4100	25	0.4	0.1	ND	0.06	ND	0.06
	05/28/92	30	C_5-C_{14}	1	860	10	7600	125	360	10	4300	10	1.9	0.1	0.06	0.06	ND	0.06
	06/05/92	43	C_5-C_{18}	1	980	25	10000	125	400	25	5400	25	2.7	0.1	ND	0.06	ND	0.06
	06/12/92	23	C_5-C_{16}	1	940	25	8700	50	210	25	4300	25	3.5	0.1	ND	0.06	ND	0.06
	06/22/92	42	C_5-C_{16}	1	890	25	9200	125	260	25	4600	25	4.2	0.1	ND	0.06	ND	0.06
	07/06/92	47	C_6-C_{22}	1	690	5	5600	50	220	5	3900	50	9	0.1	2.0	0.06	2.11	0.06
	07/13/92	36	C_6-C_{22}	1	580	25	4000	25	260	2.5	3900	25	13	0.1	7.6	0.06	NA	NA
	07/22/92	38	C_6-C_{22}	1	690	10	6800	100	260	10	3600	10	13	0.1	7.9	0.06	1.03	0.06
	08/04/92	55	C_6-C_{22}	1	950	10	6200	50	340	10	4200	10	10	0.1	8.8	0.06	0.75	0.06
	08/18/92	35	C_6-C_{22}	2	970	10	6700	50	350	10	4400	10	7	0.1	10.8	0.06	2.72	0.06
	08/31/92	35	C_6-C_{22}	1	780	50	4500	50	280	50	3700	50	11	0.1	18	0.06	1.8	0.06
	09/11/92	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.4	0.06	5.1	0.06
	09/29/92	43	C_6-C_{22}	5	880	12.5	6000	125	270	12.5	3900	12.5	10	0.1	18	0.06	3.3	0.06
	10/07/92	38	C_6-C_{22}	1	1000	5	7100	50	400	5	4300	50	10	0.1	16	0.06	3.0	0.06
	10/30/92	26	C_6-C_{22}	1	830	12.5	3900	125	330	12.5	3900	12.5	12	0.1	23	0.06	1.6	0.06
	11/17/92	38	C_6-C_{22}	1	660	25	5300	25	220	25	3600	25	9	0.1	20	0.06	2.3	0.06
	12/01/92	20	C_6-C_{22}	1	630	12.5	1300	12.5	210	2.5	2900	12.5	23	0.1	20	0.06	3.5	0.06
	12/01/92†	22	C_6-C_{22}	1	690	12.5	1700	12.5	230	2.5	3000	12.5	22	0.1	19.6	0.06	2.8	0.06
	12/10/92	32	C_6-C_{22}	1	720	10	5100	25	260	10	3600	25	15	0.1	11.7	0.06	0.33	0.06
Source Tank	05/08/92	5	C_8-C_{14}	1	270	2.5	770	50	ND	2.5	830	2.5	NA	NA	NA	NA	NA	NA

TPH = Total petroleum hydrocarbons
RL = Reporting limit

NA = Not analyzed
ND = Not detected

† Fictitious replicate

Table 4. Summary of Soil Chemistry Results from July/August 1992 Exploratory Drilling Program Thoreau Compressor Station Page 1 of 2

Sample Identification	Date	Concentration (mg/kg)													Percentage of Total Organic Carbon
		TPH	Fuel Hydro-carbon Range	RL	Benzene	RL	Toluene	RL	Ethyl-benzene	RL	Total Xylenes	RL	Total PCB*	RL	
5-SB-38 @ 50-50.5'	07/21/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	0.038	0.025	NA	NA	NA
5-SB-39 @ 49-49.5'	07/22/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA
5-SB-40 @ 46-46.5'	07/23/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	ND	0.03	NA
5-SB-41 @ 60-61.5'	07/24/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01
5-SB-42 @ 62-63.5'	07/28/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01
5-SB-43 @ 47-48.5'	07/29/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA
5-SB-44 @ 49.5-51'	07/30/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA
5-SB-45 @ 63-64.5'	07/31/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	0.09
5-SB-46 @ 50-51.5'	08/03/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA
5-SB-47 @ 63-64.5'	08/04/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01

TPH = Total petroleum hydrocarbons
RL = Reporting limit
ND = Not detected
NA = Not analyzed

* Total PCB includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260

All samples analyzed by Analytical Technologies, Inc., Phoenix, Arizona

Table 4. Summary of Soil Chemistry Results from July/August 1992 Exploratory Drilling Program Thoreau Compressor Station
Page 2 of 2

Sample Identification	Date	Concentration (mg/kg)														Percentage of Total Organic Carbon
		TPH	Fuel Hydro-carbon Range	RL	Benzene	RL	Toluene	RL	Ethyl-benzene	RL	Total Xylenes	RL	Total PCB*	RL	
5-SB-48 @ 49-50.5'	08/05/92	190 74 11	C_6-C_{10} C_{10}-C_{22} C_{22}-C_{36}	5 5 5	ND	0.025	2.1	0.025	1.1	0.025	9.1	0.025	NA	NA	NA
5-SB-49 @ 45-46.5'	08/06/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	ND	0.03	<0.01
5-SB-50 @ 49-51.5'	08/06/92	ND 22	C_6-C_{22} C_{22}-C_{36}	5 5	ND	0.025	ND	0.025	ND	0.025	0.028	0.025	NA	NA	NA
5-SB-51 @ 63-64.5'	08/10/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01
5-SB-52 @ 63-64.5'	08/11/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01
5-SB-53 @ 65-66.5'	08/12/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	<0.01
5-SB-54 @ 64-65.5'	08/13/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	0.06
5-SB-55 @ 46.5-48'	08/14/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA
5-SB-56 @ 47-48.5'	08/14/92	ND	C_6-C_{36}	5	ND	0.025	ND	0.025	ND	0.025	ND	0.025	NA	NA	NA

TPH = Total petroleum hydrocarbons
RL = Reporting limit
ND = Not detected
NA = Not analyzed

* Total PCB includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260

All samples analyzed by Analytical Technologies, Inc., Phoenix, Arizona

Table 5. Summary of Water Chemistry Results from July/August 1992 Exploratory Drilling Program Thoreau Compressor Station Page 1 of 2

Sample Identification	Date	Concentration													
		TPH (mg/L)	Fuel Hydro-carbon Range	RL (mg/L)	Benzene (µg/L)	RL (µg/L)	Toluene (µg/L)	RL (µg/L)	Ethyl-benzene (µg/L)	RL (µg/L)	Total Xylenes (µg/L)	RL (µg/L)	Total PCB* (µg/L)	RL (µg/L)
5-SB-38	07/21/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-39	07/22/92	1 5 ND	C_6-C_{10} C_{10}-C_{22} C_{22}-C_{36}	1 1 1	ND	0.5	ND	0.5	ND	0.5	0.8	0.5	NA	NA
5-SB-40	07/23/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	2.5
5-SB-41	07/24/92	1 ND	C_6-C_{10} C_{10}-C_{36}	1 1	24	0.5	ND	0.5	0.6	0.5	ND	0.5	NA	NA
5-SB-42	07/28/92	ND	C_6-C_{36}	1	34	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-43	07/29/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-44	07/30/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-45	07/31/92	ND 1 ND	C_6-C_{10} C_{10}-C_{22} C_{22}-C_{36}	1 1 1	19	0.5	0.7	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-46	08/03/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-47	08/04/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-48	08/05/92	48 11 ND	C_6-C_{10} C_{10}-C_{22} C_{22}-C_{36}	1 1 1	ND	5	45	5	130	5	1400	5	NA	NA

TPH = Total petroleum hydrocarbons ND = Not detected
RL = Reporting limit NA = Not analyzed

* Total PCB includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260

All samples analyzed by Analytical Technologies, Inc., Phoenix, Arizona

Table 5. Summary of Water Chemistry Results from July/August 1992 Exploratory Drilling Program Thoreau Compressor Station

Sample Identification	Date	Concentration													
		TPH (mg/L)	Fuel Hydro-carbon Range	RL (mg/L)	Benzene (µg/L)	RL (µg/L)	Toluene (µg/L)	RL (µg/L)	Ethyl-benzene (µg/L)	RL (µg/L)	Total Xylenes (µg/L)	RL (µg/L)	Total PCB* (µg/L)	RL (µg/L)
5-SB-49	08/06/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-SB-50	08/06/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-51	08/10/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-52 @ 40'	08/11/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-52 @ 64'	08/11/92	ND	C_6-C_{36}	1	ND	0.5	0.8	0.5	ND	0.5	0.7	0.5	NA	NA
5-SB-53	08/12/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-54	08/13/92	ND	C_6-C_{36}	1	86	0.5	ND	0.5	ND	0.5	1.0	0.5	NA	NA
5-SB-55	08/14/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	ND	0.5	NA	NA
5-SB-56	08/14/92	ND	C_6-C_{36}	1	ND	0.5	ND	0.5	ND	0.5	1.3	0.5	NA	NA

TPH = Total petroleum hydrocarbons
RL = Reporting limit
ND = Not detected
NA = Not analyzed

* Total PCB includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260

All samples analyzed by Analytical Technologies, Inc., Phoenix, Arizona

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-01B	7290.53	08/29/90	44.69	7245.84
		11/08/90	44.70	7245.83
		01/08/91	44.82	7245.71
		02/05/91	44.86	7245.67
		03/05/91	44.91	7245.62
		04/10/91	44.94	7245.59
		05/21/91	45.08	7245.45
		06/18/91	45.15	7245.38
		07/23/91	45.28	7245.25
		09/04/91	45.38	7245.15
		10/02/91	45.52	7245.01
		11/06/91	45.63	7244.90
		12/10/91	45.64	7244.89
		01/09/92	45.61	7244.92
		01/27/92	45.53	7245.00
		02/20/92	45.39	7245.14
		03/18/92	45.18	7245.35
		04/29/92	44.78	7245.75
		10/06/92	43.71	7246.82
		10/14/92	43.67	7246.86
		04/19/93	42.96	7247.57
5-02B	7292.06	08/29/90	47.60	7244.46
		11/08/90	47.72	7244.34
		01/11/91	47.88	7244.18
		02/12/91	47.90	7244.16
		03/05/91	47.93	7244.13
		04/11/91	47.92	7244.14
		05/20/91	48.14	7243.92
		06/18/91	48.23	7243.83
		07/24/91	48.36	7243.70
		09/05/91	48.55	7243.51
		10/03/91	48.62	7243.44
		11/05/91	48.73	7243.33
		12/12/91	48.68	7243.38
		01/09/92	48.58	7243.48

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-02B (cont.)	7292.06	01/28/92	48.48	7243.58
		02/20/92	48.27	7243.79
		03/19/92	47.98	7244.08
		04/29/92	47.38	7244.68
		10/06/92	46.09	7245.97
		10/14/92	46.07	7245.99
		04/19/93	45.38	7246.68
		04/22/93	45.36	7246.70
5-03B	7303.76	08/29/90	43.77	7259.99
		01/07/91	44.10	7259.66
		02/12/91	44.12	7259.64
		03/05/91	44.24	7259.52
		04/10/91	44.31	7259.45
		05/21/91	44.53	7259.23
		06/18/91	44.68	7259.08
		07/23/91	44.95	7258.81
		09/04/91	45.14	7258.62
		10/02/91	45.19	7258.57
		11/05/91	45.15	7258.61
		12/10/91	44.90	7258.86
		01/09/92	44.67	7259.09
		01/27/92	44.43	7259.33
		02/19/92	44.19	7259.57
		03/17/92	43.82	7259.94
		04/28/92	43.26	7260.50
		10/06/92	42.06	7261.70
		10/07/92	42.09	7261.67
		04/19/93	41.92	7261.84
		04/20/93	41.98	7261.78
5-04B	7292.39	08/29/90	48.35	7244.04
		11/08/90	48.42	7243.97
		01/11/91	48.42	7243.97
		01/31/91	48.94	7243.45
		03/04/91	48.68	7243.71
		04/12/91	48.79	7243.60

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Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-04B (cont.)	7292.39	05/21/91	49.90	7242.49
		06/17/91	49.00	7243.39
		07/24/91	49.15	7243.24
		09/04/91	49.34	7243.05
		10/03/91	49.44	7242.95
		11/05/91	49.50	7242.89
		12/12/91	48.40	7243.99
		01/09/92	49.23	7243.16
		01/28/92	49.11	7243.28
		02/19/92	48.91	7243.48
		03/18/92	47.22	7245.17
		04/28/92	47.65	7244.74
		10/06/92	46.36	7246.03
		10/13/92	46.35	7246.04
		04/19/93	45.77	7246.62
		04/21/93	45.79	7246.60
5-05B	7290.83	08/29/90	47.50	7243.33
		11/08/90	47.25	7243.58
		01/10/91	47.14	7243.69
		02/05/91	47.20	7243.63
		03/05/91	47.20	7243.63
		04/18/91	47.34	7243.49
		05/21/91	47.44	7243.39
		06/18/91	47.52	7243.31
		07/24/91	47.69	7243.14
		09/05/91	47.83	7243.00
		10/02/91	47.54	7243.29
		11/04/91	48.02	7242.81
		12/10/91	47.94	7242.89
		01/09/92	47.87	7242.96
		01/27/92	47.74	7243.09
		02/19/92	47.58	7243.25
		03/17/92	48.43	7242.40
		04/28/92	46.61	7244.22
		10/06/92	45.39	7245.44

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Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-05B (cont.)	7290.83	10/12/92	45.37	7245.46
		04/19/93	44.76	7246.07
		04/21/93	44.75	7246.08
5-06B	7289.30	08/29/90	43.47	7245.83
		11/08/90	43.24	7246.06
		01/08/91	43.42	7245.88
		02/12/91	43.50	7245.80
		03/05/91	43.50	7245.80
		04/18/91	43.61	7245.69
		05/21/91	43.66	7245.64
		06/18/91	43.74	7245.56
		07/23/91	43.83	7245.47
		09/05/91	44.00	7245.30
		10/03/91	44.06	7245.24
		11/05/91	44.16	7245.14
		12/10/91	44.17	7245.13
		01/09/92	44.16	7245.14
		01/27/92	44.08	7245.22
		02/20/92	43.94	7245.36
		03/18/92	43.76	7245.54
		04/29/92	43.43	7245.87
		10/06/92	42.52	7246.78
		10/14/92	42.49	7246.81
		04/19/93	41.94	7247.36
5-12B	7279.61	08/14/90	48.85	7230.76
		11/15/90	48.92	7230.69
		01/09/91	48.96	7230.65
		02/13/91	49.00	7230.61
		03/07/91	49.00	7230.61
		04/12/91	49.05	7230.56
		05/22/91	49.12	7230.49
		06/19/91	49.20	7230.41
		07/25/91	49.27	7230.34
		09/16/91	49.37	7230.24
		10/09/91	49.43	7230.18

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**Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station
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Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-12B (cont.)	7279.61	01/07/92	49.49	7230.12
		04/30/92	49.07	7230.54
		10/06/92	48.27	7231.34
		10/08/92	48.28	7231.33
		04/19/93	47.45	7232.16
5-13B	7282.43	08/14/90	52.43	7230.00
		11/15/90	52.76	7229.67
		01/09/91	52.82	7229.61
		02/07/91	52.89	7229.54
		03/07/91	52.92	7229.51
		04/12/91	53.00	7229.43
		05/22/91	53.06	7229.37
		06/19/91	53.15	7229.28
		07/26/91	53.26	7229.17
		09/16/91	53.36	7229.07
		10/10/91	53.42	7229.01
		01/08/92	53.58	7228.85
		05/01/92	52.88	7229.55
		10/06/92	51.80	7230.63
		10/13/92	51.78	7230.65
		04/19/93	51.08	7231.35
5-14B	7285.76	08/14/90	55.14	7230.62
		11/14/90	55.02	7230.74
		01/09/91	55.12	7230.64
		02/07/91	55.19	7230.57
		03/07/91	55.21	7230.55
		04/12/91	55.64	7230.12
		05/22/91	55.36	7230.40
		06/19/91	55.38	7230.38
		07/25/91	55.54	7230.22
		09/16/91	55.63	7230.13
		10/09/91	55.72	7230.04
		01/06/92	55.74	7230.02
		04/30/92	55.02	7230.74
		10/06/92	53.94	7231.82

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Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-14B (cont.)	7285.76	10/08/92	53.93	7231.83
		04/19/93	53.25	7232.51
5-15B	7292.92	08/14/90	49.86	7243.06
		11/14/90	49.98	7242.94
		01/10/91	51.10	7241.82
		02/07/91	50.16	7242.76
		03/06/91	50.17	7242.75
		04/10/91	50.25	7242.67
		05/23/91	50.45	7242.47
		06/19/91	50.54	7242.38
		07/25/91	50.70	7242.22
		09/16/91	50.92	7242.00
		10/09/91	50.95	7241.97
		01/07/92	50.57	7242.35
		04/30/92	48.74	7244.18
		10/06/92	47.75	7245.17
		10/08/92	47.74	7245.18
		04/19/93	47.41	7245.51
5-16B	7288.82	08/14/90	47.21	7241.61
		11/14/90	47.46	7241.36
		01/10/91	47.60	7241.22
		02/06/91	47.62	7241.20
		03/06/91	47.63	7241.19
		04/09/91	47.73	7241.09
		05/23/91	47.87	7240.95
		06/18/91	47.91	7240.91
		07/26/91	48.04	7240.78
		09/03/91	48.17	7240.65
		10/11/91	48.30	7240.52
		11/12/91	48.34	7240.48
		12/12/91	48.22	7240.60
		01/08/92	48.11	7240.71
		02/20/92	47.76	7241.06
		03/18/92	47.43	7241.39
		04/29/92	46.89	7241.93

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-16B (cont.)	7288.82	10/06/92	45.97	7242.85
		10/13/92	45.95	7242.87
		04/19/93	45.61	7243.21
		04/20/93	45.62	7243.20
5-17B	7284.75	08/14/90	40.79	7243.96
		11/15/90	40.83	7243.92
		01/10/91	40.96	7243.79
		02/08/91	40.99	7243.76
		03/06/91	41.01	7243.74
		04/11/91	41.06	7243.69
		05/22/91	41.14	7243.61
		06/18/91	41.23	7243.52
		07/25/91	41.34	7243.41
		09/16/91	41.50	7243.25
		10/09/91	41.60	7243.15
		01/07/92	41.60	7243.15
		02/19/92	41.46	7243.29
		03/17/92	41.21	7243.54
		04/28/92	40.84	7243.91
		10/06/92	39.97	7244.78
		10/07/92	39.97	7244.78
		04/19/93	39.40	7245.35
5-18B	7286.41	08/14/90	51.67	7234.74
		08/24/90	51.68	7234.73
		11/15/90	51.60	7234.81
		01/04/91	51.66	7234.75
		02/13/91	51.76	7234.65
		03/06/91	51.79	7234.62
		04/16/91	51.90	7234.51
		06/19/91	52.05	7234.36
		07/26/91	52.21	7234.20
		09/16/91	52.35	7234.06
		10/11/91	52.41	7234.00
		01/08/92	52.40	7234.01
		05/01/92	51.38	7235.03

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-18B (cont.)	7286.41	10/06/92	50.24	7236.17
		10/13/92	50.22	7236.19
		04/19/93	49.68	7236.73
		04/22/93	49.70	7236.71
5-19B	7290.52	08/14/90	49.44	7241.08
		11/14/90	49.76	7240.76
		01/10/91	49.86	7240.66
		02/07/91	49.90	7240.62
		03/06/91	49.92	7240.60
		04/09/91	50.02	7240.50
		05/23/91	50.92	7239.60
		06/19/91	50.23	7240.29
		07/26/91	50.37	7240.15
		09/16/91	50.55	7239.97
		10/10/91	50.60	7239.92
		01/08/92	50.36	7240.16
		02/20/92	50.04	7240.48
		03/19/92	49.60	7240.92
		04/29/92	48.97	7241.55
		10/06/92	48.05	7242.47
		10/13/92	48.04	7242.48
		04/19/93	47.73	7242.79
5-20B	7284.60	08/14/90	48.50	7236.10
		01/09/91	48.70	7235.90
		02/07/91	48.79	7235.81
		03/07/91	48.80	7235.80
		04/16/91	48.88	7235.72
		05/20/91	48.92	7235.68
		06/19/91	49.02	7235.58
		07/26/91	49.13	7235.47
		09/16/91	49.25	7235.35
		10/10/91	49.32	7235.28
		01/08/92	49.36	7235.24
		05/01/92	48.48	7236.12
		10/06/92	47.61	7236.99

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-20B (cont.)	7284.60	10/12/92	47.58	7237.02
		04/19/93	47.26	7237.34
		04/21/93	47.31	7237.29
5-22B	7292.74	10/25/90	48.08	7244.66
		11/15/90	48.08	7244.66
		01/10/91	48.33	7244.41
		02/04/91	48.38	7244.36
		03/06/91	48.42	7244.32
		04/11/91	48.49	7244.25
		05/21/91	48.65	7244.09
		06/17/91	48.76	7243.98
		07/24/91	49.24	7243.50
		09/04/91	49.06	7243.68
		10/03/91	49.19	7243.55
		11/04/91	49.26	7243.48
		12/12/91	49.15	7243.59
		01/10/92	49.00	7243.74
		01/28/92	48.84	7243.90
		02/19/92	48.67	7244.07
		03/18/92	48.24	7244.50
		04/28/92	47.46	7245.28
		10/06/92	45.97	7246.77
		10/08/92	45.98	7246.76
		04/19/93	45.34	7247.40
5-23B	7282.63	10/25/90	55.78	7226.85
		11/15/90	55.75	7226.88
		01/03/91	55.90	7226.73
		02/07/91	56.20	7226.43
		03/07/91	56.02	7226.61
		04/16/91	56.08	7226.55
		05/22/91	56.14	7226.49
		06/19/91	56.17	7226.46
		07/25/91	56.28	7226.35
		09/03/91	56.38	7226.25
		10/09/91	56.47	7226.16

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-23B (cont.)	7282.63	11/11/91	56.56	7226.07
		12/13/91	56.63	7226.00
		01/07/92	56.58	7226.05
		02/18/92	56.58	7226.05
		03/17/92	56.42	7226.21
		04/30/92	56.12	7226.51
		10/06/92	55.19	7227.44
		10/09/92	55.19	7227.44
		04/19/93	54.56	7228.07
5-24B	7279.18	10/25/90	53.64	7225.54
		11/15/90	53.72	7225.46
		01/03/91	53.76	7225.42
		01/09/91	53.78	7225.40
		02/07/91	53.86	7225.32
		03/07/91	53.86	7225.32
		04/16/91	53.94	7225.24
		05/22/91	54.00	7225.18
		07/26/91	54.15	7225.03
		09/03/91	54.21	7224.97
		10/10/91	54.30	7224.88
		11/11/91	54.38	7224.80
		12/13/91	54.43	7224.75
		01/07/92	54.40	7224.78
		02/18/92	54.40	7224.78
		03/17/92	54.25	7224.93
		04/30/92	53.98	7225.20
		10/06/92	53.06	7226.12
		10/13/92	53.02	7226.16
		04/19/93	52.33	7226.85
		04/21/93	52.33	7226.85
5-34B	7294.71	05/12/92	48.62	7246.09
		05/13/92	48.60	7246.11
		05/14/92	48.58	7246.13
		06/19/92	48.18	7246.53
		07/28/92	47.88	7246.83

MP = Measuring point
msl = Mean sea level

Table 6. Summary of Ground-Water Level Data
Thoreau Compressor Station

Well ID	Measuring Point Elevation (ft above msl)	Date	Depth to Ground Water (ft below MP)	Ground-Water Elevation (ft above msl)
5-34B (cont.)	7294.71	04/19/93	46.98	7247.73
5-35B	7296.11	05/05/92	50.55	7245.56
		05/14/92	50.32	7245.79
		05/30/92	50.14	7245.97
		06/19/92	49.94	7246.17
		06/29/92	49.81	7246.30
		07/24/92	49.61	7246.50
		08/07/92	49.51	7246.60
		08/31/92	49.35	7246.76
		09/15/92	49.29	7246.82
		09/29/92	49.26	7246.85
		10/14/92	49.20	7246.91
		04/19/93	48.79	7247.32
		04/22/93	48.73	7247.38
5-41B	7279.73	10/06/92	61.03	7218.70
		10/09/92	60.99	7218.74
		04/19/93	60.38	7219.35
		04/20/93	60.40	7219.33
5-47B	7268.35	10/06/92	62.71	7205.64
		10/07/92	62.71	7205.64
		04/19/93	62.18	7206.17
		04/20/93	62.20	7206.15
5-48B	7292.64	10/06/92	46.80	7245.84
		10/12/92	46.96	7245.68
		04/19/93	46.52	7246.12
		04/21/93	46.51	7246.13
5-57B	7257.80	04/19/93	59.97	7197.83
5-58B	7279.38	04/19/93	64.09	7215.29

MP = Measuring point
msl = Mean sea level

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station
Page 1 of 22

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-01A	05/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	12/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	04/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	06/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	01/91	EH	ND	*	ND	1.0	ND	1.0	ND	1.0	ND	1.0
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
5-01B	08/89	ER	2.1[1]	*	NA	NA	NA	NA	NA	NA	NA	NA
	12/89	ER	2.0[2]	*	ND	5.0	6.3	5.0	ND	5.0	NA	NA
	03/90	ER	94[3]	*	ND	5.0	ND	5.0	ND	5.0	25	5.0
	06/90	ER	11[2]	5.0	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	08/90	AS	2.0[2]	0.1	ND	1	ND	1	ND	1	3.5	1
	11/90	EH	5.5[2]	*	ND	0.50	ND	0.50	ND	0.50	3.0	1.0
	01/91	EH	28[2]	*	ND	1.0	ND	1.0	ND	1.0	4.8	1.0

† ABB = ASEA Brown Boveri
AS = Assaigai Laboratories
ATI-A = Analytical Technologies, Inc., Albuquerque
ATI-P = Analytical Technologies, Inc., Phoenix
ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50; Aroclor 1221 = 0.50; Aroclor 1232 = 0.50; Aroclor 1242 = 0.50; Aroclor 1248 = 0.50; Aroclor 1254 = 1.0; Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-01B	02/91	EH	ND	*	1.6	0.50	ND	0.50	ND	0.50	4.6	1.0
	03/91	EH	ND	*	2.0	0.50	ND	0.50	ND	0.50	5.2	1.0
	04/91	EH	ND	*	1.2	0.50	ND	0.50	ND	0.50	3.6	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	5.4	1.0
	06/91	EH	ND	*	ND	0.50	0.63	0.50	ND	0.50	1.9	1.0
	07/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	6.0	1.0
	09/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	7.8	1.0
	10/91	ER	210[3]	50	ND	0.50	ND	0.50	ND	0.50	6.4	0.50
	11/91	ER	76[3]	50	ND	0.50	ND	0.50	ND	0.50	9.8	0.50
	12/91	ER	ND	10	ND	0.50	ND	0.50	ND	0.50	2.4	0.50
	01/09/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/27/92	ER	67[3]	40	ND	0.50	ND	0.50	ND	0.50	0.79	0.50
	02/20/92	ER	82[3]	10	ND	0.50	ND	0.50	ND	0.50	5.2	0.50
	03/18/92	ATI-P	54[3]	2.5	ND	0.5	ND	0.5	ND	0.5	3.3	0.5
	04/29/92	ATI-P	71[3]	0.5	ND	0.5	ND	0.5	ND	0.5	2.3	0.5
	10/14/92	ATI-P	82[3]	5.0	ND	0.5	ND	0.5	ND	0.5	4.7	0.5
5-02A	08/89	ER	NA	NA	ND	5.0	ND	5.0	ND	5.0	NA	NA

[†] ABB = ASEA Brown Boveri
AS = Assaigai Laboratories
ATI-A = Analytical Technologies, Inc., Albuquerque
ATI-P = Analytical Technologies, Inc., Phoenix
ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

[‡] Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-02A	12/89	ER	ND	*	ND	25	490	25	56	25	NA	NA
	01/90	ER	ND	*	42	15	210	15	24	15	NA	NA
	04/90	ABB	ND	*	48	2	150	2	32	2	290	2
5-02B	05/89	ER	ND	*	1800	200	2000	200	ND	200	NA	NA
	08/89	ER	ND	*	2500	500	4700	500	ND	500	NA	NA
	11/89	ER	ND	*	1800	250	3100	250	250	250	NA	NA
	03/90	ER	ND	*	2300	250	3800	250	ND	250	2400	250
	06/90	ER	ND	5.0	1900	250	3100	250	ND	250	2300	250
	08/90	AS	ND	0.1	1400	1	2300	1	180	1	1700	1
	11/90	EH	ND	*	1500	100	2400	100	230	100	1900	200
	01/91	EH	ND	*	600	50	730	50	110	50	940	100
	02/91	EH	ND	*	460	50	580	50	75	50	600	100
	03/91	EH	ND	*	2400	120	3300	120	290	120	2600	25
	04/91	EH	ND	*	830	50	1200	50	110	50	920	100
	05/91	EH	ND	*	830	250	1200	250	150	25	1300	50
	06/91	EH	ND	*	5.1	0.50	7.0	0.50	0.57	0.50	4.7	1.0
	07/91	EH	ND	*	400	25	600	25	49	5.0	420	10

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EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-02B	09/91	EH	ND	*	510	25	750	25	57	25	530	50
	10/91	ER	ND	*	290	10	450	10	37	10	310	10
	11/91	ER	ND	1.0	740	25	1200	25	97	25	950	25
	12/91	ER	ND	1.0	330	12	580	12	31	12	320	12
	01/09/92	ER	ND	1.0	360	25	710	25	52	25	480	25
	01/28/92	ER	ND	1.0	420	12	810	12	64	12	560	12
	02/20/92	ER	ND	*	890	25	1600	25	140	25	1200	25
	03/19/92	ATI-P	ND	0.5	910	10	2100	50	170	10	1700	10
	04/29/92	ATI-P	ND	25.0	1700	125	3800	125	240	125	2200	125
	10/14/92	ATI-P	NA	NA	800	5	700	5	74	2.5	640	2.5
	04/22/93	ATI-A	NA	NA	120	2.5	ND	0.5	11	0.5	38	0.5
5-03A	12/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	04/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	05/90	ER	ND	**	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	08/90	AS	ND	0.1	ND	1	1.6	1	ND	1	ND	1
	11/90	EH	ND	*	1.4	0.50	0.67	0.50	ND	0.50	ND	1
	01/91	EH	ND	*	ND	1.0	ND	1.0	ND	1.0	ND	1.0

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ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

[‡] Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-03A	02/91	EH	ND	*	0.76	0.50	0.79	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	1.5	0.50	0.90	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	1.2	0.50	0.74	0.50	ND	0.50	ND	1.0
	12/91	ER	ND	1.0	0.76	0.50	0.61	0.50	ND	0.50	1.0	0.50
5-03B	05/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	11/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	04/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	05/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1
	01/91	EH	ND	*	ND	0.30	ND	0.30	ND	0.30	ND	0.60
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	ND	0.50	1.4	0.50	ND	0.50	2.2	1.0
	07/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0

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ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L) Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-03B	09/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	11/91	ER	ND	0.1	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	12/91	ER	ND	0.1	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/09/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/27/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/19/92	ER	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	03/17/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	04/28/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/07/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-04B	10/89	ER	NA	NA	ND	25	ND	25	ND	25	NA	NA
	12/89	ER	ND	*	18	5.0	ND	5.0	ND	5.0	NA	NA
	01/90	ER	ND	*	21	5.0	ND	5.0	ND	5.0	NA	NA
	04/90	ER	ND	*	54	5.0	ND	5.0	7.1	5.0	110	5.0
	06/90	ER	ND	*	60	50	ND	50	ND	50	64	50
	08/90	AS	ND	0.1	63	1	9.5	1	ND	1	15	1
	11/90	EH	ND	*	25	5.0	ND	5.0	ND	5.0	ND	10

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‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50 Aroclor 1248 = 0.50
Aroclor 1221 = 0.50 Aroclor 1254 = 1.0
Aroclor 1232 = 0.50 Aroclor 1260 = 1.0
Aroclor 1242 = 0.50

** 10 times standard reporting limits

[1] Aroclor 1016 [4] Aroclor 1248
[2] Aroclor 1242 [5] Aroclor 1254
[3] Aroclor 1221

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-04B	01/91	EH	ND	*	22	0.50	1.6	0.50	0.75	0.50	5.6	1.0
	03/91	EH	ND	*	76	5.0	11	0.50	ND	0.50	5.7	1.0
	04/91	EH	ND	*	39	5.0	0.66	0.50	ND	0.50	2.9	1.0
	05/91	EH	ND	*	90	10	1.1	0.50	0.96	0.50	13	1.0
	06/91	EH	ND	*	81	5.0	21	5.0	14	5.0	87	10
	07/91	EH	ND	*	71	5.0	ND	0.5	4.5	0.50	43	1.0
	09/91	EH	ND	*	270	50	ND	1.0	6.6	1.0	54	2
	10/91	ER	ND	*	180	5.0	ND	5.0	7.8	5.0	48	5.0
	11/91	ER	ND	1.0	ND	1.2	ND	1.2	11	1.2	83	1.2
	12/91	ER	ND	1.0	100	2.5	ND	2.5	5.1	2.5	45	2.5
	01/10/92	ER	ND	1.0	53	1.2	ND	1.2	3.7	1.2	44	1.2
	01/28/92	ER	ND	1.0	48	1.2	2.8	1.2	6.5	1.2	44	1.2
	02/19/92	ER	ND	*	42	1.0	ND	1.0	3.4	1.0	39	1.0
	03/18/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	04/28/92	ATI-P	ND	0.5	86	2.5	80	2.5	60	2.5	570	2.5
	10/13/92	ATI-P	NA	NA	230	2.0	40	2.0	19	2.0	260	2.0
	04/21/93	ATI-A	NA	NA	170	5	130	5	26	5	280	25

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‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-05B	10/89	ER	ND	*	ND	5.0	ND	5.0	8.7	5.0	NA	NA
	11/89	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	NA	NA
	04/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	06/90	ER	ND	*	ND	5.0	ND	5.0	ND	5.0	ND	5.0
	08/90	AS	0.19[2]	0.1	2.5	1	ND	1	ND	1	4.6	1
	11/90	EH	2.4[2]	*	1.4	0.50	ND	0.50	ND	0.50	2.9	1.0
	01/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	0.56	0.50
	02/91	EH	ND	*	49	5.0	35	5.0	7.4	5.0	56	10
	03/91	EH	ND	*	12	0.50	1.2	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	1.3	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	4.6	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	3.8	0.50	ND	0.50	ND	0.50	ND	1.0
	07/91	EH	ND	*	0.51	0.50	ND	0.50	ND	0.50	ND	1.0
	09/91	EH	ND	*	3.0	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	ND	5.0	0.90	0.50	ND	0.50	ND	0.50	ND	0.50
	11/91	ER	ND	1.0	1.2	0.50	ND	0.50	ND	0.50	ND	0.50
	12/91	ER	ND	2.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50

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EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station
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Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-05B	01/09/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/27/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/19/92	ER	ND	**	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	03/17/92	ATI-P	ND	0.5	53	0.5	ND	0.5	11	0.5	84	0.5
	04/28/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/12/92	ATI-P	NA	NA	770	5.0	110	5.0	25	5.0	160	5.0
	04/21/93	ATI-A	NA	NA	38	0.5	ND	0.5	2.4	0.5	3.0	0.5
5-06B	10/89	ER	ND	*	15	5.0	ND	5.0	ND	5.0	NA	NA
	12/89	ER	180[3]	50	7.4	5.0	35	5.0	21	5.0	NA	NA
	01/90	ER	100[3]	20	ND	5.0	ND	5.0	8.3	5.0	NA	NA
	04/90	ER	170	*	5.3	5.0	ND	5.0	ND	5.0	120	5.0
	06/90	ER	39[2]	5.0	ND	5.0	ND	5.0	ND	5.0	19	5.0
	08/90	AS	1.1[2]	0.1	ND	1	ND	1	1.5	1	36	1
	11/90	EH	65[2]	50	1.8	0.50	ND	0.50	0.50	0.50	21	1.0
	01/91	EH	39[2]	5.0	ND	1.0	ND	1.0	ND	1.0	31	1.0
	02/91	EH	ND	*	12	0.50	2.5	0.50	ND	0.50	21	1.0
	03/91	EH	ND	*	2.0	0.50	ND	0.50	ND	0.50	5.1	1.0

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‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-06B	04/91	EH	ND	*	5.2	0.50	ND	0.50	ND	0.50	12	1.0
	05/91	EH	ND	*	7.7	0.50	ND	0.50	ND	0.50	18	1.0
	06/91	EH	ND	*	11	0.50	2.3	0.50	ND	0.50	25	2
	07/91	EH	ND	*	1.5	0.50	ND	0.50	ND	0.50	15	1.0
	09/91	EH	ND	*	3.5	0.50	ND	0.50	ND	0.50	13	1.0
	10/91	ER	250[3]	50	3.1	0.50	0.62	0.50	0.77	0.50	9.3	0.50
	11/91	ER	140[3]	100	1.4	0.50	ND	0.50	ND	0.50	6.0	0.50
	11/91	ATI	210[3]	50	2.3	0.50	ND	0.50	ND	0.50	18	0.50
	12/91	ER	270[3]	100	ND	0.50	ND	0.50	ND	0.50	5.0	0.50
	01/09/92	ER	ND	1.0	2.3	0.50	ND	0.50	ND	0.50	ND	0.50
	01/27/92	ER	190[3]	100	1.3	0.50	ND	0.50	ND	0.50	2.6	0.50
	02/20/92	ER	200[3]	5.0	1.0	0.50	ND	0.50	ND	0.50	1.2	0.50
	03/18/92	ATI-P	140[3]	2.5	0.9	0.5	ND	0.5	ND	0.5	2.3	0.5
	04/29/92	ATI-P	150[3]	0.5	1.4	0.5	ND	0.5	ND	0.5	3.6	0.5
	10/14/92	ATI-P	280[3]	5.0	1.0	0.5	ND	0.5	ND	0.5	2.8	0.5
5-12B	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0

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‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

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Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L) Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-12B	01/91	EH	ND	*	1.5	0.50	4.7	0.50	0.79	0.50	3.8	1.0
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	07/91	EH	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/07/92	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	04/30/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/08/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-13B	08/90	AS	ND	0.1	54	1	13	1	ND	1	330	1
	11/90	EH	ND	*	61	10	ND	10	ND	10	480	20
	01/91	EH	ND	*	180	5.0	17	5.0	ND	5.0	310	10
	02/91	EH	ND	*	270	10	25	10	ND	10	460	20
	03/91	EH	ND	*	240	50	ND	50	ND	50	480	100
	04/91	EH	ND	*	430	25	ND	0.50	ND	0.50	620	50

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Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

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[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-13B	05/91	EH	ND	*	290	10	ND	10	ND	10	450	20
	06/91	EH	ND	*	330	50	0.53	0.50	ND	0.50	600	100
	07/91	EH	NA	NA	97	25	0.72	0.50	ND	0.50	760	50
	10/91	ER	NA	NA	71	5.0	ND	5.0	ND	5.0	510	5.0
	01/08/92	ER	NA	NA	150	25	ND	25	ND	25	570	25
	05/01/92	ATI-P	NA	NA	76	0.5	8.0	0.5	ND	0.5	67	0.5
	10/13/92	ATI-P	NA	NA	88	0.5	8.7	0.5	ND	0.5	1.5	0.5
5-14B	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	01/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	2.8	0.50	3.2	0.50	0.53	0.50	2.0	1.0
	07/91	EH	NA	NA	0.60	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50

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[1] Aroclor 1016
[2] Aroclor 1242
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ND = Not detected
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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-14B	01/06/92	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	04/30/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/08/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-15B	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	2.1	0.50	ND	0.50	ND	0.50	ND	1.0
	01/91	EH	ND	*	ND	0.30	ND	0.30	ND	0.30	1.0	0.60
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	07/91	EH	NA	NA	ND	0.50	0.59	0.50	ND	0.50	ND	1.0
	10/91	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/07/92	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	04/30/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/08/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5

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‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-16B	08/90	AS	ND	0.1	19	1	25	1	50	1	320	1
	01/91	EH	ND	*	ND	0.30	ND	0.30	ND	0.30	ND	0.60
	02/91	EH	ND	*	320	20	46	20	170	20	860	20
	03/91	EH	ND	*	920	50	14	0.50	1.2	0.50	130	100
	04/91	EH	ND	*	92	5.0	ND	0.50	0.68	0.50	9.2	1.0
	05/91	EH	ND	*	270	12	ND	12	230	12	1100	25
	06/91	EH	ND	*	450	120	490	120	460	120	2300	250
	07/91	EH	NA	NA	260	50	140	50	400	50	2400	100
	09/91	EH	NA	NA	460	50	320	50	550	50	3600	100
	10/91	ER	NA	NA	170	50	420	50	460	50	3200	50
	11/91	ER	NA	NA	180	50	430	50	330	50	2400	50
	12/91	ER	NA	NA	140	50	490	50	360	50	2900	50
	01/08/92	ER	NA	NA	200	120	500	120	410	120	3000	120
	02/20/92	ER	ND	*	170	25	330	25	470	25	3200	25
	03/18/92	ATI-P	ND	5.0	53	10	89	10	400	10	2400	10
	04/29/92	ATI-P	ND	10.0	23	2.5	3.3	2.5	210	2.5	1000	2.5
	10/13/92	ATI-P	NA	NA	5.1	0.5	2.3	0.5	12	0.5	63	0.5

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Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-16B	04/20/93	ATI-A	NA	NA	6.5	0.5	ND	0.5	14	0.5	51	0.5
5-17B	08/90	AS	ND	0.1	ND	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	01/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	0.72	0.50	2.9	0.50	1.8	0.50	11	1.0
	07/91	EH	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/08/92	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/19/92	ER	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	03/17/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	04/28/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/07/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5

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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L)									
			Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-18B	08/90	AS	ND	0.1	1100	1	14	1	ND	1	220	1
	11/90	EH	ND	*	1900	100	ND	100	ND	100	320	200
	01/91	EH	ND	*	1300	25	ND	25	ND	25	170	25
	02/91	EH	ND	*	970	25	11	5.0	ND	5.0	170	10
	03/91	EH	ND	*	260	12	1.8	0.50	ND	0.50	23	1.0
	04/91	EH	ND	*	1000	25	ND	1.0	ND	1.0	78	2
	06/91	EH	ND	*	680	50	1.1	0.50	1.0	0.50	150	100
	07/91	EH	NA	NA	1500	25	3.0	0.50	1.5	0.50	70	1.0
	10/91	ER	NA	NA	1200	25	ND	25	ND	25	130	25
	01/08/92	ER	NA	NA	1100	25	ND	25	ND	25	88	25
	05/01/92	ATI-P	NA	NA	790	25	2.7	0.5	ND	0.5	36	0.5
	10/13/92	ATI-P	NA	NA	820	2.5	ND	0.5	1.0	0.5	36	0.5
	04/22/93	ATI-A	NA	NA	360	2.5	ND	0.5	0.5	0.5	2.6	0.5
5-19B	08/90	AS	ND	0.1	190	1	3.5	1	5.8	1	44	1
	11/90	EH	ND	*	180	10	11	10	ND	10	ND	20
	01/91	EH	ND	*	150	0.30	ND	0.30	0.60	0.30	15	0.60
	02/91	EH	ND	*	200	10	5.8	2.5	ND	2.5	14	5.0

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Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
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Aroclor 1260 = 1.0

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Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-19B	03/91	EH	ND	*	200	25	30	25	180	25	880	50
	04/91	EH	ND	*	290	25	ND	25	210	25	880	50
	05/91	EH	ND	*	240	12	ND	0.50	0.71	0.50	21	1.0
	06/91	EH	ND	*	290	25	7.5	0.50	2.2	0.50	22	1.0
	07/91	EH	NA	NA	240	25	ND	0.50	0.58	0.50	14	1.0
	10/91	ER	NA	NA	140	2.5	ND	2.5	ND	2.5	12	2.5
	01/08/92	ER	NA	NA	240	5.0	ND	5.0	ND	5.0	9.0	5.0
	02/20/92	ER	ND	*	150	2.5	ND	2.5	ND	2.5	4.2	2.5
	03/19/92	ATI-P	ND	0.5	140	5	ND	0.5	ND	0.5	5.9	0.5
	04/29/92	ATI-P	ND	0.5	190	2.5	ND	0.5	ND	0.5	4.3	0.5
	10/13/92	ATI-P	NA	NA	130	1.0	ND	0.5	ND	0.5	4.4	0.5
5-20B	08/90	AS	ND	0.1	58	1	8	1	ND	1	51	1
	11/90	EH	ND	*	180	5.0	ND	5.0	ND	5.0	12	10
	01/91	EH	ND	*	93	1.0	14	1.0	ND	1.0	23	2
	02/91	EH	ND	*	280	10	14	10	ND	10	46	20
	02/91	EH	ND	*	110	5.0	ND	5.0	ND	5.0	ND	5.0
	03/91	EH	ND	*	200	5.0	ND	5.0	ND	5.0	ND	10

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Thoreau Compressor Station

Well No.	Date	Lab†	Concentration (µg/L)									
			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-20B	04/91	EH	ND	*	180	12	ND	1.0	ND	1.0	19	2
	05/91	EH	ND	*	160	5.0	ND	5.0	ND	5.0	32	10
	06/91	EH	ND	*	300	25	1.1	0.50	ND	0.50	15	1.0
	07/91	EH	NA	NA	73	5.0	1.1	0.50	1.0	0.50	24	1.0
	10/91	ER	NA	NA	57	1.2	2.2	1.2	ND	1.2	11	1.2
	01/08/92	ER	NA	NA	31	1.2	ND	1.2	ND	1.2	6.7	1.2
	05/01/92	ATI-P	NA	NA	55	0.5	3.9	0.5	4.9	0.5	6.2	0.5
	10/12/92	ATI-P	NA	NA	52	0.5	2.7	0.5	4.4	0.5	11	0.5
	04/21/93	ATI-A	NA	NA	14	0.5	ND	0.5	6.1	0.5	10	0.5
5-22B	10/90	AS	2.2[2]	0.1	ND	1	ND	1	ND	1	ND	1
	01/91	EH	13[4]	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	04/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	06/91	EH	ND	*	1.9	0.50	5.5	0.50	13	0.50	58	1.0
	07/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0

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Aroclor 1248 = 0.50
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Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-22B	09/91	EH	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	1.0
	10/91	ER	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	11/91	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	12/91	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/10/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/28/92	ER	ND	1.0	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	02/19/92	ER	ND	*	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	03/18/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	04/28/92	ATI-P	ND	0.5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/08/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-23B	10/90	AS	30[5]	0.1	5.3	1	ND	1	ND	1	ND	1
	11/90	EH	ND	*	5.1	0.50	ND	0.50	ND	0.50	ND	1.0
	01/91	EH	ND	*	3.0	0.30	ND	0.30	ND	0.30	ND	0.60
	02/91	EH	ND	*	6.6	0.50	ND	0.50	ND	0.50	ND	1.0
	03/91	EH	ND	*	8.5	0.50	ND	0.50	ND	0.50	1.2	1.0
	04/91	EH	ND	*	5.0	0.50	ND	0.50	ND	0.50	ND	1.0
	05/91	EH	ND	*	120	5.0	ND	0.50	ND	0.50	7.5	1.0

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Aroclor 1016 = 0.50 Aroclor 1248 = 0.50
Aroclor 1221 = 0.50 Aroclor 1254 = 1.0
Aroclor 1232 = 0.50 Aroclor 1260 = 1.0
Aroclor 1242 = 0.50

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Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethylbenzene	Reporting Limit	Total Xylenes	Reporting Limit
5-23B	06/91	EH	ND	*	3.8	0.50	0.55	0.50	ND	0.50	5.7	1.0
	07/91	EH	NA	NA	2.0	0.50	ND	0.50	ND	0.50	1.3	1.0
	09/91	EH	NA	NA	2.1	0.50	ND	0.50	ND	0.50	1.1	1.0
	10/91	ER	NA	NA	1.6	0.50	ND	0.50	ND	0.50	ND	0.50
	11/91	ER	NA	NA	0.59	0.50	ND	0.50	ND	0.50	ND	0.50
	12/91	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	01/07/92	ER	NA	NA	0.65	0.50	ND	0.50	ND	0.50	ND	0.50
	02/18/92	ER	NA	NA	ND	0.50	ND	0.50	ND	0.50	ND	0.50
	03/17/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	04/30/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
	10/09/92	ATI-P	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-24B	10/90	AS	ND	0.1	63	1	ND	1	2.0	1	1.6	1
	11/90	EH	ND	*	100	5.0	ND	5.0	ND	5.0	ND	10
	01/91	EH	ND	*	40	0.50	0.55	0.50	0.74	0.50	ND	1.0
	02/91	EH	ND	*	150	5.0	16	5.0	ND	5.0	21	10
	03/91	EH	ND	*	89	2.5	9.8	2.5	ND	0.50	3.5	1.0
	04/91	EH	ND	*	230	12	ND	1.0	ND	1.0	6.3	2

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Thoreau Compressor Station

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			Total PCB‡	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-24B	05/91	EH	ND	*	4.3	0.50	ND	0.50	ND	0.50	1.3	1.0
	06/91	EH	ND	*	280	25	0.86	0.50	0.64	0.50	13	1.0
	07/91	EH	NA	NA	130	5.0	ND	0.50	ND	0.50	8.7	1.0
	09/91	EH	NA	NA	250	12	0.54	0.50	ND	0.50	12	1.0
	10/91	ER	NA	NA	140	2.5	ND	2.5	ND	2.5	ND	2.5
	11/91	ER	NA	NA	180	5.0	ND	5.0	ND	5.0	ND	5.0
	12/91	ER	NA	NA	180	5.0	ND	5.0	ND	5.0	ND	5.0
	01/07/92	ER	NA	NA	120	2.5	ND	2.5	ND	2.5	ND	2.5
	02/18/92	ER	NA	NA	140	2.5	ND	2.5	ND	2.5	ND	2.5
	03/17/92	ATI-P	NA	NA	120	5	ND	0.5	0.8	0.5	1.4	0.5
	04/30/92	ATI-P	NA	NA	100	0.5	2.1	0.5	1.4	0.5	2.2	0.5
	10/13/92	ATI-P	NA	NA	1.2	0.5	ND	0.5	0.8	0.5	0.8	0.5
	04/21/93	ATI-A	NA	NA	ND	0.5	ND	0.5	0.7	0.5	1.4	0.5
5-35B	04/22/93	ATI-A	NA	NA	360	12.5	1400	12.5	130	12.5	1700	12.5
5-41B	10/09/92	ATI-P	NA	NA	47	0.5	3.9	0.5	0.7	0.5	1.0	0.5
	04/20/93	ATI-A	NA	NA	1.4	0.5	ND	0.5	2.5	0.5	2.1	0.5

† ABB = ASEA Brown Boveri
AS = Assaigai Laboratories
ATI-A = Analytical Technologies, Inc., Albuquerque
ATI-P = Analytical Technologies, Inc., Phoenix
ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

1 Aroclor 1016
2 Aroclor 1242
3 Aroclor 1221
4 Aroclor 1248
5 Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 7. Summary of Ground-Water Analytical Results, November 1989 Through April 1993
Thoreau Compressor Station

Well No.	Date	Lab[†]	Concentration (µg/L) Total PCB[‡]	Reporting Limit	Benzene	Reporting Limit	Toluene	Reporting Limit	Ethyl-benzene	Reporting Limit	Total Xylenes	Reporting Limit
5-47B	10/07/92	ATI-P	NA	NA	1.0	0.5	ND	0.5	ND	0.5	ND	0.5
	04/20/93	ATI-A	NA	NA	2.9	0.5	ND	0.5	ND	0.5	ND	0.5
5-48B	10/12/92	ATI-P	NA	NA	380	2.5	1100	25	84	2.5	840	2.5
	04/21/93	ATI-A	NA	NA	99	12.5	390	12.5	34	12.5	360	12.5
5-57B	04/19/93	ATI-A	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5
5-58B	04/19/93	ATI-A	NA	NA	ND	0.5	ND	0.5	ND	0.5	ND	0.5

† ABB = ASEA Brown Boveri
AS = Assaigai Laboratories
ATI-A = Analytical Technologies, Inc., Albuquerque
ATI-P = Analytical Technologies, Inc., Phoenix
ER = Enseco (Rocky Mountain Analytical)
EH = Enseco (Houston)

‡ Total PCB includes Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260

* Standard reporting limits:
Aroclor 1016 = 0.50
Aroclor 1221 = 0.50
Aroclor 1232 = 0.50
Aroclor 1242 = 0.50
Aroclor 1248 = 0.50
Aroclor 1254 = 1.0
Aroclor 1260 = 1.0

** 10 times standard reporting limits

[1] Aroclor 1016
[2] Aroclor 1242
[3] Aroclor 1221
[4] Aroclor 1248
[5] Aroclor 1254

ND = Not detected
NA = Not analyzed

Table 8. Summary of Ground-Water Inorganic Chemical Results, April 1993
Thoreau Compressor Station

Well No.	Date	Concentration (mg/L)									
		Sulfate	Reporting Limit	Sulfide	Reporting Limit	Dissolved Iron	Reporting Limit	Nitrate as N	Reporting Limit	Bromide	Reporting Limit
5-02B	04/22/93	300	5	ND	1.0	2.77	0.020	NA	NA	NA	NA
5-03B	04/20/93	85	5	NA	NA	ND	0.020	NA	NA	NA	NA
5-04B	04/21/93	68	5	NA	NA	0.751	0.020	NA	NA	NA	NA
5-05B	04/21/93	140	5	NA	NA	0.208	0.020	NA	NA	NA	NA
5-16B	04/20/93	70	5	ND	1.0	0.110	0.020	NA	NA	NA	NA
5-18B	04/22/93	82	5	NA	NA	0.122	0.020	NA	NA	NA	NA
5-20B	04/21/93	56	5	NA	NA	1.08	0.020	NA	NA	NA	NA
5-24B	04/21/93	66	5	NA	NA	0.099	0.020	NA	NA	NA	NA
5-35B	04/22/93	30	5	ND	1.0	1.87	0.020	ND	0.06	0.6	0.1
5-35B*	04/22/93	29	5	ND	1.0	1.89	0.020	ND	0.06	NA	NA
5-41B	04/20/93	70	5	NA	NA	0.082	0.020	NA	NA	NA	NA
5-47B	04/20/93	59	5	NA	NA	0.748	0.020	NA	NA	NA	NA
5-48B	04/21/93	66	5	ND	1.0	0.661	0.020	0.27	0.06	NA	NA
5-57B	04/19/93	50	5	NA	NA	ND	0.020	NA	NA	NA	NA
5-58B	04/19/93	77	5	ND	1.0	ND	0.020	NA	NA	NA	NA

ND = Not detected
NA = Not analyzed

* Fictitious replicate

All samples analyzed by Analytical Technologies, Inc., Phoenix, Arizona

Table 9. Summary of BTEX Concentrations in Soil Vapor from November 1993 SVE Pilot Test Thoreau Compressor Station

Well No.	Date	Time	Laboratory	Concentration (ppmv)			
				Benzene	Toluene	Ethyl-benzene	Total Xylenes
5-35B	11/03/93	1440	Core	30	220	48	522
			HEAL	28	151	5	40.5
			GC	<0.1	>200	<5.0	77.1
	11/04/93	1230	Core	38	262	47	590
			HEAL	25	141	6	51.3
			GC	<0.1	>200	<5.0	116.2
5-34B	11/04/93	1610	Core	192	969	96	552
			HEAL	74	182	5	43.2
			GC	<0.1	>200	<5.0	106.1
5-04B	11/05/93	0950	Core	<1	31	6	76
			HEAL	2	14	2	10.3
			GC	<0.1	59.1	<5.0	44.6
5-05B	11/05/93	1215	Core	<1	2	<1	6
			HEAL	0.1	2	0.2	1.8
			GC	<0.1	<5.0	<5.0	<5.0

Core = Core Laboratories, Houston, Texas

HEAL = Hall Environmental Analysis Laboratory, Albuquerque, New Mexico, concentrations converted from µg/L to ppmv using the ideal gas law.

GC = Hand-held gas chromatograph

APPENDIX A

WELL ABANDONMENT REPORT

DANIEL B. STEPHENS & ASSOCIATES, INC.
ENVIRONMENTAL SCIENTISTS AND ENGINEERS

June 4, 1992 0388-2105-92

Mr. Bill Olson
Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87504-2088

RE: Closure of Deep Monitor Wells 5-1A and 5-3A, and Shallow Monitor Wells 5-7B, 5-8B, 5-26B and 5-27B at Transwestern Pipeline Company, Compressor Station No. 5, Thoreau, N.M.

Dear Mr. Olson:

The purpose of this letter is to describe closure (abandonment) details for Thoreau monitor wells 5-1A, 5-3A, 5-7B, 5-8B, 5-26B, and 5-27B as required by OCD correspondence dated March 12, 1992. The wells were abandoned during the period April 23 to May 7, 1992.

WELL CLOSURE PROCEDURES

For all well closure procedures described below, depth measurements were referenced from ground surface. All casing and annulus depths were made using either an electronic sounding device or a tremie pipe. All volume calculations were based on the assumption that 18.2 sacks of hydrated cement are equal to 1 cubic yard.

All neat cement grout mixtures, with the exception of monitor well 5-1A, consisted of 7.5 gallons of water and 4 pounds of bentonite per 94-lb sack of type 1 & 2 cement. This mixture yielded approximately 14.2 lb/gal of cement having a specific gravity of 1.67. The bentonite used in 5-1A was a high yield material (SUPER GEL-X); therefore, only 2 pounds of bentonite per sack of cement were added in the above-mentioned mixture.

SHALLOW MONITOR WELLS 5-7B, 5-8B, 5-26B and 5-27B

The shallow monitor wells were abandoned by filling the 2-inch PVC monitor well screen and casing from total depth to the surface with a bentonite neat cement grout. The grout was pumped from the bottom up through a 1-inch PVC tremie pipe. The steel monitor well vault cover was welded in place, and a steel identification plate with the well number and abandonment date was welded to the vault cover. Photographs of the identification plates are included in Attachment I, and well construction diagrams are included as Attachment II.

MONITOR WELL 5-1A

An attempt was made to pull the entire well casing from the borehole. However, the casing could not be pulled using two 12-ton hydraulic jacks along with jars and the rig hydraulics pulling approximately 78,000 pounds. The casing stretched 3.5 inches, indicating material had fallen in

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around the casing at depth. A tremie pipe was lowered into the casing and the total depth of the well was measured at 663.5 feet.

The tremie pipe was removed and a mechanical perforating tool was lowered in the casing to a depth of 606 feet. A total of 59 perforations measuring 5/16 inches wide by 1 3/4 inches long were cut in the casing at approximately 25-foot intervals from total depth to 27 feet below ground surface. The tremie pipe was then lowered in the casing to a depth of 645 feet, and 2.08 cubic yards (38 sacks) of cement were pumped through the tremie into the casing. Six joints of tremie pipe were removed from the casing to eliminate the possibility of cementing the tremie in the hole. The cement was allowed to set up for approximately 4 hours. The tremie was then lowered into the casing and the top of the grout was tagged at 573.5 feet. An additional 2.08 cubic yards (38 sacks) were pumped through the tremie into the casing, and the tremie was then pulled from the casing.

The following morning the tremie pipe was used to tag the top of the cement at 210 feet. A 1-inch PVC tremie pipe was lowered in the annulus between the 10.75-inch surface pipe and the 6.25-inch well casing. The tremie would not pass below 82 feet, indicating a bridge or slough in the annulus. A total of 3.7 cubic yards (68 sacks) of cement were pumped in the casing and annulus alternating between the 2.67-inch steel tremie in the casing and the 1-inch PVC tremie in the annulus. The level of cement in the annulus was kept higher than that in the casing to eliminate the possibility of diluting the annular seal with displaced formation water through the perforations. Monitor well 5-1A required a total of 7.9 cubic yards (144 sacks) to bring the level of the cement to ground surface. The surface casing was then cut off, and a steel cap with the well number and abandonment date was then welded to the top of the surface casing (see Attachment I).

MONITOR WELL 5-3A

Monitor well 5-3A was gravel packed from the bottom of the well screen to 23 feet below ground surface; therefore, no attempt was made to pull the casing. A perforating tool attached to the tool line was lowered into the casing. The total depth of the well was measured at 433.8 feet. A total of 48 perforations measuring 5/16 inches wide by 1 3/4 inches long were cut in the casing at approximately 25-foot intervals from 428 feet to 56 feet below ground surface. The perforator was then pulled from the casing.

The following morning, the tremie pipe was lowered into the casing to a depth of 424.9 feet, and 1.1 cubic yards (20 sacks) of cement were pumped in the casing through the tremie pipe from the bottom up. Five joints of tremie pipe were pulled from the casing to eliminate the possibility of cementing the tremie in the casing. The cement was allowed to set up for four hours. The tremie pipe was then lowered in the casing and the cement was measured at 332.6 feet. The tremie was elevated to 329.3 feet, and an additional 1.1 cubic yards (20 sacks) of cement were pumped in the casing through the tremie pipe from the bottom up and allowed to set up overnight.

The following morning the tremie was lowered into the casing and the cement was measured at 264.8 feet. The tremie pipe was elevated to 234.8 feet below ground surface, and 1.1 cubic yards (20 sacks) of cement were pumped through the tremie in the casing from the bottom up. The cement was allowed to set up for approximately 5.5 hours. The tremie was then lowered in the hole and the cement measured at 168 feet below ground surface. The tremie pipe was elevated in the casing to 140.4 feet, and 1.7 cubic yards (31 sacks) were pumped in the casing, bringing the grout to the surface. Monitor well 5-3A required 5 cubic yards (91 sacks) of cement to bring the level of the cement to ground surface. The surface casing was cut off, and a steel cap with the well number and abandonment date was then welded to the top of the surface casing (see Attachment I).

If you have any questions concerning these procedures or need more information, please call me.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

KCT

K.C. Thompson
Geologist

Joanne Hilton

Joanne Hilton
Project Manager

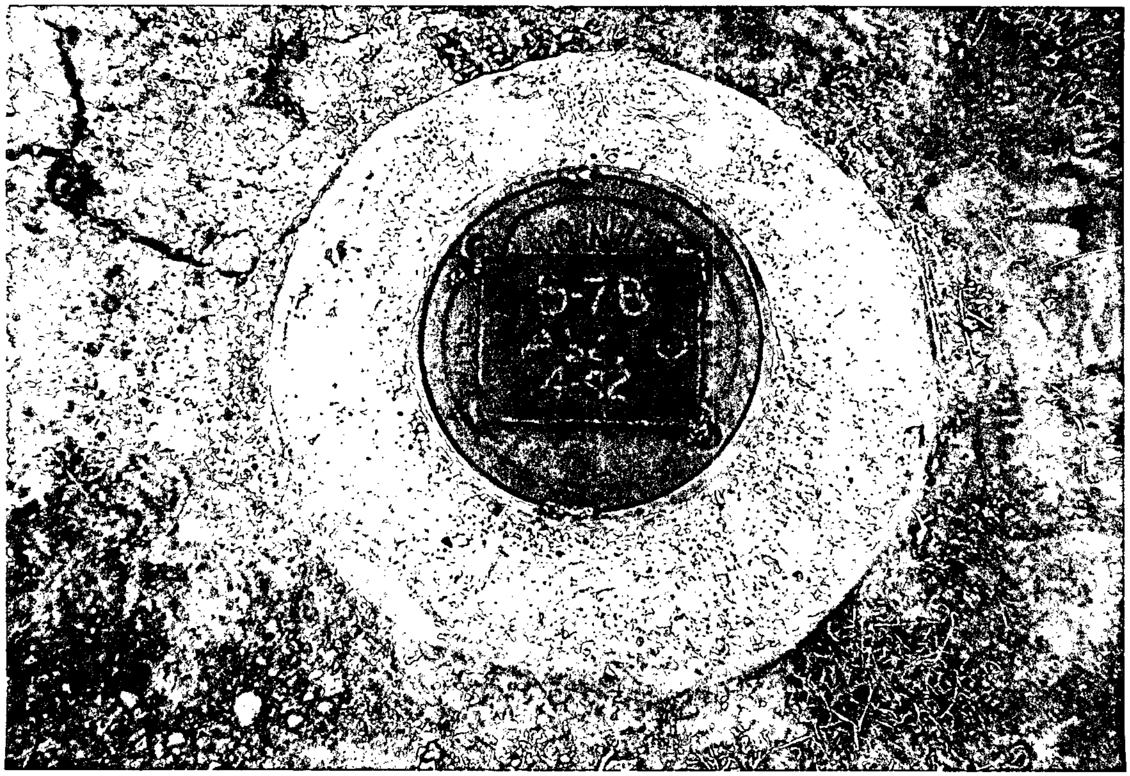
cc: Ted Ryther
Enron

ATTACHMENT I

PHOTOGRAPHS

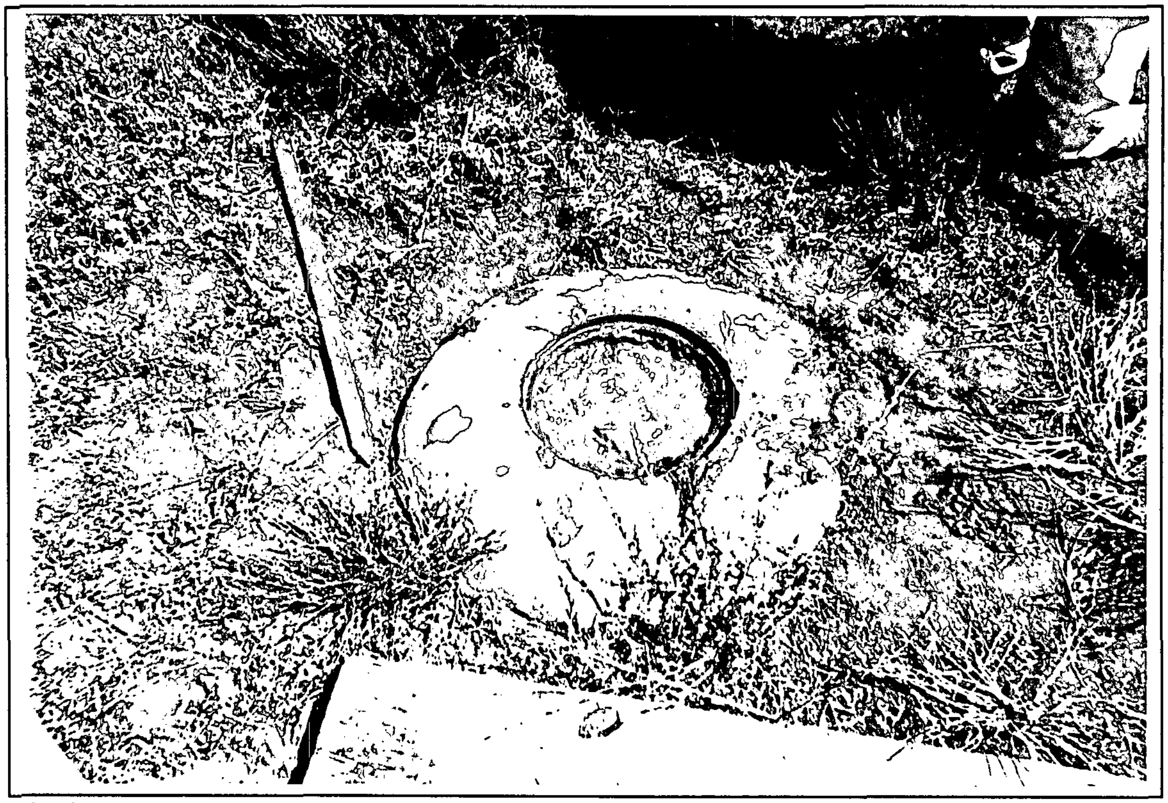
SHALLOW MONITOR WELLS

Monitor well 5-7B prior to abandonment

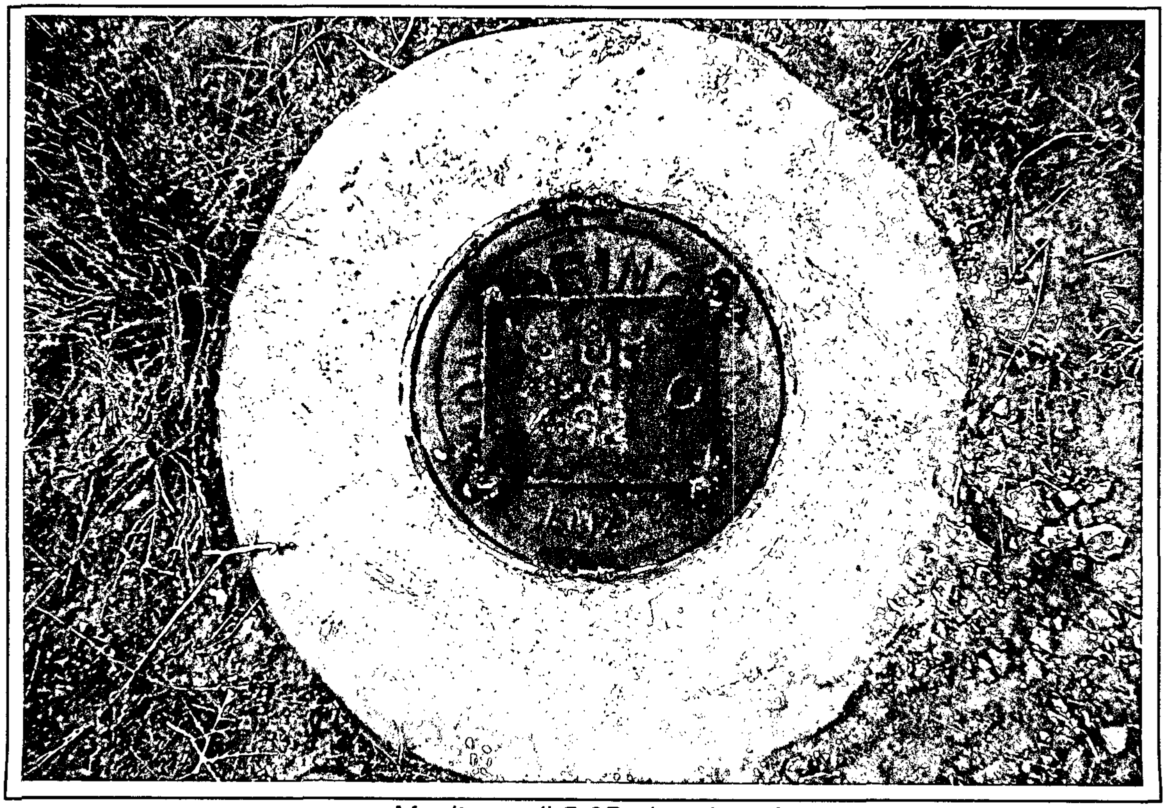


Monitor well 5-7B abandoned

SHALLOW MONITOR WELLS

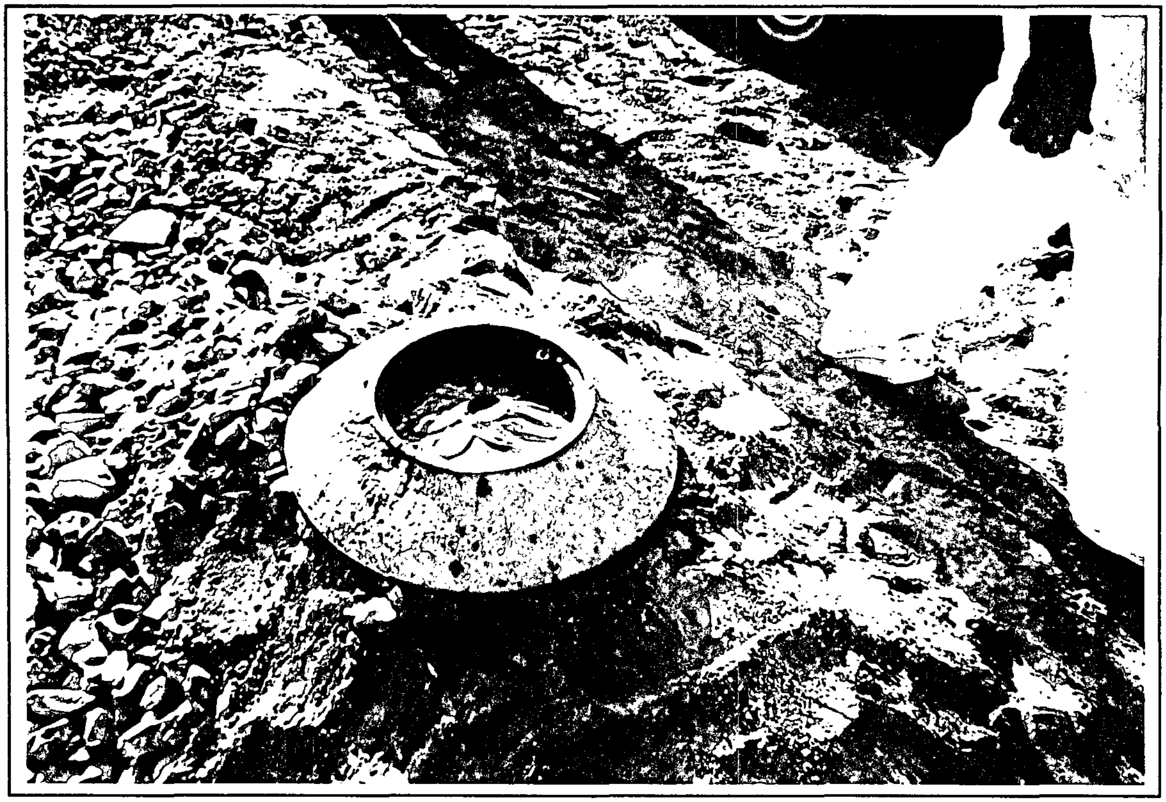


Monitor well 5-8B cement grout level at surface, prior to welding steel abandonment cap

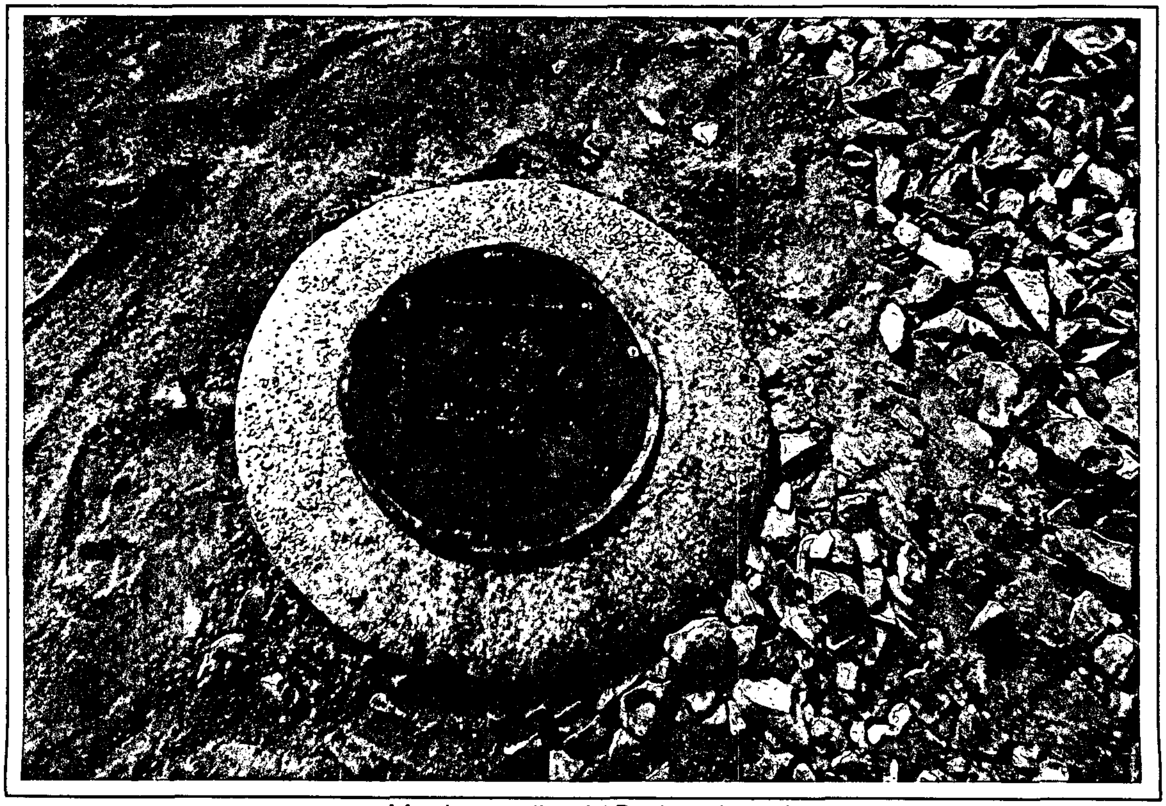


Monitor well 5-8B abandoned

SHALLOW MONITOR WELLS



Monitor well 5-26B cement grout level at surface, prior to welding steel abandonment cap



Monitor well 5-26B abandoned

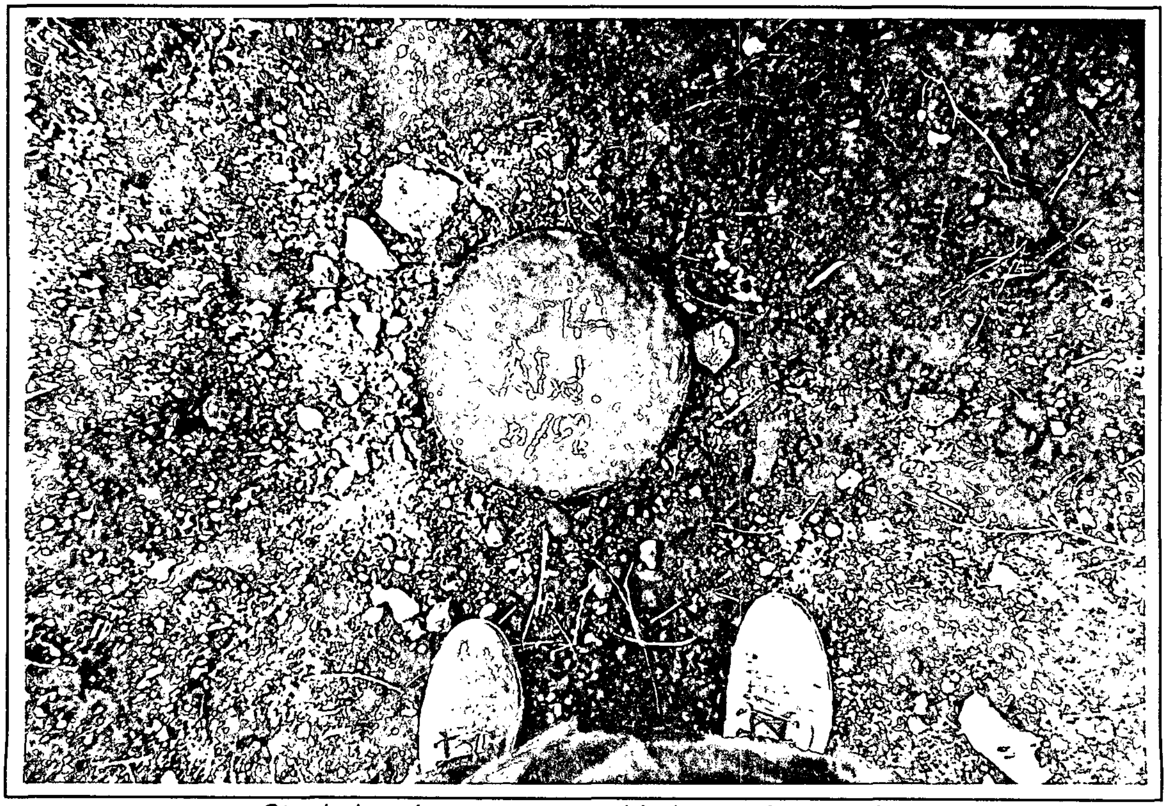
SHALLOW MONITOR WELLS

Monitor well 5-27B cement grout level at surface, prior to welding steel abandonment cap

Monitor well 5-27B abandoned

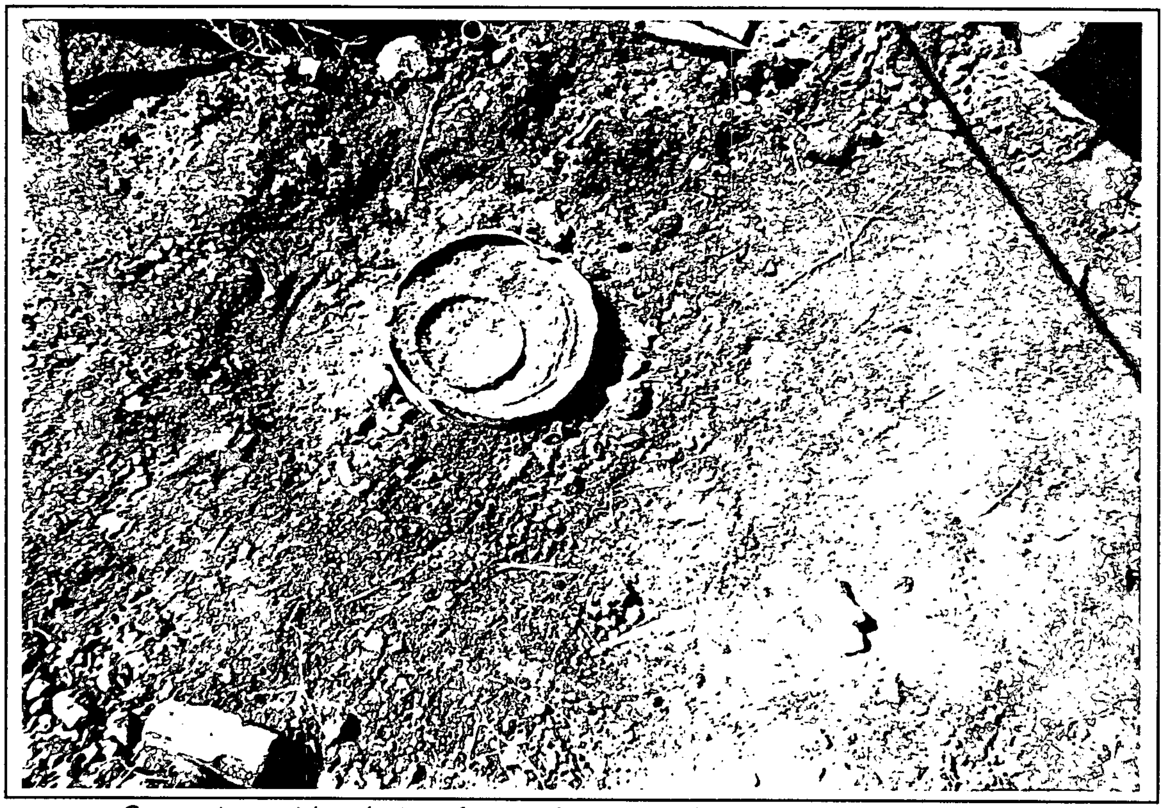
MONITOR WELL 5-1A

Pumping cement grout



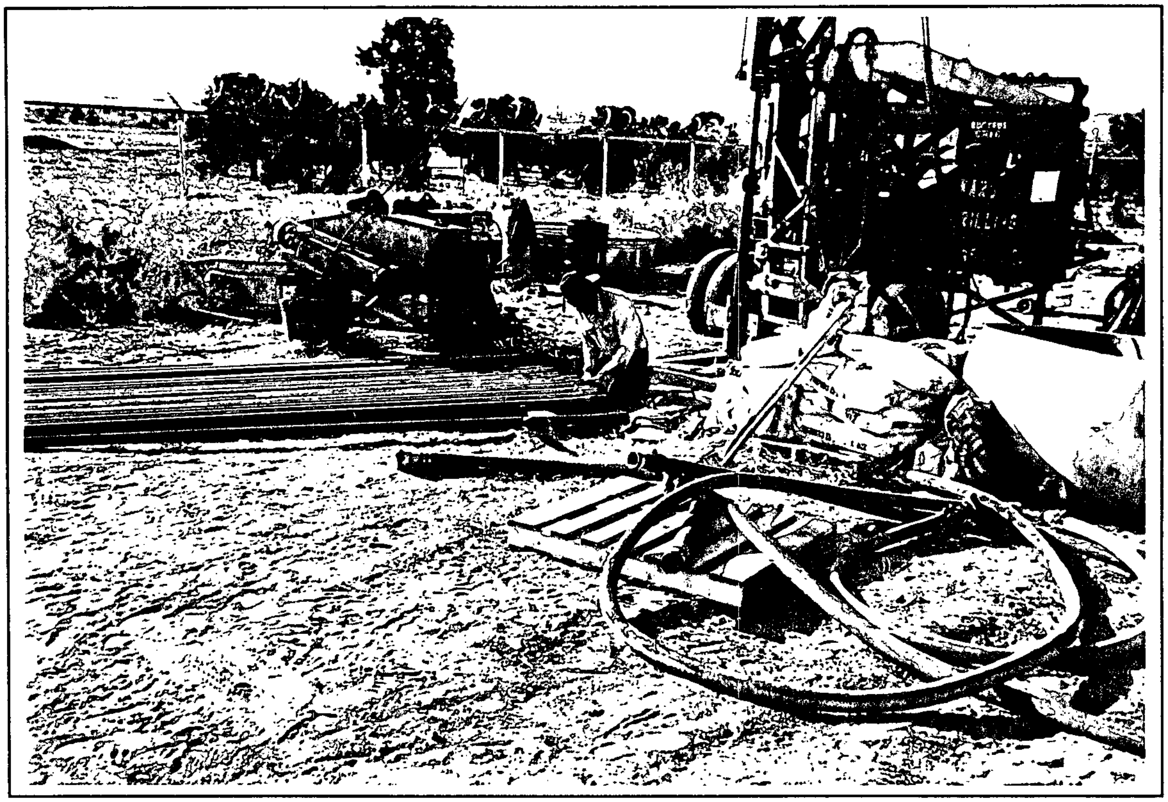
Steel abandonment cap welded to surface casing

MONITOR WELL 5-1A

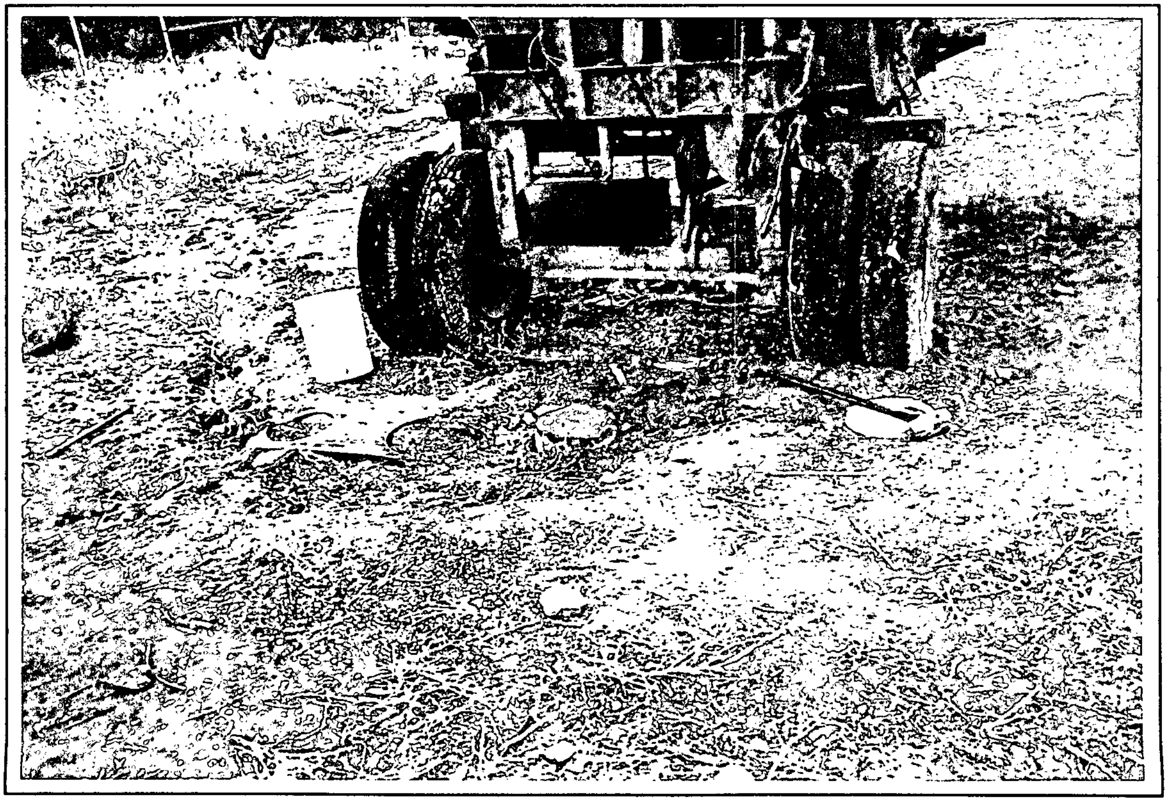


Cement grout level at surface, prior to welding steel abandonment cap

MONITOR WELL 5-1A



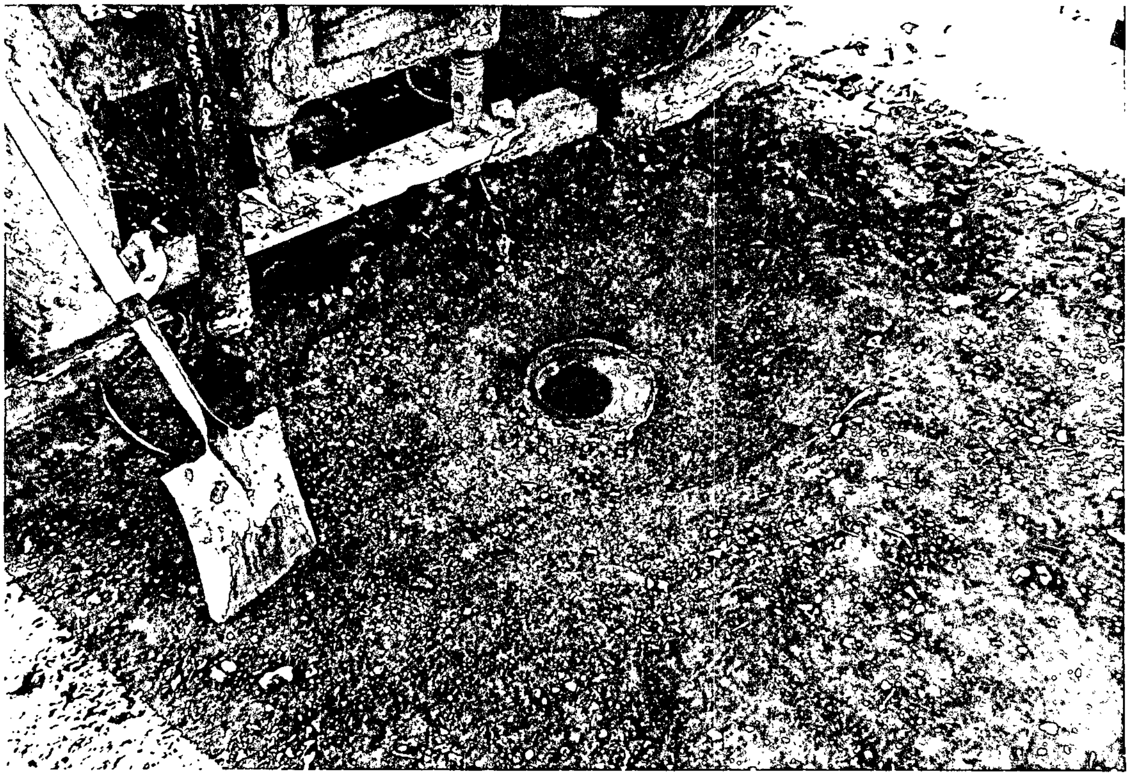
Measuring tremie pipe



Monitor well 5-1A abandoned

MONITOR WELL 5-3A

Test perforation at surface



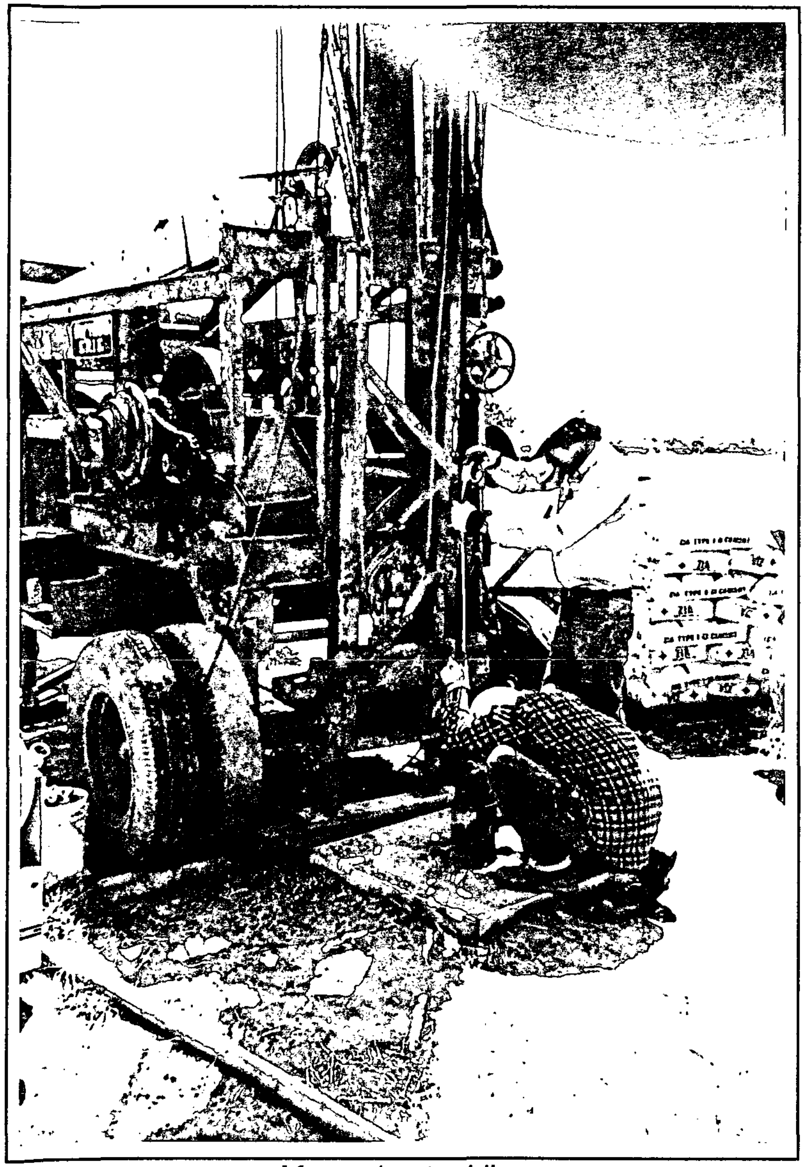
Cement grout level at surface, prior to welding steel abandonment cap

MONITOR WELL 5-3A

Steel abandonment cap welded to surface casing

Mixing cement grout

MONITOR WELL 5-3A

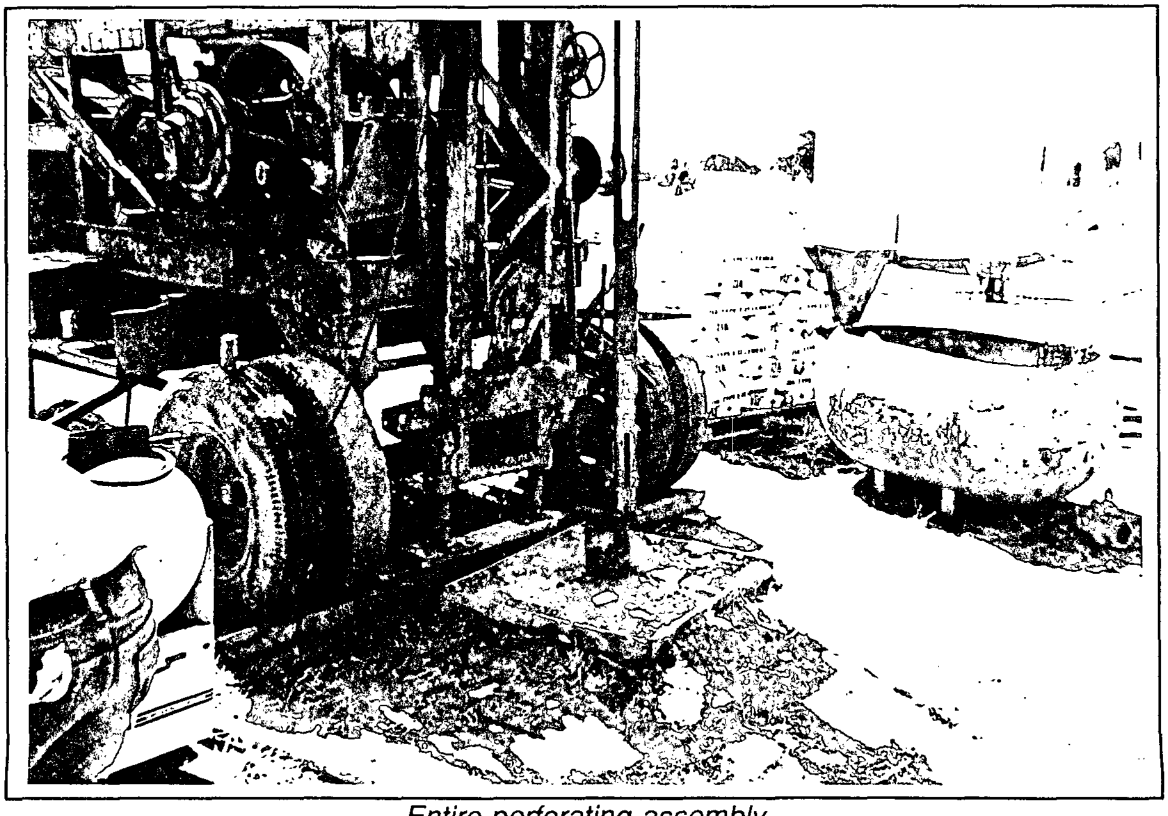


Measuring tool line

Modified perforating tool

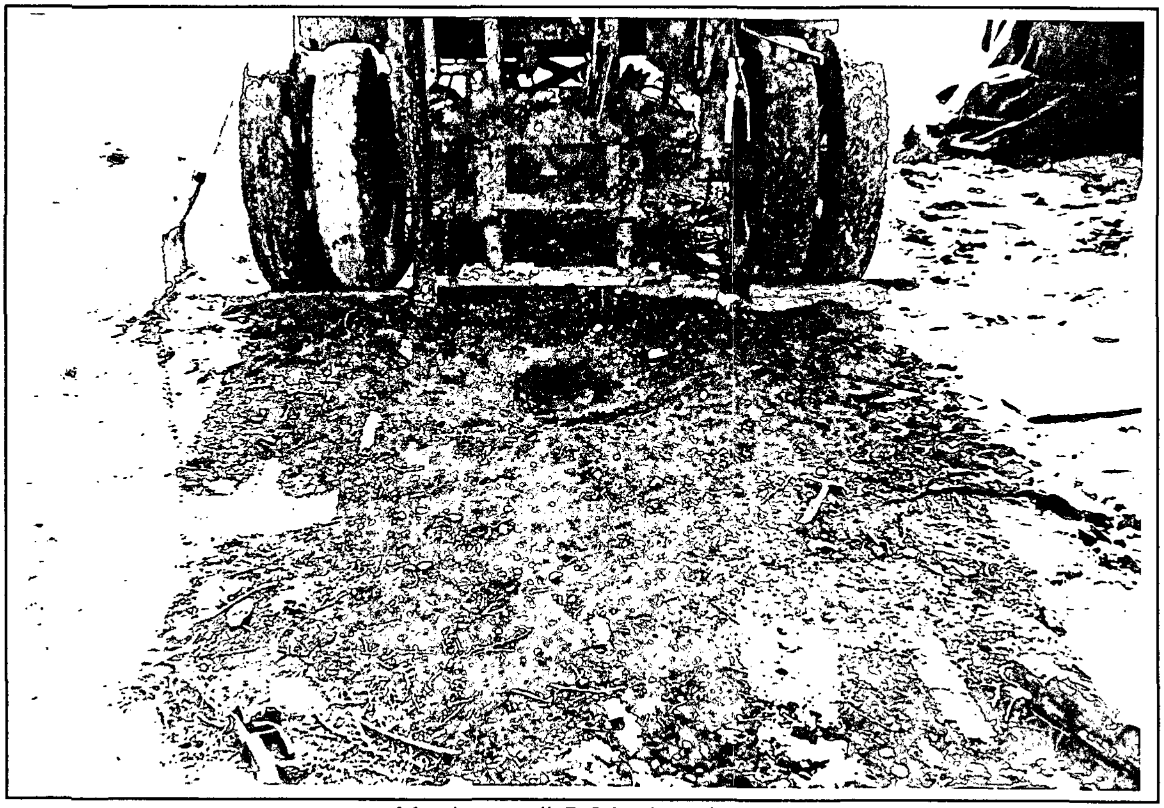
MONITOR WELL 5-3A

Perforating knife



Entire perforating assembly

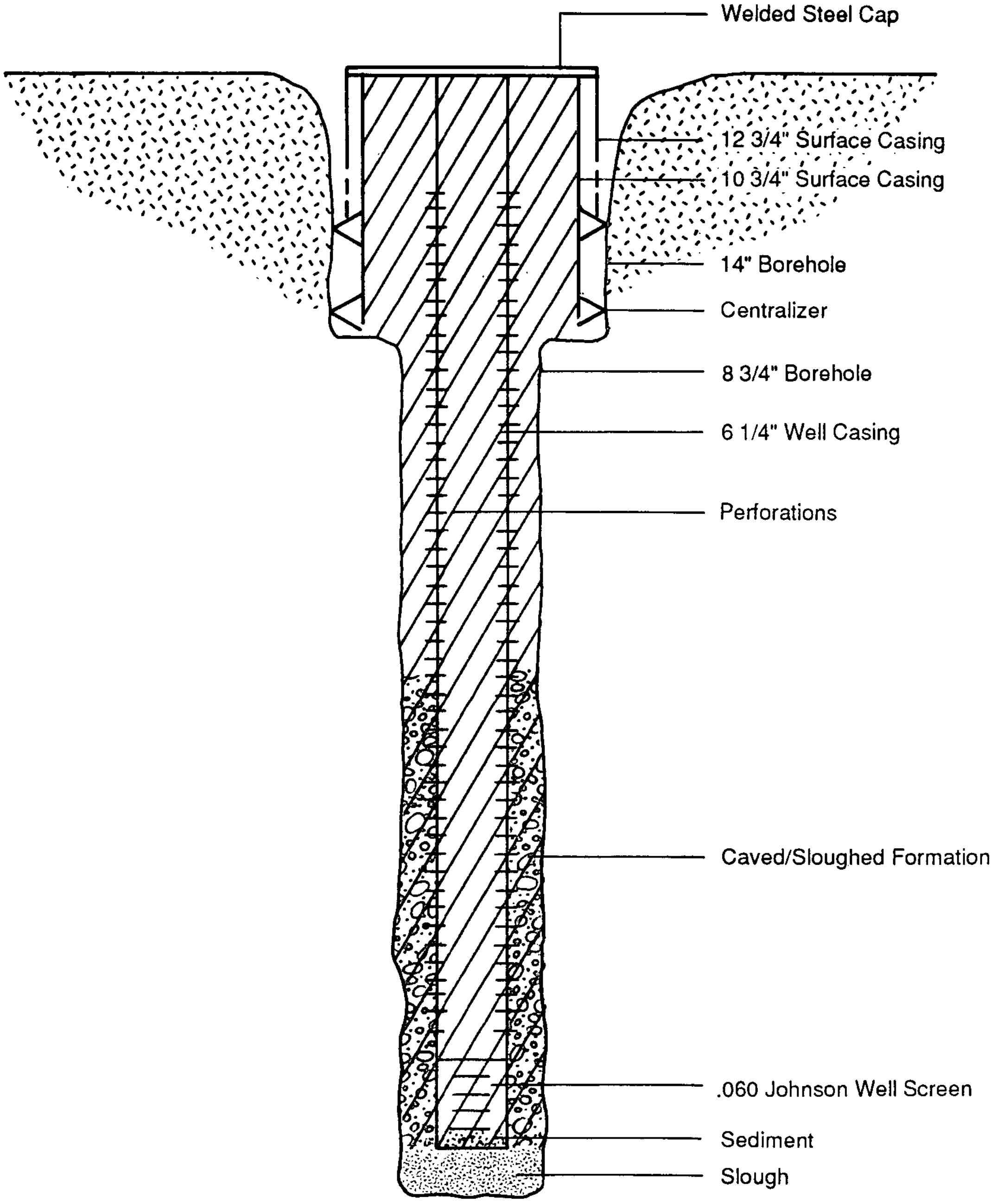
MONITOR WELL 5-3A



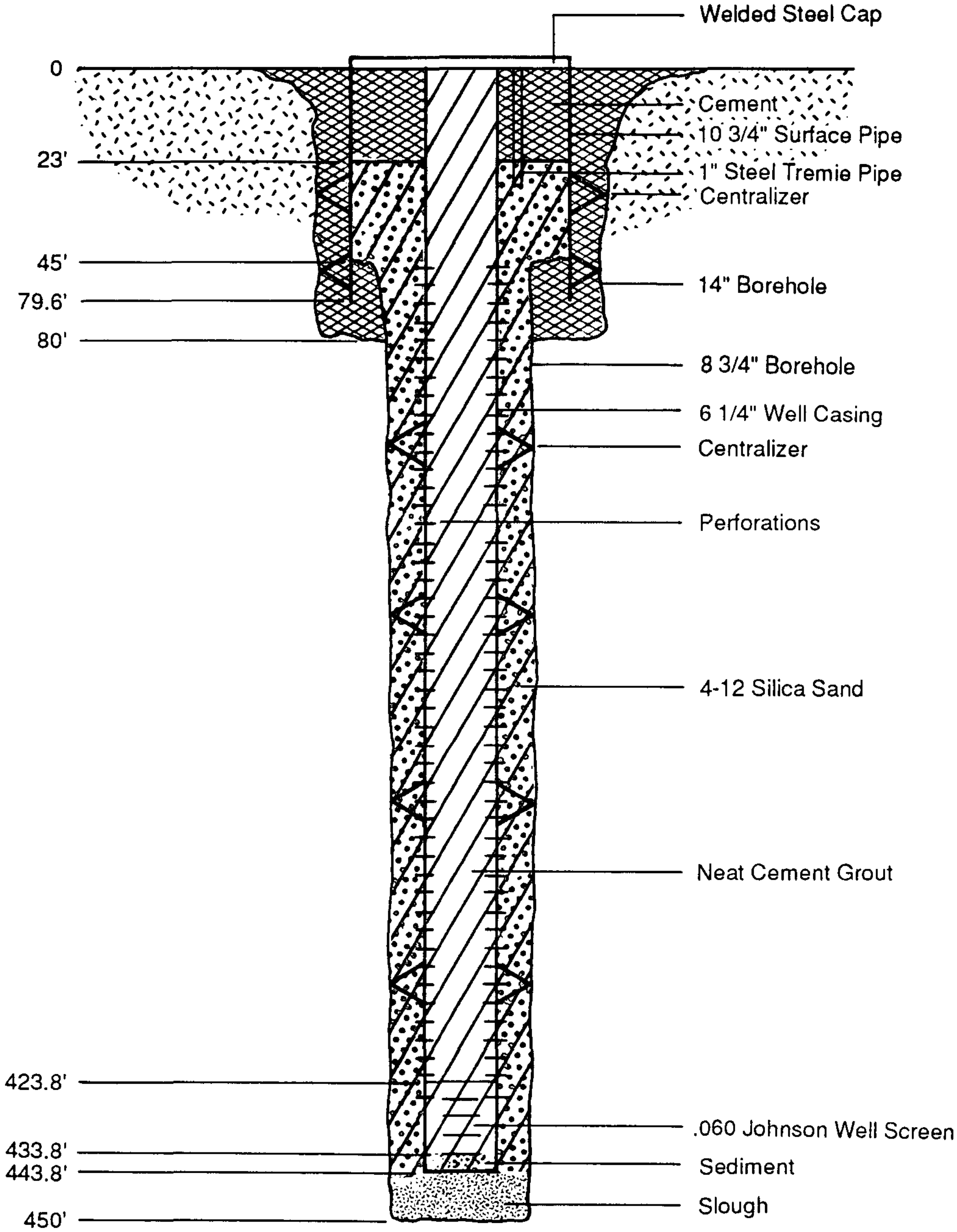
Monitor well 5-3A abandoned

ATTACHMENT II

WELL SCHEMATICS



Well Schematic 5-1A as Abandoned



Well Schematic 5-3A as Abandoned

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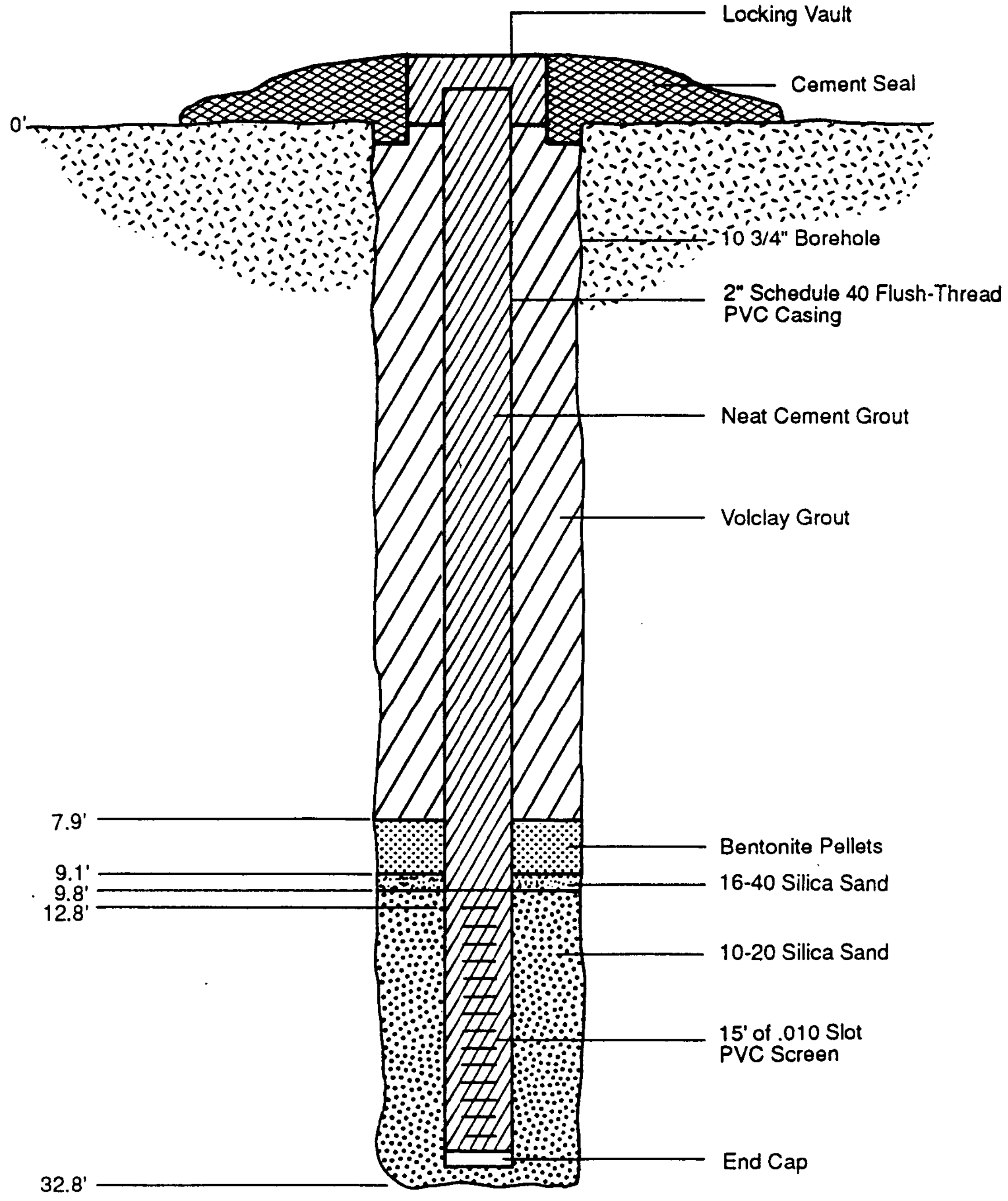

Well Schematic 5-7B as Abandoned

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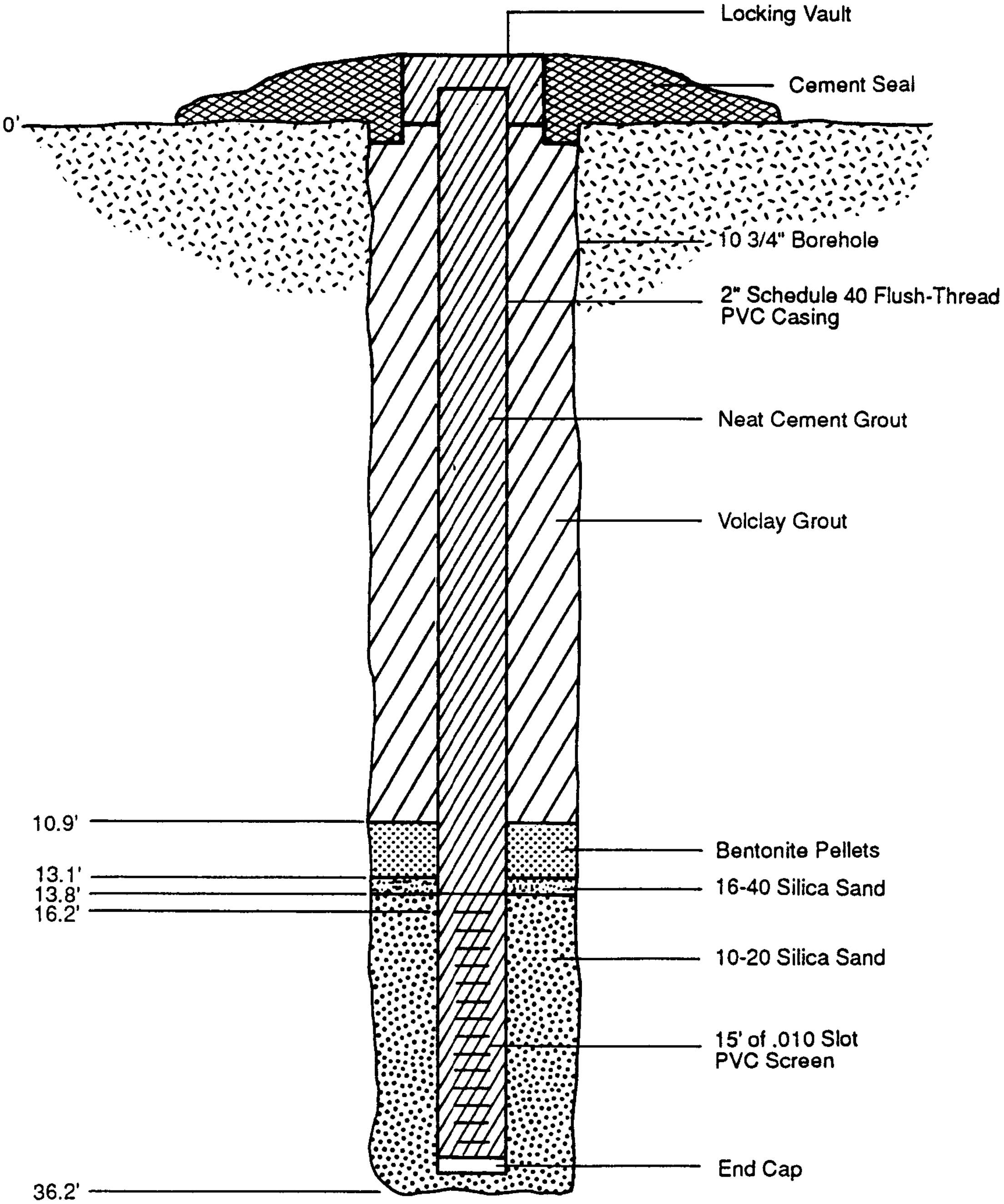

Well Schematic 5-8B as Abandoned

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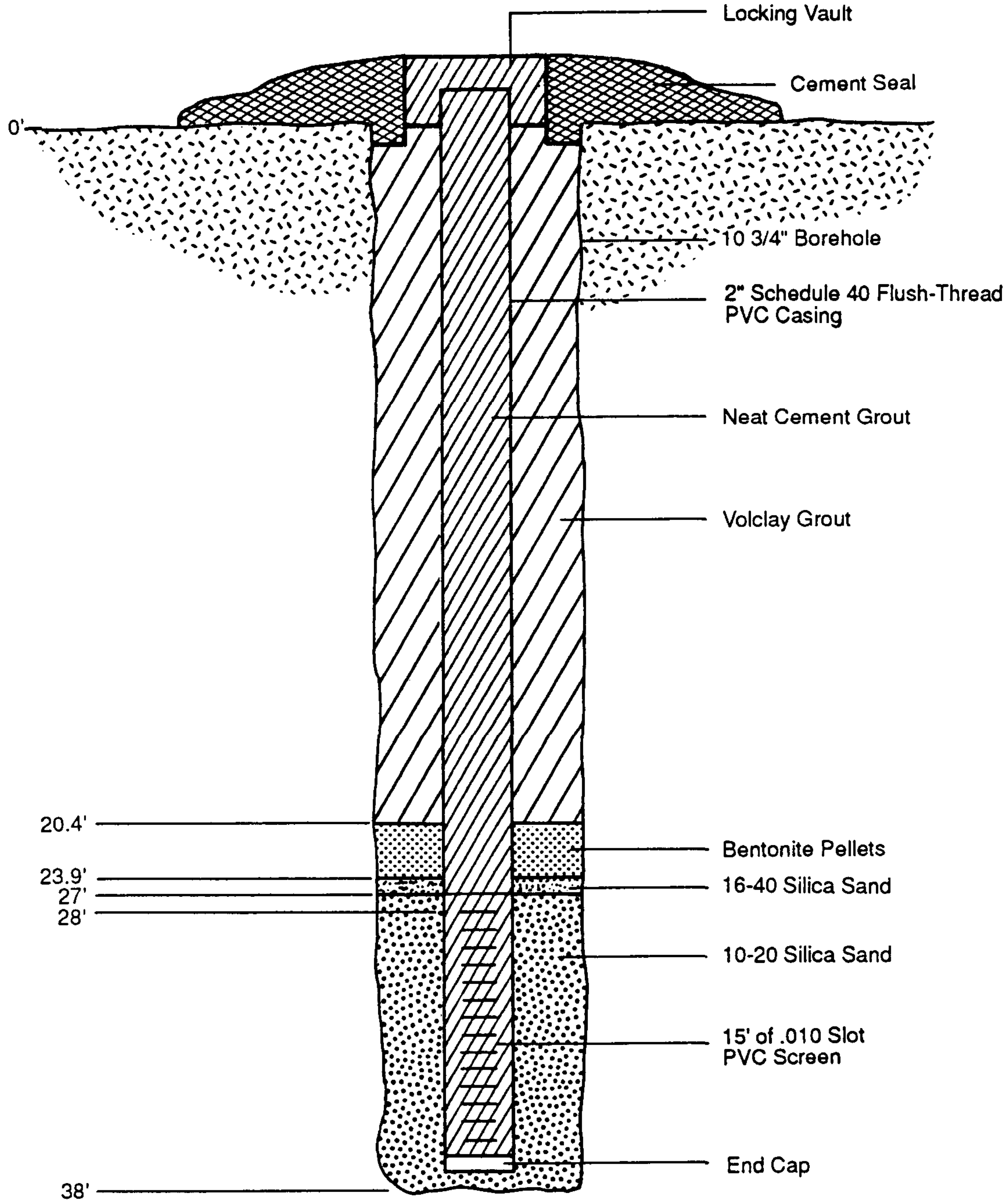
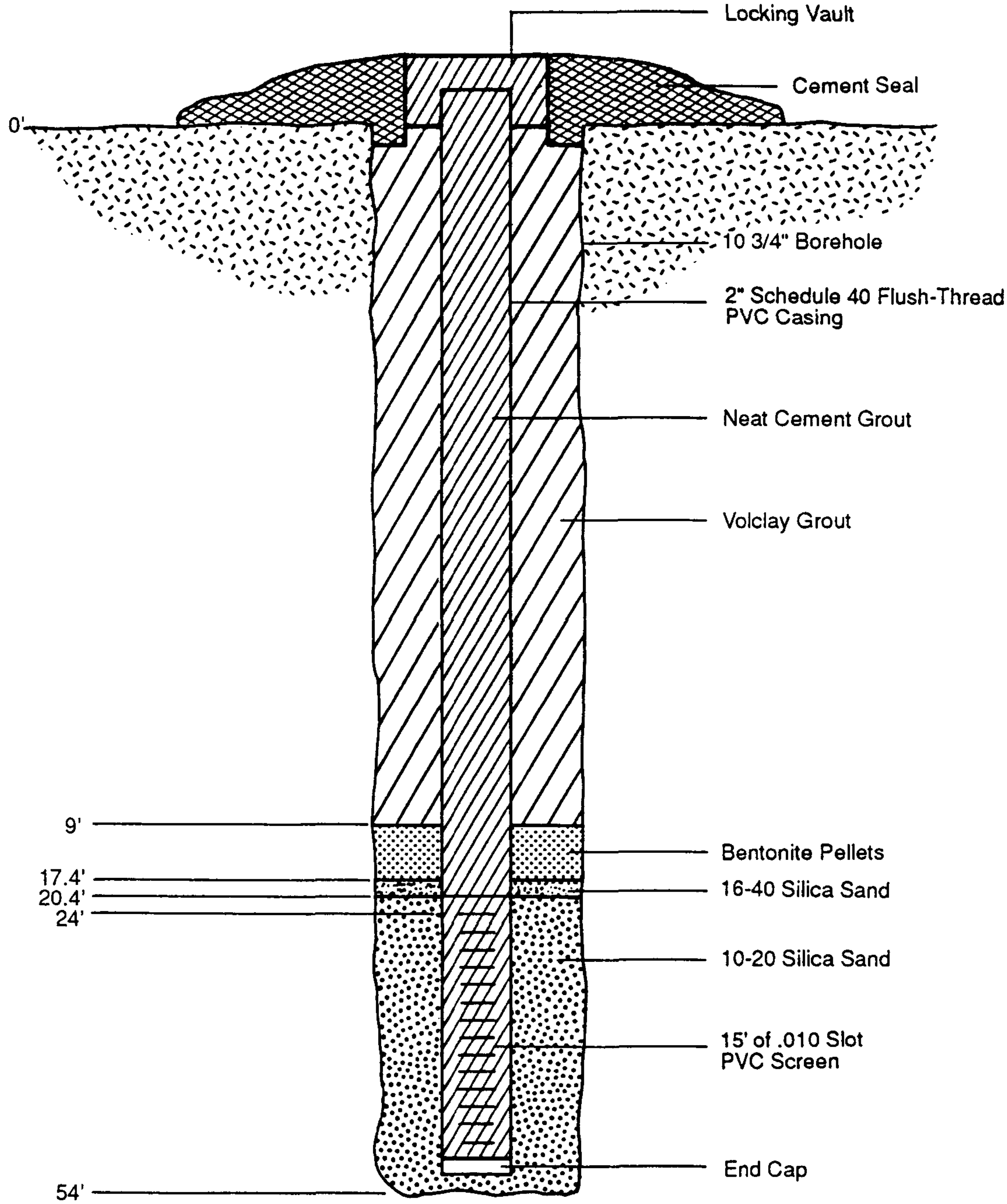
5-92 JN 2105



Well Schematic 5-26B as Abandoned

DANIEL B. STEPHENS & ASSOCIATES, INC.

5-92 JN 2105



Well Schematic 5-27B as Abandoned

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5-92 JN 2105

APPENDIX B

BIOREMEDIATION PILOT TEST INFORMATION

PILOT TEST OF NITRATE-ENHANCED HYDROCARBON BIOREMEDIATION IN A MODERATE- TO LOW-PERMEABILITY AQUIFER

Joanne Hilton[1], Bob Marley[1], Ted Ryther, P.E.[2], Jeffrey Forbes[1]

[1]Daniel B. Stephens & Associates, Inc.
Albuquerque, New Mexico

[2]Consulting Engineering Services
Houston, Texas

Abstract

A pilot test was conducted to determine the feasibility of using nitrate as an oxidant to enhance hydrocarbon bioremediation in a moderate- to low-permeability aquifer. The aquifer consists of approximately 15 feet of saturated silty sand, with an average hydraulic conductivity of approximately 0.28 ft/day and an average depth to water of 48 feet below land surface. A recirculating injection/extraction system was used to introduce potassium nitrate into the aquifer. The injection well was installed 15 feet upgradient of the extraction well, with a monitoring well placed halfway between the two. Soil samples collected during drilling were analyzed for denitrifying bacterial population, nutrients, and hydrocarbons. Potassium nitrate, sodium bromide, and monosodium phosphate were injected into the recirculating ground water via an automatic metering pump. Field measurements of nitrate and bromide in the monitoring and extraction wells were made with ion selective electrodes, and water samples were sent to an analytical laboratory to verify the field measurements. The nitrate-to-bromide ratios were evaluated to determine nitrate consumption rates. Total petroleum hydrocarbons, benzene, toluene, ethylbenzene and total xylene were also monitored. Toluene, ethylbenzene and total xylene concentrations decreased during the pilot test period, but no reduction in benzene was observed. The presence of nitrite, along with the observed reduction in dissolved hydrocarbon concentrations, indicated that denitrification was occurring.

Introduction and Site Description

A pilot test of nitrate-enhanced hydrocarbon bioremediation was conducted at a natural gas compressor station in western New Mexico. The site is situated on the southern end of the San Juan Structural Basin within the Colorado Plateau physiographic province. The pilot test area consists of approximately 60 feet of alluvium comprised mostly of reddish-brown, silty, fine sand having moderate to low permeability. Perched ground water is encountered at approximately 48

Hilton, J.A., R. Marley, T. Ryther, and J. Forbes. 1992. Pilot test of nitrate-enhanced bioremediation in a moderate-to-low permeability aquifer. NGWA Petroleum Hydrocarbons and Organic Chemicals in Ground Water. Houston, Texas.

feet below land surface. The average natural hydraulic gradient in the perched alluvial aquifer is approximately 0.03 ft/ft, the average hydraulic conductivity is about 0.28 ft/day (10^{-4} cm/sec), and the site average ground-water flow velocity in the alluvium is approximately 30 ft/year. The alluvium is underlain by the Triassic Chinle Formation which is comprised mostly of red claystones and mudstones and is roughly 1000 to 1300 feet thick. The regional water table lies about 400 feet beneath the site, within the upper Chinle Formation.

Dissolved hydrocarbons, including benzene, toluene, ethylbenzene and xylene (BTEX) have been detected in perched ground water at the site. The source of the hydrocarbons in ground water is believed to be primarily natural gas condensate. Natural gas is composed mostly of alkane compounds, with methane being the most abundant (Eiceman, 1986). In addition, natural gas contains variable concentrations of heavier molecular weight hydrocarbons (C_{4+}) which may condense due to changes in temperature and pressure within the distribution pipelines. The condensate is removed from the pipeline through "pigging" operations, which make use of a cylindrical piston-like device known as a "pig". The pig cleans the condensate from the interior pipeline wall by scraping and brushing as it is carried through the pipeline by the pressurized gas stream. Two major classes of organic chemicals are contained in the condensate: (1) alkanes/ alkenes and (2) benzene/alkylated benzenes. While currently all condensate from pigging operations is contained, past practices resulted in release of hydrocarbons to the perched ground water beneath the site.

Nitrate-enhanced hydrocarbon bioremediation was selected for consideration at the site because moderate to low permeabilities limited the feasibility of using either pump-and-treat remediation or in-situ techniques requiring flushing of large volumes of water or air. The objective of the pilot test was to evaluate the feasibility of using nitrate to stimulate bioremediation of the dissolved hydrocarbons and to apply information from the pilot test to a site wide design.

Theory of Nitrate-Enhanced Bioremediation

Most biodegradation reactions result from oxidation of hydrocarbons to carbon dioxide (CO_2) and water (H_2O). For example, the oxidation of benzene (C_6H_6) may occur according to the following reaction:

$$\overset{-1+1}{2C_6H_6} + \overset{0}{15O_2} \longrightarrow \overset{+4-2}{12CO_2} + \overset{+1-2}{6H_2O} \qquad \text{Rxn. 1}$$

Thus oxidation of one mole of benzene requires 7½ moles of molecular oxygen. As shown by the above reaction, oxidative biodegradation usually involves molecular oxygen (O_2) as the oxidizing agent (oxidant), but this need not always be the case. In the more general sense, oxidation of an organic compound, or any other substance, simply requires transfer of electrons from the substance being oxidized to the oxidizing agent, which is thereby reduced to a lower oxidation state. The numbers above the reactants and products in Rxn. 1 give the oxidation states of the elements that make up the compounds. In this case, carbon has been oxidized through the removal of electrons, raising its oxidation state from -1 to +4. Molecular oxygen (O_2) serves as the electron acceptor and is thereby reduced from an oxidation state of 0 to -2.

Oxidants other than molecular oxygen are also possible. The nitrate ion (NO_3^-) may serve as an oxidant (electron acceptor), as shown in the following oxidation reaction:

$$\text{-CH-} + NO_3^- + H^+ \longrightarrow CO_2 + \tfrac{1}{2}N_2 + H_2O \qquad \text{Rxn. 2}$$

In this reaction, the hydrocarbon (symbolized -CH-) is oxidized to carbon dioxide and water, while nitrate is simultaneously reduced to N_2 gas, a process known as denitrification[1]. In Rxn. 2, 1 mole of nitrate is capable of oxidizing 1 mole of carbon atoms. Note also that Rxn. 2 is pH-dependent. Although thermodynamics indicate that the reaction should proceed to the right at near-neutral pH conditions, the very high activation energy causes the rate to be very slow. Therefore, denitrification would proceed exceedingly slowly were it not for denitrifying bacteria, which manufacture enzymes to facilitate the reaction. Genera of bacteria which are known to perform denitrification include Pseudomonas, Escherichia, Bacillus, and Proteus, though not all of these are capable of complete reduction of nitrate to nitrogen gas (Fenchel and Blackburn, 1979). Thus, Rxn. 2 is a simplification of a complex set of reaction steps through several transient intermediate nitrogen species, including the nitrite ion (NO_2^-), nitric oxide (NO), and nitrous oxide (N_2O). The nitrate-nitrite reduction reaction is generally the rate-limiting step in the overall reaction (Postma et al., 1991). Indeed, some laboratory experiments performed with an excess of available nitrate have been shown to proceed only as far as nitrite (NO_2^-), instead of going all the way to di-nitrogen gas (Hutchins, 1991).

Oxidation-reduction reactions that occur naturally in ground water generally follow in strict succession, with those reactions that yield the most energy occurring first at the highest redox potential, and those yielding the least energy occurring last at the lowest redox potential (Drever, 1982). Providing there is an excess of organic matter to act as a reducing agent, aerobic oxidation of the organic matter by O_2 will generally proceed until all molecular oxygen is consumed. Only then will denitrification commence. Following consumption of all of the nitrate, subsequent redox reactions may occur at successively lower redox potentials (e.g., $Fe^{3+} \rightarrow Fe^{2+}$, $SO_4^{2-} \rightarrow H_2S$). Each of these successive reactions causes a phenomenon known as "redox buffering," which causes the redox potential of the ground water to be fixed at a value close to that of the redox pair in question (Drever, 1982).

Although the ability of denitrifying bacteria to fully degrade or "mineralize" certain petroleum hydrocarbons to CO_2 and H_2O under both laboratory and field conditions is now undisputed (Kuhn et al., 1988; Hutchins et al., 1991), the full-scale application of nitrate-enhanced hydrocarbon biodegradation remains experimental. Previous laboratory "microcosm studies" conducted under controlled denitrifying conditions (anaerobic) have revealed the following phenomena (Hutchins, 1991):

1. Dissolved toluene, ethylbenzene, meta-xylene and para-xylene (TEX) initially present as sole-source substrates at mg/l levels can be successfully degraded by denitrifying bacteria to <0.5 μg/l, with toluene generally being degraded most rapidly.

2. Ortho-xylene is not degraded when present as a sole-source substrate, but is slowly degraded in the presence of other hydrocarbons.

3. Benzene is not generally degraded under strictly denitrifying (anaerobic) conditions, regardless of the presence of other hydrocarbons, but degradation of benzene has been observed in several field studies, presumably due to the presence of low concentrations of dissolved oxygen.

---

[1] "Denitrification" refers to the reduction of nitrate-nitrogen to di-nitrogen gas. The term refers to the conversion of NO_3^- to N_2, the dominant natural process by which nitrogen is removed from soils. The reverse reaction is termed "nitrification".

4. Rates of biodegradation under denitrifying conditions for those compounds which are degraded are typically slower than equivalent rates under aerobic conditions.

5. Although the stoichiometry suggests that approximately 1 kg of nitrate-nitrogen is required to oxidize 1 kg of BTEX (Rxn. 2), nearly ten times as much nitrogen is actually consumed in field applications of nitrate-enhanced bioremediation, possibly due to the oxidation of other non-BTEX hydrocarbons (e.g., alkanes).

6. Denitrification rates are pH dependent, with optimum conditions being in the range pH 6 to 8.

The principal advantage of in-situ nitrate-based bioremediation of hydrocarbons in ground water, as opposed to oxygen-based aerobic biodegradation, is that it is possible to introduce more oxidizing power into the subsurface using nitrate than would be possible using oxygen, due to the low aqueous solubility of the latter (≈9 mg/l @ 20°C with air @ 1 atm., ≈44 mg/l with oxygen). Nitrate salts, on the other hand, are extremely soluble in water (>100 g/l), and the nitrate ion is generally considered to be a conservative solute in the ground-water environment, and therefore highly mobile. Given that 1 mole of nitrate-nitrogen has the same oxidizing power as 5/4 mole of O_2, nitrate at the concentration of the drinking water standard (10 mg/l NO_3-N) has approximately three times the oxidizing capacity as dissolved oxygen at saturation (9 mg/l). If nitrate is injected at concentrations higher than 10 mg/l NO_3-N, hydrocarbons can be degraded at a more rapid rate.

Pilot System Installation and Operation

Figure 1 shows a schematic of the pilot system, which was designed to operate unattended for up to 5 days at a time. The pilot system consists of a single injection well located 15 feet upgradient of an extraction well, with a monitoring well located halfway between the injection and extraction wells (Figure 1). While this type of spacing would not be considered to be economically feasible for a full-scale remedial design, it was chosen for the pilot test so that results could be observed within a relatively short time period.

Drilling and Soil Sample Collection

The pilot test location was chosen based on the delineation of the hydrocarbon plume and proximity to the original release. Previous installation of 2-inch monitoring wells at that location, using hollow stem-auger techniques, proved difficult within the saturated, heaving sands encountered at the site. Consequently, a cable tool rig, capable of advancing casing with the bit, was chosen in hopes of minimizing flowing sands entering the boring during drilling, thereby simplifying installation of the 4-inch pilot test wells.

Pilot system wells were drilled to approximately 65 feet. Prior to each drilling operation, all drilling equipment, soil samplers, and well materials were thoroughly decontaminated by steam cleaning. In addition, down-hole sampling devices were decontaminated prior to collection of all samples by scrubbing them in a solution of deionized water and liquinox, followed by a deionized water rinse.

Soil samples were collected with a 2.5-inch ID split spoon sampler lined with brass rings. Soil samples were collected within the vadose zone immediately above the water table, the middle of the saturated alluvium, and at the bottom of the aquifer. Samples were analyzed for total and

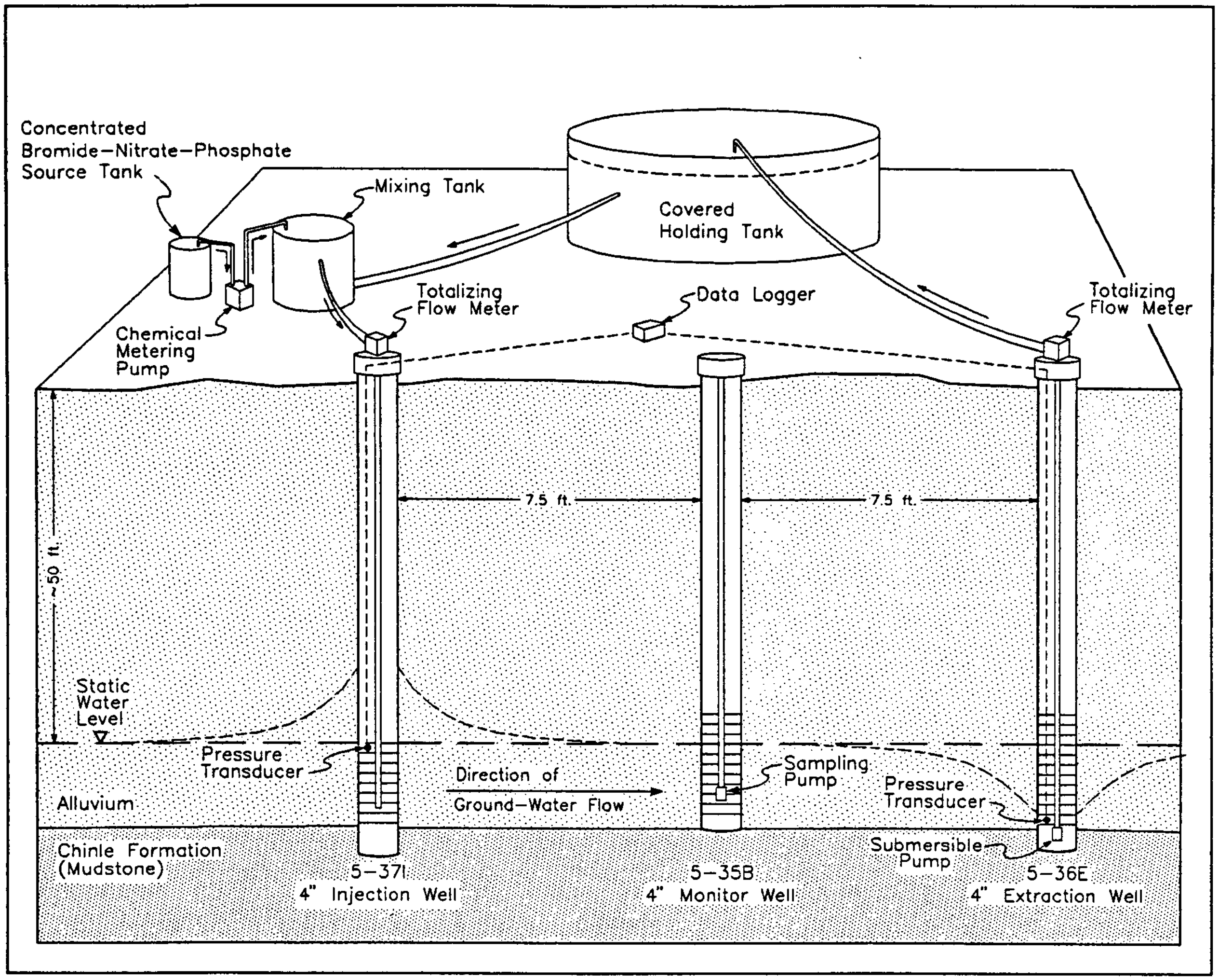

Figure 1. Pilot System Schematic

denitrifying bacteria counts, total organic carbon (TOC), total petroleum hydrocarbons (TPH), and BTEX. Plate counts revealed viable denitrifying and total bacterial populations of up to 10^4/gram and 10^6/gram, respectively. The existing denitrifying bacterial soil populations, though not extremely large, were thought to be adequate for the purpose of the pilot test.

<u>Well Construction</u>

The injection well was constructed with 4-inch diameter, low carbon steel casing and 0.040-inch wire-wound stainless steel screen to maximize screen open area and minimize potential screen clogging. Additionally, steel construction facilitates vigorous mechanical redevelopment should clogging become a problem. The annulus around the screen was filled with 8-12 mesh silica sand filter pack which extends to 6 inches above the well screen. A 24-inch bentonite seal was emplaced on top of the filter pack followed by a cement grout to surface. The grout sealed the well screen below the water table, and injection water was delivered via a drop pipe below the water table to further avoid potential aeration of ground water and possible iron precipitation.

Downgradient of the injection well, a 4-inch diameter PVC monitoring well with 0.010-inch PVC screen was installed to monitor nitrate and bromide breakthrough and BTEX concentrations. The well was screened from the bottom of the aquifer to several feet above the water table. The annulus around the screen was filled with 10-20 mesh silica sand filter pack followed by a 16-40 mesh silica sand, a 24-inch bentonite seal, and cement grout to the surface.

The extraction well was constructed of 4-inch diameter low carbon steel casing and 0.025-inch wire-wound screen, with a filter pack of 10-20 mesh silica sand. The well was screened from the bottom of the aquifer to approximately 2 feet above the static water table, and was completed to the surface as described for the first two wells.

System Operation

The Figure 1 schematic outlines the operation of the pilot system. Ground water is pumped from the extraction well to a holding tank, where sediments that could potentially clog the injection well settle out. The holding tank and other system components are covered to minimize hydrocarbon volatilization, so that the effectiveness of denitrification can be evaluated with minimal interferences from dilution effects. From the holding tank, the ground water flows by gravity feed to the chemical mixing tank. Chemical source solutions of potassium nitrate, sodium bromide, and monosodium phosphate are metered from the source tank to the mixing tank via a piston type metering pump. A mechanical stirrer is used to keep the chemicals in solution. In-line flow meters measure and record the total volume of water recirculating through the system at the pumping and injection wells, and water levels in the injection and extraction wells are monitored continuously with transducers linked to a data logger. The system is equipped to automatically shut itself off in case of well clogging, overflowing tanks, and/or lack of water in the pumped well.

The extraction well is equipped with a Grunfos Redi-Flo2 pump. As shown on the summary of average pumping rates (Figure 2), the extraction well was initially pumped at a rate of approximately 0.18 to 0.22 gallons per minute (gpm). This pumping rate was the highest sustainable rate based on measured water level response in the pumped well. During the first two weeks of system operation, frequent measurements of flow rates and water levels were made to maximize the injection rate and radius of influence. The pumping rate was steadily increased until mid-July when the system hydraulics equilibrated at an average flow rate of 0.36 gpm.

Chemical Injection and Monitoring

Chemical injection began on May 15, 1992. The permit for the pilot test allowed for up to 100 mg/l of potassium nitrate (as N) to be injected under controlled conditions. However, nitrate was initially injected at 10 mg/l (as N) so that denitrification could be evaluated prior to injecting at higher levels. Sodium bromide (25 mg/l as Br^-) was also injected to serve as a conservative tracer that would allow for comparison of nitrate losses due to dilution and dispersion with those due to denitrification. Source solution was metered into the mixing tank at an average rate of 25 ml per minute.

The monitoring and extraction wells and the chemical mixing tank immediately upstream of the injection well were sampled approximately every two weeks. The samples were analyzed by Analytical Technologies, Inc. for nitrate and bromide to confirm field results, and for nitrite, phosphate, BTEX and TPH.

Field measurements of nitrate, bromide, dissolved oxygen, pH, and conductivity were made approximately three times per week at the monitoring and extraction wells and at the chemical mixing tank. The dissolved oxygen concentrations measured from the pilot test monitoring wells

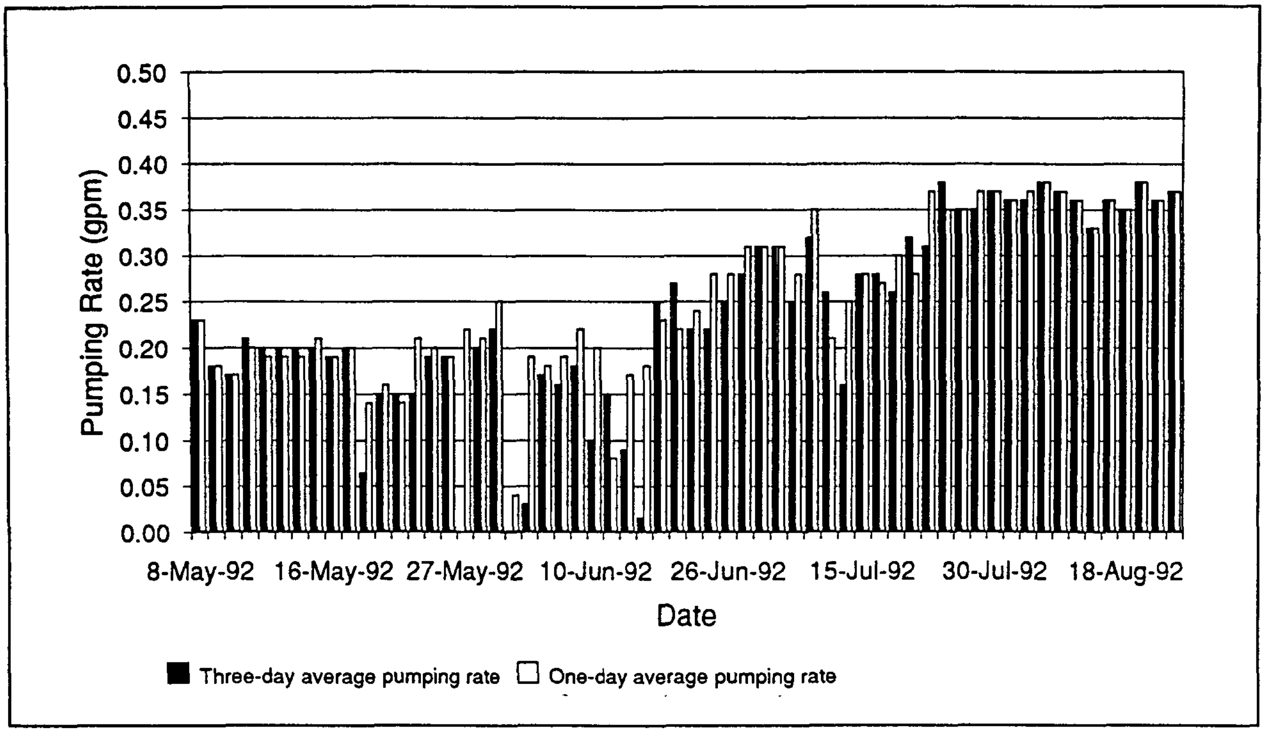

Figure 2. Pilot Test Pumping History

were less than 1 mg/l, as compared to background dissolved oxygen concentrations at the site of approximately 6 to 7 mg/l.

Orion ion selective electrodes (ISEs) were used in conjunction with a digital millivolt meter to allow rapid field determination of ground-water nitrate and bromide concentrations. The ISE operates much like a pH electrode, except that the probe is sensitive to ions other than H^+, in this case NO_3^- or Br^-. A double-junction reference electrode serves to establish the reference potential (voltage). Because the potentials of both the ISE and the reference electrode tend to vary with temperature and time, the method of standard addition (MSA) was chosen for field use, to avoid the necessity of frequent recalibration with standard solutions.

Using MSA, the ISE is immersed in the ground-water sample and the potential is measured on the millivolt meter relative to the constant potential of the reference electrode. A nitrate or bromide "spike" of known concentration is then added to the sample, and the potential measured again. The difference between the unspiked and spiked millivolt readings may then be used to calculate the initial NO_3^- (or Br^-) concentration of the sample prior to adding the spike. A programmable calculator was used to facilitate calculations in the field.

Following solute breakthrough, field (ISE) and laboratory results for nitrate were in good agreement, generally within about 30% relative difference. Prior to breakthrough, the nitrate ISE had consistently indicated concentrations of several mg/l, even when the laboratory results indicated that nitrate was below the detection limit (0.06 mg/l). It is believed that the laboratory results are correct, since the analytical method employed by the laboratory is subject to fewer interferences. The reason for the positive systematic error of the ISE at low nitrate concentrations is unknown, but hydrocarbon concentrations may be a factor.

Following bromide breakthrough, the relative percent differences between the field- and laboratory-determined values ranged from 8% to 84%. Thus, the bromide ISE exhibited somewhat lower precision than the nitrate ISE, if the laboratory values are assumed to be correct. A systematic error was also evident for bromide, with the bromide ISE consistently indicating higher concentrations than the laboratory. Although the systematic error was evident, similar general trends in bromide concentrations were apparent in both the ISE and laboratory data.

Observations

Bromide and nitrate concentrations measured in the monitoring and extraction wells are shown on Figures 3 and 4, respectively. Bromide was first detected above background levels at the monitoring well approximately eight days after injection began. This observed travel time from the injection well to the monitoring well corresponds well with the calculated travel time of seven days, obtained by using the observed hydraulic gradient between the two wells and the site average hydraulic conductivities and effective porosities. Bromide concentrations continued to rise to approximately 10 mg/l, and stabilized at that level for approximately two weeks. The plateau at the 10 mg/l level is most likely due to dilution effects resulting from mechanical problems which lowered the average injection concentration. Once injection reached a steady average bromide concentration of 25 mg/l, bromide concentrations continued to increase until approximately 95% of the bromide concentration injected was detected in the monitoring well, and approximately 80% was detected in the extraction well. The lower concentrations of bromide detected in the extraction well, which is further from the source, are indicative of dilution and dispersion. A subsequent decline in bromide concentrations is most likely due to lower-than-average injection rates resulting from temporary shutdowns of the extraction well pump.

Nitrate concentrations in the monitoring and extraction wells were not observed to be increasing at the same rate as the bromide concentrations. In fact, during the first five weeks of operation, nitrate concentrations measured by the analytical laboratory were at or below detection limits (0.06 mg/l) in both the monitoring and extraction wells, with the exception of 0.4 mg/l nitrate measured on June 22, 1992 in the monitoring well. As discussed previously, some nitrate was detected with the ISEs, but it was believed to be due to hydrocarbon interference, and greater confidence was held in the laboratory data. In mid-June, the concentrations of bromide in the monitoring well and extraction wells were approximately 60% and 30%, respectively, of the average injection concentration. Since the nitrate levels were well below those percentages, it was surmised that either the nitrate was being retarded to a higher degree than the bromide, denitrification was occurring, or a combination of both. Retardation of nitrate was considered unlikely, and nitrate consumption was believed to be responsible. Since it appeared that denitrification was occurring, the injection concentration was increased to 50 mg/l nitrate (as N).

Following the increased injection rates, an increase in nitrate concentrations was observed in both the injection and monitoring wells. Two possible explanations for the lack of total nitrate consumption are 1) there is insufficient contact time for the nitrate to be totally consumed, or 2) some essential nutrient was lacking, therefore limiting growth of the denitrifying bacteria population. Consequently, monosodium phosphate was added at 10 mg/l to determine if this nutrient would enhance denitrification. The monosodium phosphate concentration was later increased to 20 mg/l. Even with the addition of the monosodium phosphate, however, nitrate breakthrough concentrations persisted at approximately 20 mg/l in the monitoring well and 10 to 15 mg/l in the extraction well.

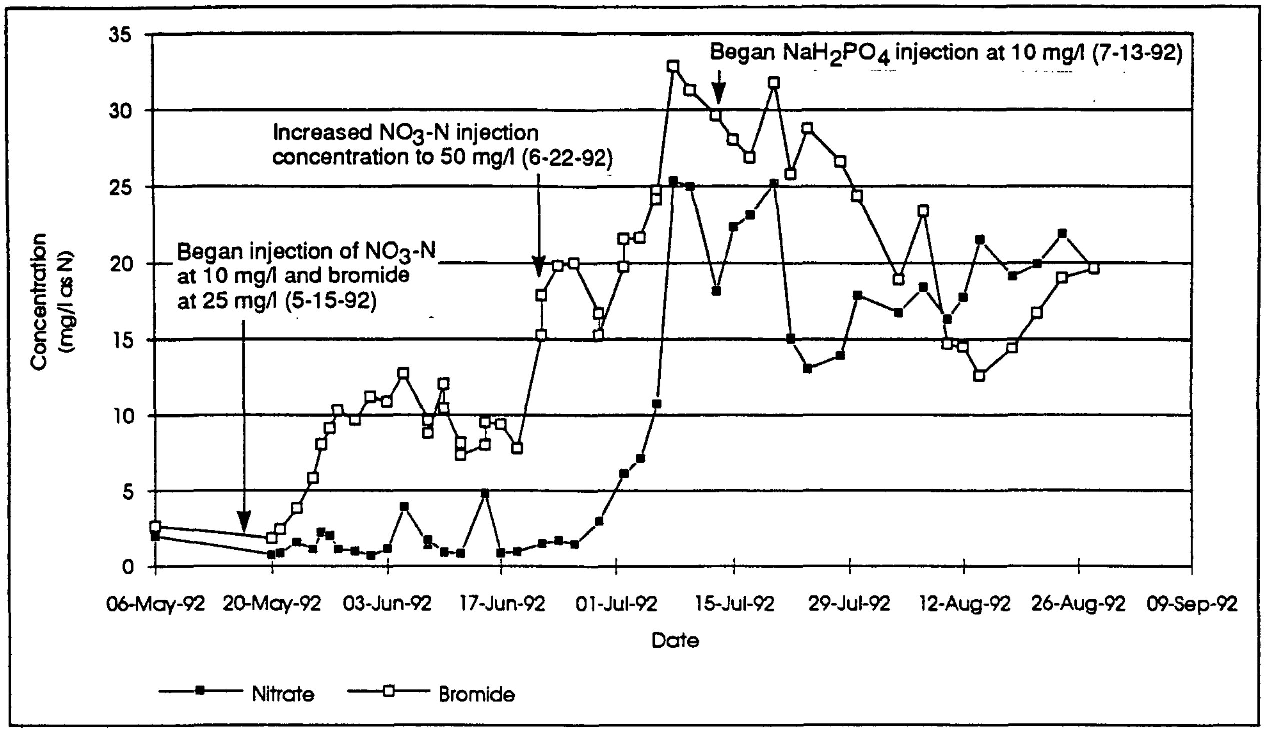

Figure 3. Monitoring Well: Nitrate and Bromide Concentrations (measured with ISEs)

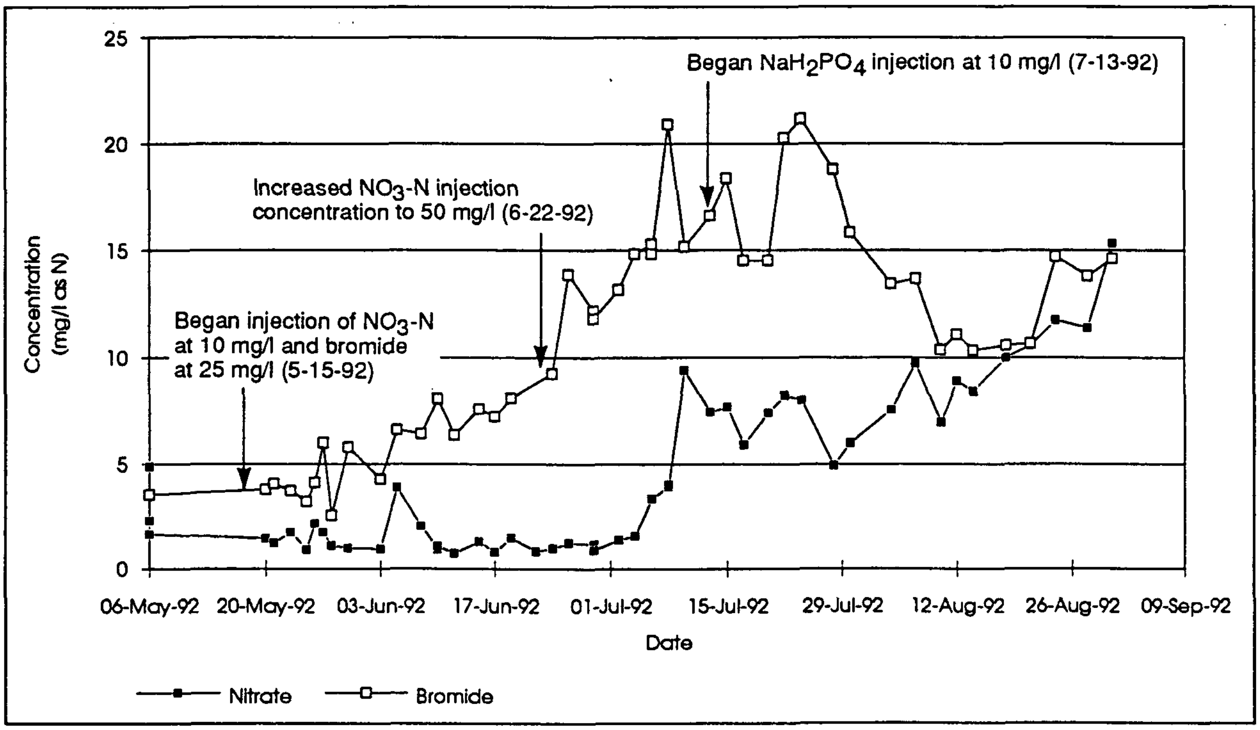

Figure 4. Extraction Well: Nitrate and Bromide Concentrations (measured with ISEs)

In spite of the nitrate breakthrough, an increase in nitrite concentrations indicated that denitrification was occurring. Nitrite concentrations measured by the analytical laboratory were initially below the detection limit of 0.06 mg/l. Following the increase in the nitrate injection rates, nitrite was measured at concentrations up to 6.1 mg/l and 2.7 mg/l in the monitoring and extraction wells, respectively. Nitrite is produced as an intermediate product in the conversion of nitrate to nitrogen gas (Rxn. 2) and is indicative of denitrification.

Concentrations of BTEX in the monitoring and extraction wells are shown in Figures 5 to 8. These plots show that toluene was the most readily degraded of the BTEX compounds. Toluene concentrations in monitoring well 5-35B decreased steadily from an initial concentration of 7600 µg/l to approximately 1000 µg/l (an 87% reduction) between May 15 and August 15. Ethylbenzene and total xylene decreased by 67% and 34%, respectively, at the monitoring well during this period. Benzene concentrations were not observed to decline during the pilot test. Previous researchers have hypothesized that once the majority of the hydrocarbons are removed, dissolved oxygen levels will increase and aerobic degradation of benzene will be initiated (Hutchins, 1991). However, hydrocarbon levels did not drop sufficiently during this test period for aerobic conditions to develop.

After approximately six weeks of continuous pumping, free product was observed pooling in the extraction well. The free product (approximately 0.4 ft) provides a persistent source which may keep dissolved hydrocarbon concentrations from continuing to drop. The slight increases in TEX concentrations shown on Figures 5 to 8, following initial reductions, may be due to contributions from the free product, and/or from additional hydrocarbons released as a result of the saturation of previously unsaturated sediments near the injection well.

Conclusions

The pilot test has been operational for approximately four months. At this point, the following conclusions can be drawn:

1. Denitrification is actively degrading hydrocarbons within the pilot study area, as evidenced by the following:

   - Nitrite production has been observed, with concentrations of up to 6.1 mg/l (NO_2-N) measured in ground water from the monitoring well.
   - After recirculation of approximately 1½ pore volumes of ground water (50,000 gallons), the concentration of nitrate being removed from the extraction well has only reached about 30% of the injection concentration, as compared with approximately 80% for the conservative bromide tracer. Since nitrate and bromide are considered equally conservative (mobile) in the subsurface, the difference is attributable to nitrate consumption.
   - Concentrations of toluene, ethylbenzene, and total xylene in the monitoring well have dropped to 13%, 33%, and 66%, respectively, of their initial concentrations since the start of nitrate injection.

2. No benzene degradation has been observed as a result of the nitrate addition.

3. At the present nitrate injection rate (95 g/day NO_3-N), approximately 88 g of hydrocarbons are being degraded per day due to denitrification.

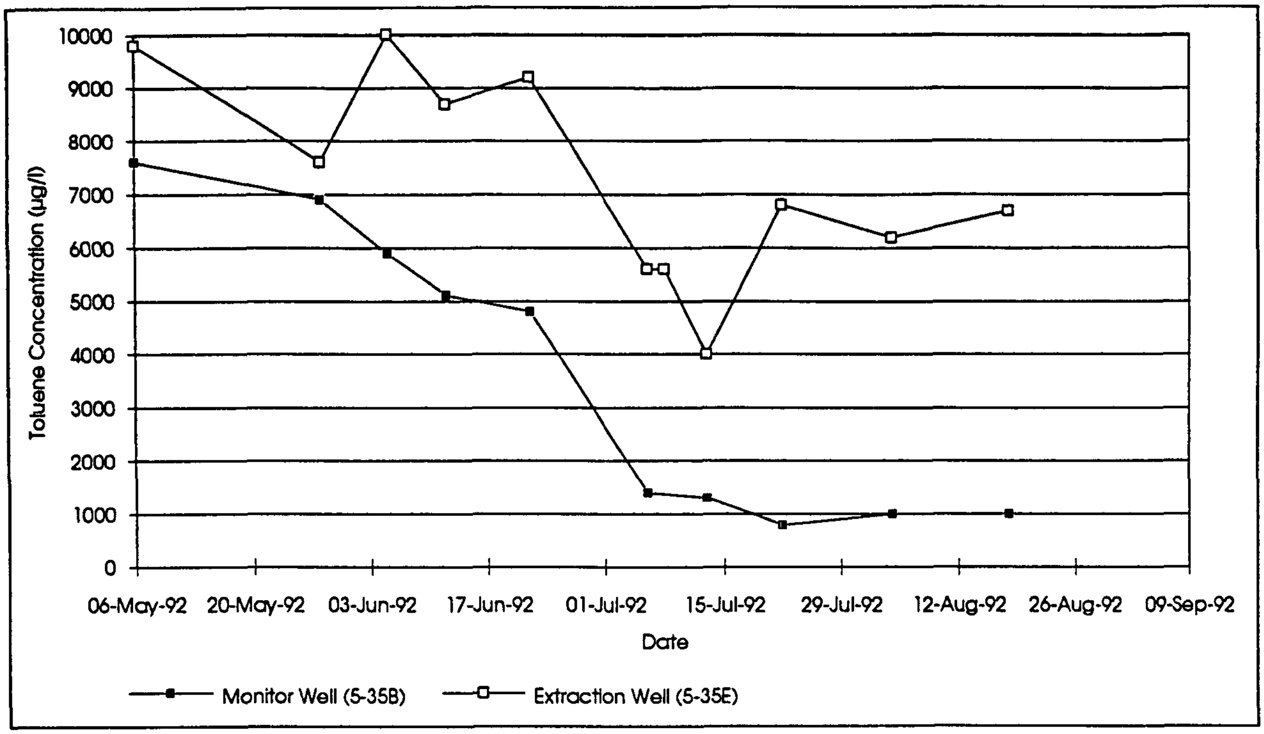

Figure 5. Toluene vs Time

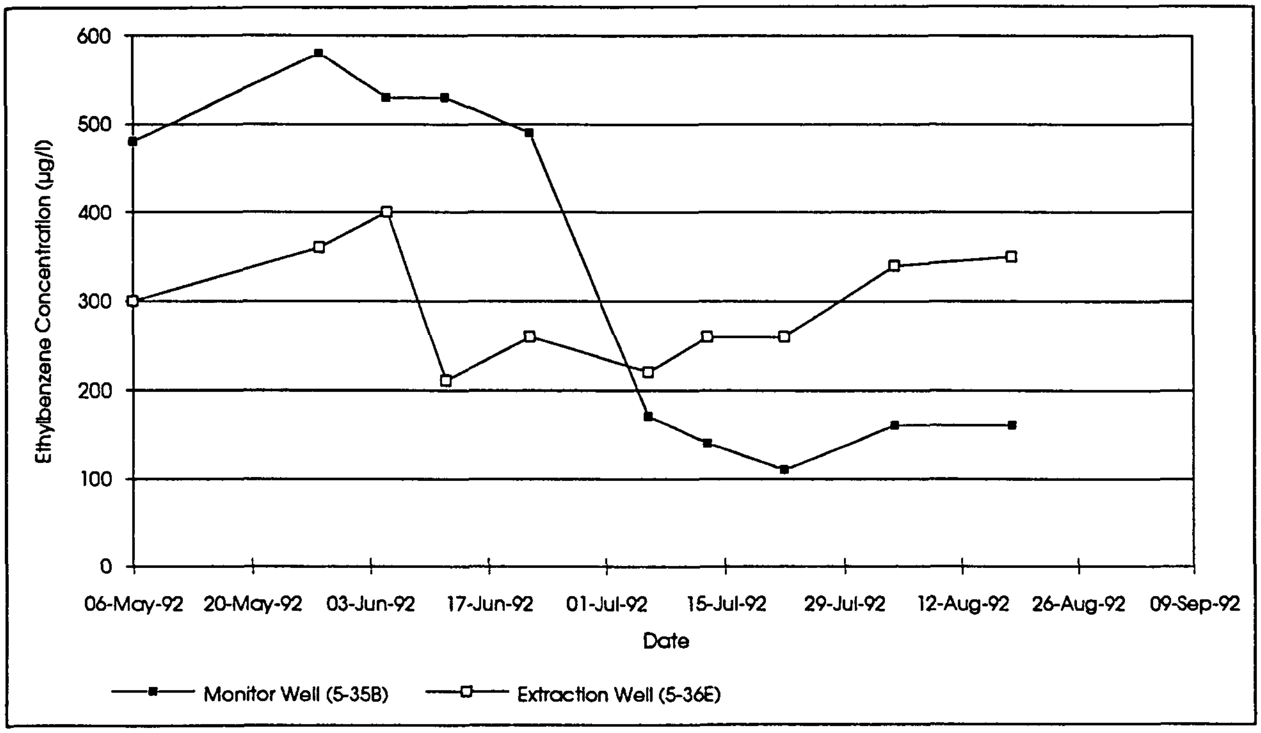

Figure 6. Ethylbenzene vs Time

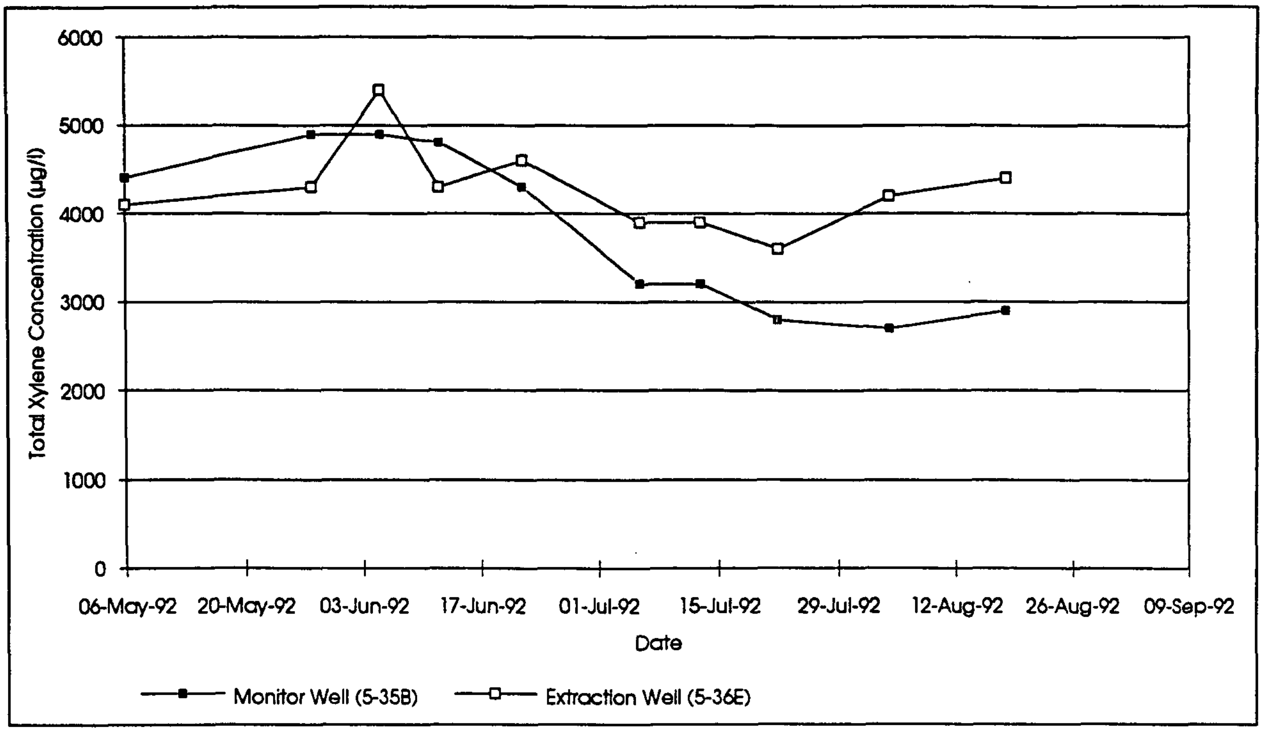

Figure 7. Xylene vs Time

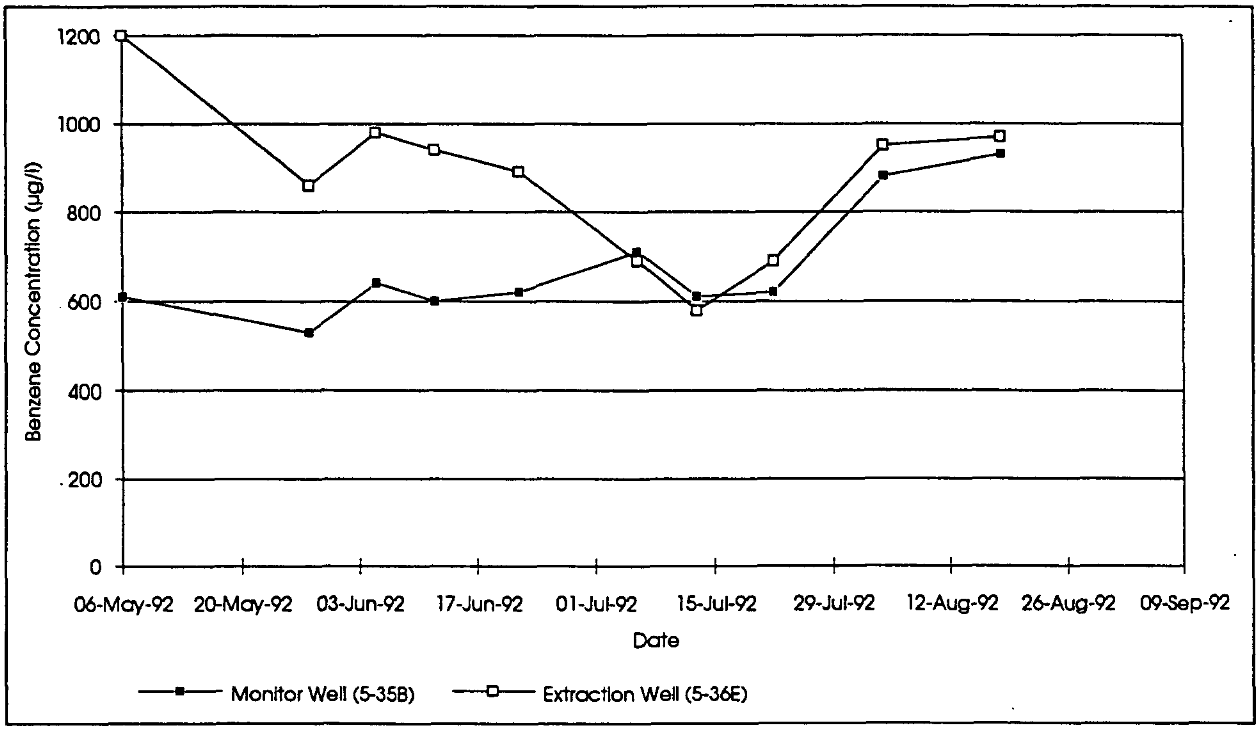

Figure 8. Benzene vs Time

References

Drever, J.I., 1982. *Geochemistry of natural waters.* Prentice-Hall, p. 282.

Fenchel, T. and T.H. Blackburn, 1979. *Bacteria and mineral cycling.* Academic Press.

Eiceman, G.A., 1986. *Hazardous organic wastes from natural gas production, processing, and distribution: Environmental fates.* New Mexico Water Resources Research Institute Report No. 227.

Hutchins, S.R., 1991. Optimizing BTEX biodegradation under denitrifying conditions. *Environmental Toxicology and Chemistry,* 10:1437-1448.

Hutchins, S.R., W.C. Downs, J.T. Wilson, G.B. Smith, D.A. Kovacs, D.D. Fine, R.H. Douglass, and D.J. Hendrix, 1991. Effect of nitrate addition on biorestoration of fuel-contaminated aquifer: Field demonstration. *Ground Water,* 29(4):571-579.

Kuhn, E.P., J. Zeyer, P. Eicher, and R.P. Schwarzenbach, 1988. Anaerobic degradation of alkylated benzenes in denitrifying laboratory aquifer conditions. *Applied and Environmental Microbiology,* 54(2):490-496.

Postma, D., C. Boesen, H. Kristiansen, and F. Larsen, 1991. Nitrate reduction in an unconfined sandy aquifer: Water chemistry, reduction processes, and geochemical modeling. *Water Resources Research,* 27(8):2077-2045.

Biographical Sketches

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Bob Marley is a hydrogeologist with Daniel B. Stephens & Associates, Inc. in Albuquerque, New Mexico, specializing in site characterization and remediation and in-situ hydraulic testing. He has conducted contaminant transport and water supply investigations in the southwestern U.S. and Australia, and is currently involved in remedial actions at several sites in New Mexico. He holds a bachelors degree in geology from Northern Arizona University and an M.S. in hydrology from the University of Arizona.

Fenley "Ted" Ryther received his Bachelor of Civil Engineering degree from the Georgia Institute of Technology. He has practiced consulting civil and environmental engineering, including permitting, design, site investigation, and remediation of hazardous and toxic wastes in soils and ground water, for more than 35 years. He has project experience in 25 states and 8 foreign countries. He is a registered Professional Engineer in six states, a member of the National Society of Professional Engineers and the Air and Waste Management Association, and a Fellow and Past President of the Houston Branch of the American Society of Civil Engineers.

Jeffrey Forbes is a senior hydrogeochemist with Daniel B. Stephens & Associates, Inc. in Albuquerque, New Mexico. He has seven years of experience in the analysis and interpretation of geochemical data pertaining to environmental site investigations. He has also worked as an analytical chemist performing laboratory analysis of water and soil samples for major elements, trace metals, and isotopic composition. Mr. Forbes received a bachelors degree in geology from Indiana University and a masters degree in geological sciences from the University of Washington. He is a Registered Geologist in Arizona and Indiana and is a member of the American Chemical Society.

NAPL Analytical Report

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CORE LABORATORIES

ANALYTICAL REPORT

925918

FOR

ENRON
GEORGE ROBINSON
ENVIRONMENTAL AFFAIRS
HOUSTON, TX 77002

01/14/93

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LABORATORY TESTS RESULTS
01/14/93

JOB NUMBER: 925918 CUSTOMER: ENRON ATTN: GEORGE ROBINSON

CLIENT I.D.........:
DATE SAMPLED.......: 12/10/92
TIME SAMPLED.......: 10:45
WORK DESCRIPTION...: 5-36E LNAPL

LABORATORY I.D...: 925918-0001
DATE RECEIVED....: 12/21/92
TIME RECEIVED....: 16:36
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Capillary Gas Chromatography	N/A		See Attachment	Capilliary GC	N/A	N/A
Sulfur, Total by x-ray Fluoresc.	0.61		Wt. %	ASTM D-4294	12/23/92	RRS
Sulfur Analysis by Chemiluminescen		*1		GC/SCD	12/22/92	SD
Hydrogen Sulfide	15	1	ppm wt sulfur			
Carbonyl Sulfide	16	1	ppm wt sulfur			
Sulfur Dioxide	<1	1	ppm wt sulfur			
Carbon Disulfide	<1	1	ppm wt sulfur			
Methyl Mercaptan	1	1	ppm wt sulfur			
Ethyl Mercaptan	7	1	ppm wt sulfur			
Isopropyl Mercaptan	8	1	ppm wt sulfur			
N-Propyl Mercaptan	2	1	ppm wt sulfur			
Tert-Butyl Mercaptan	9	1	ppm wt sulfur			
Sec-Butyl Mercaptan	<1	1	ppm wt sulfur			
Isobutyl Mercaptan	<1	1	ppm wt sulfur			
N-Butyl Mercaptan	<1	1	ppm wt sulfur			
Methyl Sulfide	1	1	ppm wt sulfur			
Ethyl Methyl Sulfide	<1	1	ppm wt Sulfur			
Ethyl Sulfide	<1	1	ppm wt sulfur			
Methyl Disulfide	<1	1	ppm wt sulfur			
Ethyl Methyl Disulfide	9	1	ppm wt sulfur			
Ethyl Disulfide	54	1	ppm wt sulfur			
Thiophene	27	1	ppm wt sulfur			
Tetra-Hydro Thiophene	<1	1	ppm wt sulfur			
2-Methyl Thiophene	2	1	ppm wt sulfur			
3-Methyl Thiophene	<1	1	ppm wt sulfur			
2-Ethyl Thiophene	<1	1	ppm wt sulfur			
3-Ethyl Thiophene	<1	1	ppm wt sulfur			
Thianaphthene	149	1	ppm wt sulfur			
Unidentified Sulfur Compounds	5810	0	ppm wt sulfur			

APPROVED BY: [signature]

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January 5, 1993

Enron
Environmental Affairs
Suite 3AC 3115
1400 Smith Street
Houston, TX 77002
ATTN: George Robinson

Job No: 925918
Date Received: 12/21/92
Sample Description: 5-36E LNAPL 12/10/92 10:45

CAPILLARY ANALYSIS

	Wt. %	L.V.%	Mole %
n-Butane	0.01	0.01	0.02
iso-Pentane	0.01	0.01	0.02
n-Pentane	0.03	0.04	0.05
Cyclopentane	0.02	0.02	0.04
2,3-Dimethylbutane	0.02	0.02	0.03
2-Methylpentane	0.17	0.19	0.24
3-Methylpentane	0.18	0.20	0.26
n-Hexane	0.61	0.70	0.89
2,2-Dimethylpentane	0.06	0.07	0.07
Methylcyclopentane	0.43	0.44	0.65
2,4-Dimethylpentane	0.09	0.10	0.11
2,2,3-Trimethylbutane	0.02	0.02	0.02
Benzene	0.01	0.01	0.02
3,3-Dimethylpentane	0.65	0.71	0.81
Cyclohexane	1.21	1.19	1.82
2-Methylhexane	1.30	1.46	1.64
2,3-Dimethylpentane	0.37	0.41	0.47
1,1-Dimethylcyclopentane	0.20	0.20	0.25
3-Methylhexane	1.60	1.78	2.02
cis-1,3-Dimethylcyclopentane	0.44	0.45	0.57
trans-1,3-Dimethylcyclopentane	0.41	0.42	0.53
3-Ethylpentane	0.15	0.16	0.18
trans-1,2-Dimethylcyclopentane	0.68	0.69	0.87
n-Heptane	3.92	4.38	4.93
Methylcyclohexane	5.23	5.20	6.73
2,2-Dimethylhexane	0.46	0.50	0.51
Ethylcyclopentane	0.27	0.27	0.35
2,5-Dimethylhexane	0.31	0.34	0.35
2,4-Dimethylhexane	0.35	0.38	0.39
trans,cis-1,2,4-Trimethylcyclopentane	0.42	0.43	0.47
3,3-Dimethylhexane	0.13	0.14	0.14

Continued on Page 2

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

P.O. Box 34282
Houston, TX 77234
(713) 943 9776

Enron
ATTN: George Robinson

Sample Description: 5-36E LNAPL 12/10/92 10:45

CAPILLARY ANALYSIS

	Wt. %	L.V.%	Mole %
trans,cis-1,2,3-Trimethylcyclopentane	0.46	0.47	0.52
Toluene	0.45	0.40	0.62
2,3-Dimethylhexane	0.45	0.48	0.50
2-Methyl-3-Ethylpentane	0.09	0.09	0.10
1,1,2-Trimethylcyclopentane	0.01	0.01	0.01
2-Methylheptane	2.54	2.78	2.81
4-Methylheptane	0.95	1.03	1.05
3,4-Dimethylhexane	0.10	0.10	0.11
cis,trans-1,2,4-Trimethylcyclopentane	0.06	0.06	0.07
3-Methylheptane	2.22	2.40	2.45
cis-1,3-Dimethylcyclohexane	1.70	1.70	1.91
trans-1,4-Dimethylcyclohexane	0.64	0.64	0.72
2,2,4,4-Tetramethylpentane	0.30	0.32	0.30
2,2,5-Trimethylhexane	0.03	0.03	0.03
trans-1-Ethyl-3-Methylcyclopentane	0.15	0.14	0.17
cis-1-Ethyl-3-Methylcyclopentane	0.13	0.12	0.14
trans-1-Ethyl-2-Methylcyclopentane	0.26	0.25	0.30
1-Ethyl-1-Methylcyclopentane	0.04	0.04	0.04
trans-1,2-Dimethylcyclohexane	0.74	0.73	0.84
cis,cis-1,2,3-Trimethylcyclopentane	0.01	0.01	0.01
n-Octane	5.00	5.44	5.53
Isopropylcyclopentane	0.08	0.08	0.09
2-Methyl-4-Ethylhexane	0.04	0.04	0.04
2,3,5-Trimethylhexane	0.05	0.05	0.05
cis-1-Ethyl-2-Methylcyclopentane	0.04	0.04	0.04
2,2-Dimethylheptane	0.11	0.12	0.11
cis-1,2-Dimethylcyclohexane	0.44	0.42	0.50
4,4-Dimethylheptane	0.03	0.03	0.03
n-Propylcyclopentane	1.38	1.36	1.55
2,6-Dimethylheptane	0.83	0.83	0.82
1,1,3-Trimethylcyclohexane	0.63	0.63	0.62
3,5-Dimethylheptane	0.75	0.80	0.74
3,3-Dimethylheptane	0.16	0.16	0.15
3-Methyl-3-Ethylhexane	0.05	0.05	0.05
Ethylbenzene	0.07	0.06	0.08
2,3,4-Trimethylhexane	0.22	0.23	0.21
trans,trans-1,2,4-Trimethylcyclohexane	0.36	0.36	0.36
cis,trans-1,3,5-Trimethylhexane	0.04	0.04	0.04
meta-Xylene	0.69	0.61	0.83

Continued on Page 3

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ATTN: George Robinson

Sample Description: 5-36E LNAPL 12/10/92 10:45

CAPILLARY ANALYSIS

	Wt. %	L.V.%	Mole %
para-Xylene	0.22	0.19	0.26
2,3-Dimethylheptane	0.42	0.44	0.41
3,4-Dimethylheptane	0.19	0.19	0.18
C-9 Naphthene	0.23	0.22	0.22
4-Ethylheptane	0.20	0.21	0.19
2,3-Dimethyl-3-Ethylpentane	0.02	0.02	0.02
4-Methyloctane	1.05	1.11	1.03
2-Methyloctane	1.40	1.50	1.38
3-Ethylheptane	0.26	0.28	0.26
3-Methyloctane	1.64	1.74	1.62
3,3-Diethylpentane	0.02	0.02	0.02
ortho-Xylene	0.40	0.35	0.48
C-10 Paraffin	0.12	0.12	0.10
1-Methyl-2-Propylcyclopentane	0.27	0.27	0.27
cis-1-Ethyl-3-Methylcyclohexane	0.52	0.50	0.52
trans-1-Ethyl-4-Methylcyclohexane	0.28	0.27	0.28
iso-Butylcyclopentane	0.05	0.05	0.05
2,2,6-Trimethylheptane	0.06	0.06	0.05
n-Nonane	5.43	5.80	5.35
Unidentified C-9 Compounds	0.30	0.32	0.30
trans-1-Ethyl-3-Methylcyclohexane	0.37	0.36	0.37
1-Methyl-1-Ethylcyclohexane	0.13	0.12	0.13
iso-Propylbenzene	0.03	0.03	0.03
sec-Butylcyclopentane	0.23	0.22	0.22
iso-Propylcyclohexane	0.17	0.16	0.17
2,2-Dimethyloctane	0.23	0.25	0.21
3,5-Dimethyloctane	0.13	0.13	0.11
Propylcyclohexane	0.78	0.75	0.78
n-Butylcyclopentane	0.37	0.36	0.37
2,6-Dimethyloctane	0.89	0.94	0.79
3,3-Dimethyloctane	0.09	0.09	0.08
n-Propylbenzene	0.30	0.27	0.32
1,3-Dimethyl-2-Ethylcyclohexane	0.23	0.23	0.21
meta-Ethyltoluene	0.23	0.20	0.24
para-Ethyltoluene	0.19	0.16	0.20
1,3,5-Trimethylbenzene	0.93	0.82	0.98
4-Ethyloctane	0.04	0.04	0.03
5-Methylnonane	0.45	0.47	0.40
4-Methylnonane	1.01	1.06	0.89

Continued on Page 4

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January 14, 1993

Enron-Environmental Affairs
ATTN: George Robinson

Job No: 925918
Sample ID: 5-36E LNAPL 12/10/92 10:45

CAPILLARY ANALYSIS

	Wt.%	LV.%	Mol.%
C4 Summation	0.01	0.01	0.02
C5 Summation	0.04	0.05	0.07
C6 Summation	1.00	1.13	1.46
C7 Summation	11.54	12.49	14.96
C8 Summation	23.50	24.50	27.17
C9 Summation	19.05	19.57	19.30
C10 Summation	17.86	17.86	16.53
C11 Summation	13.27	12.95	11.11
C12 Summation	3.37	3.27	2.59
C13 Summation	4.62	3.55	3.22
C14 Summation	4.84	3.72	3.08
C15 Summation	0.51	0.51	0.30
C16 Summation	0.17	0.17	0.09
C17 Summation	0.12	0.12	0.07
C18 Summation	0.04	0.04	0.01
C19 Summation	0.03	0.03	0.01
C20 Summation	0.02	0.02	0.01
C21 Plus Compounds	0.01	0.01	0.00
	100.00	100.00	100.00

	LV.%
Paraffins	60.53
Naphthenes	21.96
Aromatics	8.31
Unidentified	9.20
	100.00

M. Jean Waits
Supervising Chemist

VW

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January 14, 1993

Enron-Environmental Affairs
ATTN: George Robinson

Job No.: 925918
Sample ID: 5-36E LNAPL 12/10/92 10:45

Liquid Volume Percent

Carbon No	Paraffins	Naphthene	Aromatics	Unidentified	Total
C-4	.01				.01
C-5	.05	.02			.07
C-6	1.11	1.63	.01		2.75
C-7	9.09	7.23	.40		16.72
C-8	14.03	6.50	1.21		21.74
C-9	13.68	4.54	2.90	.32	21.44
C-10	11.04	1.93	2.19	.77	15.93
C-11	5.47	.14	1.58	1.26	8.45
C-12	4.26		.02	.44	4.72
C-13	.94			2.61	3.55
C-14	.47			3.25	3.72
C-15	.11			.40	.51
C-16	.07			.10	.17
C-17	.07			.05	.12
C-18	.04				.04
C-19	.03				.03
C-20+	.03				.03
Total	60.50	21.99	8.31	9.20	100.00

Laboratory Supervisor

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APPENDIX C

LITHOLOGIC LOGS AND WELL COMPLETION DIAGRAMS

Lithologic Logs

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.3

Date Started: 3/28/93

Date Completed: 3/31/93

Boring No.: 5-34B

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Drilling Method: Cable Tool

Total Depth Drilled: 65.7 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 10.0	Cuttings	Silty sand	Fine-grained, moderately sorted, 5% medium-grained, 5-10% clay, red (2.5 YR 4/6, wet)
10.0 - 20.0	Cuttings	Silty sand	Fine-grained, moderately sorted, 5% medium-grained, 5-10% clay with minor coarse sand, red (2.5 YR 4/6, wet)
20.0 - 27.0	Cuttings	Sand	Fine-grained, moderately sorted, 20% silt and clay, reddish-brown (2.5 YR 5/4, wet)
27.0 - 40.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 15% clay, 23% limestone gravel (1.0 - 1.5 cm diameter), reddish-brown (2.5 YR 5/4, wet)
40.0 - 43.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 10% limestone gravel (0.8 - 1.5 cm diameter), reddish-brown (2.5 YR 5/4, wet)
43.0 - 50.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 15-20% clay, minor gravel, reddish-brown (2.5 YR 5/4, wet)
50.0 - 55.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 5-10% gravel (0.2 - 0.6 cm/diameter), reddish brown (2.5 YR 5/4, wet)
55.0 - 59.6	Cuttings	Sand	Fine-grained, well sorted, minor silt and clay, reddish-brown (2.5 YR 5/4, wet)
59.6 - 60.6	Split spoon	Silty clay	Well sorted, plastic, moist, light gray reduction spots with claystone partings, red (10 R 4/6)
60.6 - 65.7	Cuttings	Silty clay	Well sorted, plastic, red (10 R 4/6)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105

Date Started: 4/4/92

Date Completed: 4/5/92

Boring No.: 5-35B

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Drilling Method: Cable Tool

Total Depth Drilled: 70.0 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 20.0	Cuttings	Sand	Very fine-grained, moderately sorted, trace clay, red (2.5 YR 4/6, wet)
20.0 - 25.0	Cuttings	Silty sand	Very fine-grained, moderately sorted, minor clay, reddish-brown (2.5 YR 5/4, wet)
25.0 - 30.0	Cuttings	Sandy clay	Very fine-grained, poorly sorted, reddish-brown (2.5 YR 5/4, wet)
30.0 - 35.0	Cuttings	Silty sand	Fine-grained, moderately sorted, reddish-brown (2.5 YR 5/4, wet)
35.0 - 40.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 10-15% coarse sand and limestone gravel (0.2 - 0.7 cm diameter), reddish-brown (2.5 YR 5/4, wet)
40.0 - 50.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 15-20% coarse sand and gravel, reddish-brown (2.5 YR 5/4, wet)
50.0 - 55.4	Cuttings	Sand	Fine-grained, moderately sorted, 15-20% coarse sand and gravel (0.2 - 0.8 cm diameter), reddish brown (2.5 YR 5/4, wet)
55.4 - 56.4	Split spoon	Sand	Medium-grained, well sorted, minor fines, 3-5% gravel, reddish brown (2.5 YR 5/4, wet)
56-4 - 60.2	Cuttings	Silty sand	Fine-grained, moderately sorted, reddish-brown (2.5 YR 5/4, wet)
60.2 - 61.2	Split spoon	Clay	Plastic, with light gray reduction spots, red (10 R 4/6)
61.2 - 65.2	Cuttings	Clay	Plastic, with light gray reduction spots, red (10 R 4/6)

BORING NO.: 5-35B (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
65.2 - 65.5	Split spoon	Clay	Plastic, moist, with light gray reduction spots, red (10 R 4/6)
65.5 - 70.0	Cuttings	Clay	Plastic, with light gray reduction spots, red (10 R 4/6)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.3

Date Started: 4/8/92

Date Completed: 4/9/92

Boring No.: 5-36E

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Drilling Method: Cable Tool

Total Depth Drilled: 67.5 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 20.0	Cuttings	Silty sand	Very fine-grained, moderately sorted, trace clay, weak red (10 R 5/4, wet)
20.0 - 25.0	Cuttings	Silty sand	Very fine-grained, moderately sorted, minor clay, reddish-brown (2.5 YR 5/4, wet)
25.0 - 32.0	Cuttings	Silty sand	Fine-grained, moderately sorted, 5% coarse sand, reddish-brown (2.5 YR 5/3, wet)
32.0 - 35.7	Cuttings	Silty sand	Fine-grained, moderately sorted, 5-10% gravel (0.3 - 0.4 cm diameter), reddish-brown (2.5 YR 5/3, wet)
35.7 - 36.5	Split spoon	Sand	Medium-grained, well sorted, 10% coarse sand and gravel, reddish-brown (2.5 YR 5/3, wet)
36.5 - 49.9	Cuttings	Silty sand	Fine-grained, poorly sorted, 10-15% coarse sand and gravel, red (2.5 YR 5/6, wet)
49.9 - 51.1	Split spoon	Sand	Medium-grained, well sorted, moist to wet, minor silt, red (10 R 5/6, wet)
51.1 - 52.0	Cuttings	Sand	Medium-grained, well sorted, red (10 R 5/6, wet)
52.0 - 58.0	Cuttings	Sand	Fine-grained, moderately sorted, red (10R 5/6, wet)
58.0 - 59.0	Split spoon	Sand	Medium-grained, well sorted, 2% gravel and cobbles (1.0 - 1.5 cm diameter), red (10R 5/6, wet)
59.0 - 61.5	Cuttings	Sand	Very fine-grained, moderately sorted, 2% coarse sand, minor clay, red (2.5 YR 5/6)
61.5 - 67.5	Cuttings	Clay	Plastic, with light gray reduction spots, red (10 R 5/6, wet)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.3

Date Started: 4/15/92

Date Completed: 4/16/92

Boring No.: 5-371

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Drilling Method: Cable Tool

Total Depth Drilled: 72.5 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 37.0	Cuttings	Silty sand	Very fine to fine-grained, moderately sorted, trace clay, yellowish-red (5 YR 5/6, wet)
37.0 - 53.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 15% limestone gravel and coarse sand, trace clay, yellowish-red (5 YR 5/6, wet)
53.0 - 59.0	Cuttings	Silty sand	Very fine to fine-grained, moderately sorted, trace clay, yellowish-red (5 YR 5/8, wet)
59.0 - 72.5	Cuttings	Clay	Plastic, moist to dry, trace fine sand, red (2.5 YR 4/8), partings with light gray reduction spots to 1/8" diameter. (N8)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/21/92

Date Completed: 7/21/92

Boring No.: 5-SB-38

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 50.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-11.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, with minor fine-grained limestone gravel at 9.5', damp, moderate brown (5YR 4/4)
11.0-14.0	Cuttings	Sandy silty clay	Very fine-grained, poorly sorted, very slightly plastic, damp, moderate brown (5YR 4/4)
14.0-17.4	Split Spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
17.4-18.0	Split Spoon	Silty clay	Very fine-grained, slightly plastic, with minor secondary calcite filling, damp, moderate brown (5YR 4/4)
18.0-18.5	Split Spoon	Silty clayey sand	Very fine- to fine-grained, poorly sorted, damp, moderate brown (5YR 4/4)
18.5-19.0	Split Spoon	Silty clay	Very fine-grained, with dark, reduced material, slightly plastic, damp, moderate brown (5YR 4/4)
19.0-23.0	Cuttings	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, damp (5YR 4/4)
23.0-25.0	Cuttings	Silty clayey sand	Slightly plastic, damp, with minor limestone gravel, moderate brown (5YR 4/4)
25.0-26.0	Cuttings	Silty clay	Very fine-grained, with fine-grained limestone gravel at 26', damp, moderate brown (5YR 4/4)
26.0-44.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-38 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
44.0-45.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with medium-grained limestone gravel at 44', slightly damp, moderate brown (5YR 4/4)
45.0-49.0	Cuttings	Gravel	Limestone gravel with fine-grained silty sand, slightly damp, moderate brown (5YR 4/4)
49.0-50.5	Split Spoon	Gravelly clay	Plastic, fat, damp with fine to medium limestone gravel, moderate brown (5YR 4/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.
ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/22/92

Date Completed: 7/22/92

Boring No.: 5-SB-39

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 48.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-13.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, minor clay, very slightly damp, rootlets at 8.0', moderate brown (5YR 4/4)
13.0-15.0	Cuttings	Silty clayey sand	Fine- to medium-grained, moderately sorted, subangular to subrounded sand, with limestone gravel at 13', very slightly damp, moderate brown (5YR 3/4)
15.0-17.2	Split Spoon	Silty sandy clay	Very fine- to fine-grained, poorly sorted, subangular to subrounded, with secondary calcite filling, very slightly damp, moderate brown (5YR 4/4)
17.2-17.6	Split spoon	Clayey sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
17.6-20.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)
20.0-22.0	Cuttings	Silty sand	Fine- to medium-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
22.0-26.0	Cuttings	Silty clayey sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
26.0-30.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with limestone gravel at 26', dry, moderate brown (5YR 3/4)

BORING NO.: 5-SB-39 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
30.0-36.0	Split spoon	--	No recovery, no cuttings
36.0-38.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp to dry, moderate brown (5YR 3/4)
38.0-38.4	Split spoon	Silty sandy clay	Very fine- to medium-grained, poorly sorted, subangular to subrounded, slightly plastic clay, with secondary calcite filling, very slightly damp, moderate brown (5YR 3/4)
38.4-39.5	Split spoon	Silty sand	Very fine-grained, well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 3/4)
39.5-40.0	Split spoon	Silty clayey sand	Very fine-grained, poorly sorted, very slightly damp, moderate brown (5YR 4/4)
40.0-43.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, with minor limestone gravel, dry, moderate brown (5YR 4/4)
43.0-43.5	Split spoon	Silty sand	Very fine- to fine-grained, with minor limestone gravel and light gray clay nodules, damp, moderate brown (5YR 4/4)
45.0-46.2	Split spoon	Clayey silty sand	Very fine- to fine-grained, poorly sorted, damp, moderate brown (5YR 4/4)
46.2-47.0	Split spoon	Sandy silty clay	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
47.0-48.0	Split spoon	Clayey sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
48.0-48.5	Split spoon	Clayey gravel	Fine to medium, wet, moderate orange (10YR 6/6)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/23/92

Date Completed: 7/23/92

Boring No.: 5-SB-40

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 43.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-6.5	Cuttings	Silty sandy clay	Very fine-grained, poorly sorted, damp, moderate brown (5YR 3/4)
6.5-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
10.0-13.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
13.0-13.5	Split spoon	Clayey gravelly sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded with limestone gravel, slightly damp, moderate brown (5YR 3/4)
13.5-17.0	Cuttings	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
17.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very fine- to medium-grained limestone gravel at 23′ and 25′, very slightly damp, moderate brown (5YR 4/4)
25.0-25.5	Split spoon	Silty clayey sandy gravel	Very fine to coarse, poorly sorted, well graded, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
25.5-26.2	Split spoon	Silty clay	Very fine-grained, well sorted, with subangular to subrounded, slightly plastic, light gray (10YR 6/2) clay nodules, slightly damp (5YR 4/4)

BORING NO.: 5-SB-40 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
26.2-26.7	Split spoon	Gravel	Very coarse, subangular to subrounded, with minor clay and light gray (10YR 6/2) clay nodules, very slightly damp, pale yellowish brown (5YR 6/2)
26.7-27.2	Split spoon	Silty clay	Very fine-grained, well sorted, with light gray (10YR 3/4) clay nodules and minor medium-grained sand, slightly damp (5YR 3/4)
27.2-28.0	Split spoon	Gravelly clay	Fine to medium limestone gravel, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
28.0-33.0	Cuttings	Gravelly clay	Very fine to medium limestone gravel, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
33.0-36.0	Cuttings	Silty clay	Very fine-grained, moderately well sorted, subangular to subrounded, with minor fine-grained gravel, damp, moderate brown (5YR 4/4)
36.0-40.0	Cuttings	Clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
40.0-43.5	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very damp, moderate brown (5YR 4/4)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/16/92

Date Completed: 8/16/92

Boring No.: 5-41B

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 77.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-7.0	Cutting	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
7.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp to dry, moderate brown (5YR 4/4)
10.0-15.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp to dry, moderate brown (5YR 4/4)
15.0-19.0	Cuttings	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
19.0-25.0	Cuttings	Silty sandy clay	Very fine- to medium-grained, poorly sorted, subangular to subrounded, dark organic material at 23', slightly damp, moderate brown (5YR 4/4)
25.0-26.5	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, secondary calcite filling, very slightly damp, moderate brown (5YR 4/4)
26.5-35.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, minor limestone gravel at 30', very slightly damp, moderate brown (5YR 4/4)
35.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)
40.0-43.0	Split spoon	Silty sandy clay/silty clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)

BORING NO.: 5-41B (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
43.0-43.5	Split spoon	Silty clay/clayey silt	Very fine-grained, well sorted, secondary calcite filling, dry, moderate brown (5YR 4/4)
43.5-49.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)
49.0-53.0	Cuttings	Gravel	Fine to medium limestone gravel
53.0-55.0	No returns		
55.0-56.2	Split spoon	Clayey sand	Very fine-grained, moderately well sorted, very damp, (5YR 4/4)
56.2-56.5	Split spoon	Silty Clay	Very fine-grained, fat, plastic, wet, moderate brown (5YR 4/4)
56.2-75.0	Cuttings	No returns	
75.0-76.5	Split spoon	Sand	Very fine-grained, well sorted, saturated, moderate brown (5YR 3/4)
76.5-77.0	Split spoon	Clay	Plastic, light gray (7N7) clay nodules, slightly damp, minor silt, moderate reddish brown (10YR 4/6)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/28/92

Date Completed: 7/28/92

Boring No.: 5-SB-42

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 62.0 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Fine- to medium-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
10.0-10.4	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
10.4-12.0	Split spoon	Silty clay	Slightly plastic, with light gray (10YR 6/2) clay nodules, very slightly damp, moderate brown (5YR 4/4)
12.0-13.7	Split spoon	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)
13.7-15.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with secondary calcite filling, dry, moderate brown (5YR 4/4)
15.0-20.0	Cuttings	Silty clay	Fat, plastic, damp, moderate reddish brown (10YR 4/6)
20.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with some dark grayish brown (5YR 3/2) organic soil at 20', slightly damp, moderate brown (5YR 4/4)
25.0-25.2	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
25.2-26.2	Split spoon	Sand	Medium- to coarse-grained, poorly sorted, dry, moderate brown (5YR 4/4)

BORING NO.: 5-SB-42 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
26.2-26.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, very slightly damp, moderate brown (5YR 3/4)
26.8-28.3	Split spoon	Silty clay	Very fine-grained, moderately well sorted, with light gray (10YR 6/2) clay nodules and secondary calcite filling, slightly damp, moderate brown (5YR 3/4)
28.3-30.0	Split spoon	Silty sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
30.0-51.5	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
51.5-59.0	Cuttings	Gravel	Limestone gravel, cobbles, and boulder
59.0-62.0	Split spoon	No recovery	Split spoon barrel wet

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/29/92

Date Completed: 7/29/92

Boring No.: 5-SB-43

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 47.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, limestone cobbles at 5′, damp, moderate brown (5YR 3/4)
10.0-10.9	Split spoon	Silty sand	Very fine-grained, well sorted, damp, moderate brown (5YR 3/4)
10.9-12.2	Split spoon	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
12.2-15.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
15.0-22.0	Cuttings	Silty sand	Very fine- to medium-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
22.0-25.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
25.0-26.4	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
26.4-26.9	Split spoon	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
26.9-27.4	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, loose, moderate brown (5YR 4/4)

BORING NO.: 5-SB-43 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
27.4-28.0	Split spoon	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
28.0-31.0	Cuttings	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
31.0-32.0	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel
32.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, very slightly damp to dry, moderate brown (5YR 4/4)
40.0-41.0	Split spoon	Gravel	Limestone cobbles and gravel
41.0-42.5	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, large limestone boulder at 41-41.5', dry, moderate brown (5YR 4/4)
42.5-44.0	Split spoon	Gravelly sand	Medium- to coarse-grained, well sorted, subangular to subrounded, dry, light brown (5YR 6/4)
44.0-45.0	Split spoon	Gravelly clay	Fine to coarse, poorly sorted, well graded, with light gray (N/8) clay nodules and some silty clay, damp, moderate brown (5YR 3/4)
45.0-47.0	Cuttings	Gravelly clay	Fine to coarse, poorly sorted, well graded, subangular to subrounded, with light gray (N/8) clay nodules and some silty clay, wet, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/30/92

Date Completed: 7/30/92

Boring No.: 5-SB-44

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 49.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-3.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, damp, gray brown (5YR 3/2)
3.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
10.0-10.9	Split spoon	Silty clayey sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
10.9-12.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
12.8-13.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
13.0-22.0	Cuttings	Silty clay	Very fine-grained, well sorted, with gravel at 16′, slightly damp, yellowish gray (5YR 3/2)
22.0-25.0	Cuttings	Silty clay	Very fine-grained, plastic, damp, moderate brown (5YR 4/4)
25.0-25.5	Split spoon	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
25.5-26.0	Split spoon	Clayey silty sand	Very fine-grained, moderately sorted, subangular to subrounded, with light gray (10YR 6/2) clay nodules, damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-44 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
26.0-27.0	Split spoon	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
27.0-30.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
30.0-34.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
34.0-35.0	Cuttings	Gravel	Sandstone gravel to 34.5′, limestone gravel to 35′, damp, moderate brown (5YR 4/4)
35.0-42.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
42.0-42.2	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
42.2-43.8	Split spoon	Gravel	Limestone gravel and cobbles in a clayey silty sand matrix, damp, moderate brown (5YR 4/4)
43.8-44.5	Split spoon	Silty clayey sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, with minor gravel, damp, moderate brown (5YR 3/4)
44.5-49.5	Cuttings	Silty clayey sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 7/31/92

Date Completed: 7/31/92

Boring No.: 5-SB-45

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 63.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-7.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
7.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor fine gravel, dry to slightly damp, light brown (5YR 6/4)
10.0-13.5	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, light brown (5YR 6/4)
13.5-14.2	Split spoon	Clayey silty sand	Very fine- to fine-grained, subangular to subrounded, with minor dark organic material, slightly damp, moderate brown (5YR 3/4)
14.2-15.0	Split spoon	Silty clay	Slightly plastic, damp, moderate brown (5YR 3/4)
15.0-17.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, slightly damp, moderate brown (5YR 3/4)
17.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
25.0-26.5	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, light brown (5YR 6/4)
26.5-27.9	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-45 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
27.9-28.4	Split spoon	Gravelly sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, with very fine to fine limestone gravel, dry, moderate brown (5YR 4/4)
28.4-29.0	Split spoon	Silty gravelly sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
29.0-33.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with fine gravel, dry, light brown (5YR 6/4)
33.0-37.0	Cuttings	Silty gravelly sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, with fine to medium, subangular to subrounded limestone gravel, dry, light brown (5YR 6/4)
37.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 4/4)
40.0-41.2	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
41.2-41.7	Split spoon	Silty sandy gravel	Fine- to medium, subangular to subrounded limestone gravel, with very fine- to medium-grained, poorly sorted, subangular to subrounded sand, dry, moderate brown (5YR 4/4)
41.7-42.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
42.8-43.5	Split spoon	Silty gravelly sand	Fine to medium, subangular to subrounded limestone gravel, with very fine- to medium-grained, poorly sorted, subangular to subrounded sand, very slightly damp, moderate brown (5YR 3/4)

BORING NO.: 5-SB-45 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
43.5-44.5	Cuttings	Silty gravelly sand	Fine to medium-grained, subangular to subrounded sand, very fine- to medium, poorly sorted, subangular to subrounded limestone gravel, very slightly damp, moderate brown (5YR 3/4)
44.5-46.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
46.0-47.5	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, dry, light brown (5YR 6/4)
47.5-50.0	Cuttings	Clay	Plastic, fat, damp, moderate brown (5YR 3/4)
50.0-51.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, with minor limestone gravel, damp, moderate brown (5YR 3/4)
51.0-57.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with minor clay and fine limestone gravel, damp, moderate brown (5YR 3/4)
57.0-57.6	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
57.6-58.0	Split spoon	Silty clayey gravel	Very fine to fine limestone gravel, with very fine- to fine-grained, moderately sorted, subangular to subrounded sand and silt, damp, moderate brown (5YR 3/4)
58.0-63.0	Cuttings	Silty clayey gravel	Very fine to fine, subangular to subrounded limestone gravel, with very fine-grained, moderately well sorted, subangular to subrounded clayey silt, damp, moderate brown (5YR 3/4)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/3/92

Date Completed: 8/3/92

Boring No.: 5-SB-46

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 58.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
10.0-13.2	Split spoon	Silty sand	Very fine-grained, well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
13.2-15.0	Split spoon	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
15.0-20.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with minor limestone gravel at 18', damp, moderate brown (5YR 4/4)
20.0-21.0	Cuttings	Clay	Plastic, fat, damp, moderate brown (5YR 4/4)
21.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
25.0-28.2	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with very fine-grained, very well sorted sand from 26.4' to 26.6', damp, moderate brown (5YR 4/4)
28.2-29.2	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor medium limestone gravel, slightly damp, moderate brown (5YR 4/4)
29.2-30.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-46 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
30.0-35.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, damp, moderate brown (5YR 4/4)
35.0-42.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor limestone and sandstone gravel at 42′, damp, moderate brown (5YR 4/4)
42.0-42.5	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, with very fine- to fine-grained, moderately well sorted, subangular to subrounded sand, damp, moderate brown (5YR 3/4)
42.5-45.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
45.0-47.5	Split spoon	Gravel	Fine to medium, subangular to subrounded limestone gravel, with very fine- to fine-grained, moderately sorted, subangular to subrounded silty sand, damp, moderate brown (5YR 4/4)
47.5-50.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very damp to 49.2′, wet from 49.2′ to 50.0′, moderate brown (5YR 4/4)
50.0-58.5	Cuttings	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)
58.5	Cuttings	Clay	Plastic, fat, wet, with light gray (7N7) clay nodules and minor silt, moderate reddish brown (10YR 4/6); Chinle Fm.

Client:	Transwestern Pipeline Compressor Station No. 5 Thoreau, New Mexico	**Boring No.:**	5-47B
Project No.:	2105 2.2	**Drilling Contractor:**	Stewart Brothers Drilling Grants, New Mexico
Date Started:	8/16/92	**Drilling Method:**	Hollow Stem Auger
Date Completed:	8/16/92	**Total Depth Drilled:**	80.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
10.0-10.3	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
10.3-12.6	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, light brown (5YR 6/4)
12.6-15.0	Split spoon	Silty clay/clayey silt	Very fine-grained, well sorted, subangular to subrounded, very fine gravel at 13′ at 13.2′, secondary calcite filling, damp, moderate brown (5YR 3/4)
15.0-17.5	Cuttings	Silty clay	Very fine-grained, well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
17.5-17.7	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, minor sandstone gravel, damp, moderate brown (5YR 3/4)
17.7-22.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
22.0-24.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, light brown (5YR 6/4)
24.0-30.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, minor clay, slightly damp, moderate brown (5YR 4/4)
30.0-32.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-47B (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
32.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
40.0-40.4	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
40.4-40.8	Split spoon	Sand	Very fine-grained, well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
40.8-41.1	Split spoon	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, secondary calcite filling, very slightly damp, (5YR 4/4)
41.1-41.7	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
41.7-43.0	Split spoon	Silty gravelly sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
43.0-44.0	Split spoon	Silty clayey sand	Very fine-grained, moderately well sorted, some secondary calcite filling, very slightly damp, moderate brown (5YR 4/4)
44.0-58.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
58.0-63.0	Split spoon	Gravel ?	Large limestone cobble, very damp fine-grained sand in drive shoe
63.0-75.0	Cuttings	Sand, clay and gravel	Undifferentiated cuttings
75.0-75.4	Split spoon	Clay	Plastic, fat, wet, moderate brown (5YR 3/4)
75.4-75.7	Split spoon	Gravel	Fine to medium, subrounded to subangular limestone gravel and cobbles, very fine- to fine-grained, subangular to subrounded sand, damp, moderate brown (5YR 3/4)
75.7-76.5	Split spoon	Silty clay/clayey silt	Very fine-grained, well sorted, slightly plastic, damp, moderate brown (5YR 3/4)
76.5-80.0	Split spoon	Clay	Plastic, light gray (7N7) clay nodules, minor silt, damp, moderate reddish brown (10YR 4/6)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client:	Transwestern Pipeline Compressor Station No. 5 Thoreau, New Mexico	**Boring No.:**	5-48B
Project No.:	2105 2.2	**Drilling Contractor:**	Stewart Brothers Drilling Grants, New Mexico
Date Started:	8/19/92	**Drilling Method:**	Hollow Stem Auger
Date Completed:	8/20/92	**Total Depth Drilled:**	63.7 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
10.0-13.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
13.8-14.3	Split spoon	Gravelly sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, damp, light brown (5YR 6/4)
14.3-15.0	Split spoon	Clay	Plastic, fat, wet, moderate brown (5YR 3/4)
15.0-20.0	Cuttings	Silty clay	Very fine-grained, well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
20.0-23.0	Cuttings	Clay	Plastic, fat, wet, moderate brown (5YR 3/4)
23.0-23.5	Cuttings	Silty clay	Plastic, slightly damp, moderate brown (5YR 3/4)
23.5-25.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
25.0-25.2	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
25.2-25.5	Split spoon	Silty clay	Slightly plastic, secondary calcite filling and minor organic material, damp, moderate brown (5YR 3/4)
25.5-26.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
26.0-26.8	Split spoon	Clayey silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)

BORING NO.: 5-48B (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
26.8-33.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, very slightly damp, (5YR 3/4)
33.0-35.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
35.0-36.0	Cuttings	Silty sand	Fine-grained, well sorted, subangular to subrounded, very slightly damp, light brown (5YR 6/4)
36.0-37.0	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, fine-grained, subangular to subrounded sand, very slightly damp, moderate brown (5YR 4/4)
37.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
40.0-42.0	Cuttings	Gravel	Fine to medium, subangular to subrounded, very fine- to fine-grained silty sand, slightly damp, (5YR 4/4)
42.0-44.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, (5YR 4/4)
44.0-45.0	Split spoon	Gravel	Fine to medium, subangular to subrounded, some re-worked Chinle and limestone cobbles, slightly damp, moderate brown (5YR 3/4)
45.0-45.9	Split spoon	Silty gravelly sandy clay	Very fine- to medium-grained, poorly sorted, well graded, subangular to subrounded, very damp, moderate brown (5YR 3/4)
45.9-47.8	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)
47.8-49.0	Split spoon	Silty sandy clay/silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded sand, minor fine gravel, wet, moderate brown (5YR 3/4)
49.0-58.0	Cuttings	Sand silt and gravel	Undifferentiated cuttings

BORING NO.: 5-48B (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
58.0-60.8	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)
60.8-61.0	Split spoon	Cobbles	Limestone cobbles
61.0-61.2	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)
61.2-63.7	Split spoon	Clay	Plastic, fat, wet, light gray (7N7) clay nodules, moderate reddish brown (10YR 4/6)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/6/92

Date Completed: 8/6/92

Boring No.: 5-SB-49

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 44.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
10.0-11.7	Split spoon	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, with secondary calcite filling and rootlets, very slightly damp, moderate brown (5YR 4/4)
11.7-15.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with secondary calcite filling and rootlets, very slightly damp, moderate brown (5YR 4/4)
15.0-21.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with secondary calcite filling and minor limestone gravel at 20', very slightly damp (5YR 4/4)
21.0-22.0	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, with very fine- to fine-grained, moderately well sorted, subangular to subrounded silty sand, very slightly damp, moderate brown (5YR 4/4)
22.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
25.0-25.9	Split spoon	Sand	Fine-grained, well sorted, subangular to subrounded, with minor silt, slightly damp, light brown (5YR 6/4)

BORING NO.: 5-SB-49 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
25.9-26.6	Split spoon	Silty clay	Very fine-grained, slightly plastic, with minor fine limestone gravel, damp, moderate brown (5YR 3/4)
26.6-27.4	Split spoon	Silty sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, slightly damp, light brown (5YR 6/4)
27.4-27.9	Split spoon	Silty clay	Very fine-grained, slightly plastic, with some secondary calcite filling, damp (5YR 3/4)
27.9-29.0	Split spoon	Sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, slightly damp, light brown (5YR 6/4)
29.0-29.5	Split spoon	Gravelly sand	Very fine- to medium-grained, poorly sorted, well graded, subangular to subrounded, with very fine to fine, subangular to subrounded limestone gravel, very slightly damp, light brown (5YR 6/4)
29.5-30.0	Split spoon	Silty clay	Very fine-grained with some secondary calcite filling, very slightly damp, moderate brown (5YR 3/4)
30.0-40.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly to slightly damp, moderate brown (5YR 4/4)
40.0-43.2	Split spoon	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
43.2-44.0	Split spoon	Sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, wet, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/6/92

Date Completed: 8/6/92

Boring No.: 5-SB-50

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 49.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with some clay, damp, moderate brown (5YR 3/4)
10.0-10.8	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded with rootlets, very slightly damp, moderate brown (5YR 3/4)
10.8-12.6	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, light brown (5YR 6/4)
12.6-14.8	Split spoon	Silty sand	Fine- to medium-grained, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
14.8-15.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly plastic, with secondary calcite filling, slightly damp, moderate brown (5YR 3/4)
15.0-19.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly plastic, with secondary calcite filling, slightly damp, moderate brown (5YR 3/4)
19.0-21.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)

BORING NO.: 5-SB-50 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
21.0-23.5	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone and sandstone gravel, with very fine- to fine-grained, moderately well sorted silty sand, slightly damp, moderate brown (5YR 3/4)
23.5-25.0	Cuttings	Sand	Fine-grained, well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
25.0-26.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
26.8-27.1	Split spoon	Clay	Plastic, fat, wet, moderate brown (5YR 3/4)
27.1-29.4	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
29.4-29.8	Split spoon	Sand	Fine-grained, well sorted, subangular to subrounded, slightly damp, light brown (5YR 6/4)
29.8-30.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
30.0-35.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
35.0-42.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
42.0-43.5	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, with very fine- to fine-grained silty sand, slightly damp, moderate brown (5YR 3/4)

BORING NO.: 5-SB-50 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
43.5-44.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
44.0-47.0	Cuttings	Gravel, cobbles	Fine to medium, subangular to subrounded limestone gravel, cobbles and boulder, slightly damp, light brown (5YR 6/4)
47.0-47.6	Split spoon	Silty gravelly clayey sand	Very fine- to coarse-grained, poorly sorted, well graded, subangular to subrounded, damp, moderate brown (5YR 3/4)
47.6-48.6	Split spoon	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
48.6-49.5	Split spoon	Clay	Plastic, fat, damp, moderate brown (5YR 3/4)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/7/92

Date Completed: 8/10/92

Boring No.: 5-SB-51

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 63.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, light brown (5YR 6/4)
10.0-15.0	Split spoon	--	No recovery
15.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
25.0-27.6	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp to dry, light brown (5YR 6/4)
27.6-28.0	Split spoon	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor light gray clay nodules, very slightly damp, moderate brown (5YR 4/4)
28.0-41.0	Cuttings	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, with minor limestone gravel at 37', dry, light brown (5YR 6/4)
41.0-41.9	Split spoon	Clayey silty sand	Very fine-grained, moderately sorted, subangular to subrounded, with minor clay, very slightly damp, moderate brown (5YR 4/4)
41.9-44.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor silt, dry, moderate brown (5YR 4/4)

BORING NO.: 5-SB-51 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
44.0-46.5	Cuttings	Silty sand	Very fine-grained, well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
46.5-47.0	Cuttings	Silty clay	Very fine-grained, slightly plastic, damp, moderate brown (5YR 3/4)
47.0-58.0	Cuttings	Silty sandy clay	Very fine-grained, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
58.0-60.0	Split spoon	Silty clay	Very fine-grained, slightly plastic, with minor limestone gravel, moderate brown (5YR 3/4)
60.0-63.0	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, and limestone cobbles with very fine-grained silty sand, slightly damp, moderate brown (5YR 4/4)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/10/92

Date Completed: 8/11/92

Boring No.: 5-SB-52

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 60.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, light brown (5YR 6/4)
10.0-12.0	Split spoon	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, with minor clay, slightly damp, moderate brown (5YR 4/4)
12.0-16.5	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor limestone gravel, dry, light brown (5YR 6/4)
16.5-17.0	Cuttings	Clayey silty sand	Very fine-grained, well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
17.0-25.0	Cuttings	Clayey silty sand	Very fine-grained, well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
25.0-30.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
30.0-31.0	Cuttings	Silty clayey sand	Very fine-grained, moderately sorted, subangular to subrounded, dry, light brown (5YR 6/4)
31.0-35.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded dry, light brown (5YR 6/4)
35.0-42.0	Cuttings	Silty sand	Very fine-grained, moderately well sorted, subangular to subrounded, with limestone gravel at 38', slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-52 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
42.0-43.5	Cuttings	Gravel	Fine to medium, subangular to subrounded with some very fine- to fine-grained, moderately sorted, subangular to subrounded sand, slightly damp, moderate brown (5YR 4/4)
43.5-45.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor clay, slightly damp, moderate brown (5YR 4/4)
45.0-50.0	Split spoon	No recovery	Plastic, fat, wet clay on sampler
50.0-55.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, dry, light brown (5YR 6/4)
55.0-58.0	Cuttings	Silty clay	Very fine-grained, moderately well sorted, subangular to subrounded, slightly plastic with some light gray clay nodules, damp, moderate brown (5YR 3/4)
58.0-60.0	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, saturated, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/12/92

Date Completed: 8/12/92

Boring No.: 5-SB-53

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 65.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to medium-grained, moderately sorted, subangular to subrounded, minor gravel at 4', damp, moderate brown (5YR 4/4)
10.0-10.9	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
10.9-13.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with secondary calcite filling and light gray clay nodules, very slightly damp to dry, moderate brown (5YR 4/4)
13.0-25.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
25.0-27.5	Split spoon	Gravel	No recovery
27.5-28.5	Cuttings	Gravel	Fine to medium, subangular to subrounded limestone gravel, with minor sandstone gravel, damp, moderate brown (5YR 3/4)
28.5-34.5	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, light brown (5YR 6/4)
32.0-40.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very dry, light brown (5YR 6/4)
40.0-45.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)

BORING NO.: 5-SB-53 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
40.0-43.0	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, dry, moderate brown (5YR 6/4)
43.0-45.0	Cuttings	Silty clayey sand	Very fine-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
45.0-46.5	Cuttings	Gravel	Fine- to medium-grained, subangular to subrounded limestone gravel, with very fine- to fine-grained, moderately well sorted, subangular to subrounded sand, slightly damp, moderate brown (5YR 4/4)
46.5-55.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, very slightly damp to dry, moderate brown (5YR 4/4) to light brown (5YR 6/4)
55.0-56.8	Split spoon	Clayey silty sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
56.8-58.0	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
58.0-60.0	Cuttings	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
60.0-65.0	Cuttings	Gravel	Large limestone cobble and very damp fine-grained sand at bottom of drive shoe, very damp, moderate brown (5YR 3/4)

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/13/92

Date Completed: 8/13/92

Boring No.: 5-SB-54

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 64.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor clay and gravel, slightly damp, moderate brown (5YR 3/4)
10.0-10.9	Split spoon	Clayey silty sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
10.9-14.0	Split spoon	Clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, with secondary calcite filling and limonite staining, minor very fine limestone gravel, dry, light brown (5YR 6/4)
14.0-22.0	Cuttings	Clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, with secondary calcite filling and very fine, subangular to subrounded limestone gravel, slightly damp, moderate brown (5YR 3/4)
22.0-25.0	Cuttings	Silty sand	Very fine-grained, well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
25.0-26.2	Split spoon	Silty sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, with minor very fine, subangular to subrounded limestone gravel, slightly damp, light brown (5YR 6/4)
26.2-28.2	Split spoon	Clayey silty sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, with minor fine-grained, subangular to subrounded limestone gravel, very slightly damp, light brown (5YR 6/4)

BORING NO.: 5-SB-54 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
28.2-28.7	Split spoon	Sand	Fine-grained, well sorted, subangular to subrounded dry, light brown (5YR 6/4)
28.7-29.0	Split spoon	Silty clay/clayey silt	Very fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
29.0-29.4	Split spoon	Silty clay	Very fine-grained, moderately well sorted, subangular to subrounded, plastic, moderate brown (5YR 3/4)
29.4-30.0	Split spoon	Silty clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
30.0-40.0	Cuttings	Silty clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
40.0-41.1	Split spoon	Silty clayey sand	Very fine- to medium-grained, poorly sorted, subangular to subrounded, with minor fine-grained limestone gravel, very slightly damp, light brown (5YR 6/4)
41.1-42.4	Split spoon	Silty sand	Very fine- to medium-grained, moderately sorted, subangular to subrounded, slightly damp, moderate brown (5YR 4/4)
42.4-45.0	Split spoon	Silty clay	Very fine-grained, poorly sorted, subangular to subrounded, with minor limestone gravel and light gray clay nodules, very slightly damp to dry, light brown (5YR 6/4)
45.0-46.0	Cuttings	Silty clay	Very fine-grained, poorly sorted, subangular to subrounded, with minor limestone gravel and light gray clay nodules, very slightly damp to dry, light brown (5YR 6/4)
46.0-51.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, moderately sorted, subangular to subrounded, with minor fine limestone gravel, dry, light brown (5YR 6/4)

BORING NO.: 5-SB-54 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
51.0-51.5	Cuttings	Gravel	Very fine to medium, subangular to subrounded limestone gravel, with very fine-grained silty sand, slightly damp, moderate brown (5YR 4/4)
51.5-57.0	Cuttings	Silty clay	Very fine-grained, moderately well sorted, subangular to subrounded, very slightly damp, moderate brown (5YR 4/4)
57.0-58.6	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded with minor clay, damp, moderate brown (5YR 3/4)
58.6-59.3	Split spoon	Silty clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded with light gray clay nodules, damp, moderate brown (5YR 3/4)
59.3-59.8	Split spoon	Gravel	Fine to medium, subangular to subrounded limestone gravel, very fine- to fine-grained silty sand, damp, moderate brown (5YR 3/4)
59.8-61.4	Split spoon	Silty clay	Very fine-grained, well sorted, subangular to subrounded with light gray clay nodules at 61', damp, moderate brown (5YR 3/4)
61.4-62.0	Split spoon	Clay	Plastic, fat, wet light gray clay nodules, damp, moderate brown (5YR 3/4)
62.0-63.0	Cuttings	Clay	Plastic, fat, wet, moderate brown (5YR 3/4)
63.0-64.0	Cuttings	Silty clayey sand	Very fine-grained, moderately well sorted, subangular to subrounded, very damp, moderate brown (5YR 4/4)

Client:	Transwestern Pipeline Compressor Station No. 5 Thoreau, New Mexico	**Boring No.:**	5-SB-55
Project No.:	2105 2.2	**Drilling Contractor:**	Stewart Brothers Drilling Grants, New Mexico
Date Started:	8/14/92	**Drilling Method:**	Hollow Stem Auger
Date Completed:	8/14/92	**Total Depth Drilled:**	46.5 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
10.0-11.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
11.0-12.6	Split spoon	Clayey silty sand	Very fine- to medium-grained, moderately well sorted, subangular to subrounded, with some secondary calcite filling, damp, moderate brown (5YR 4/4)
12.6-13.4	Split spoon	Silty sand	Very fine-grained to medium-grained, poorly sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
13.4-15.0	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
15.0-17.0	Cuttings	Sand	Very fine- to medium-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
17.0-25.0	Cuttings	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
25.0-27.2	Split spoon	Silty clayey sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)

BORING NO.: 5-SB-55 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
27.2-28.1	Split spoon	Sandy gravel	Fine to medium, with very fine- to medium-grained poorly sorted, subangular to subrounded limestone gravel, subangular to subrounded sand, damp, moderate brown (5YR 3/4)
28.1-28.3	Split spoon	Clay	Plastic, fat, damp, brownish gray (5YR 4/1)
28.3-30.0	Split spoon	Clay	Plastic, fat, minor silt and some secondary calcite filling, damp, moderate brown (5YR 3/4)
30.0-39.0	Cuttings	Clayey silty sand	Very fine- to fine-grained, poorly sorted, subangular to subrounded, with some very fine to fine, subangular to subrounded limestone gravel, damp, moderate brown (5YR 4/4)
39.0-40.0	Cuttings	Gravel	Very fine to medium, subangular to subrounded, limestone gravel, with fine- to medium-grained, subangular to subrounded, poorly sorted sand, damp, moderate brown (5YR 3/4)
40.0-45.0	Split spoon	Gravel	Fine to medium, poorly sorted, subangular to subrounded limestone gravel, with fine- to medium-grained, subangular to subrounded sand, damp, moderate brown (5YR 3/4)
45.0-46.5	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp to wet, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 8/14/92

Date Completed: 8/14/92

Boring No.: 5-SB-56

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 47.0 ft.

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
10.0-13.0	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, slightly damp, moderate brown (5YR 3/4)
13.0-24.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
24.0-25.0	Cuttings	Silty clay	Very fine-grained, well sorted, subangular to subrounded, slightly plastic, damp, moderate brown (5YR 3/4)
25.0-25.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 4/4)
25.8-27.5	Split spoon	Silty clay	Very fine-grained, well sorted, subangular to subrounded, slightly plastic, damp, moderate brown (5YR 3/4)
27.5-33.0	Cuttings	Silty clay	Very fine-grained, moderately sorted, subangular to subrounded, slightly plastic, damp, moderate brown (5YR 3/4)
33.0-34.0	Cuttings	Gravel	Very fine to medium, subangular to subrounded limestone gravel, with very fine- to fine-grained, moderately well sorted, subangular to subrounded sand, damp, moderate brown (5YR 3/4)

BORING NO.: 5-SB-56 (CONTINUED)

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
34.0-42.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded with minor clay, damp, moderate brown (5YR 4/4)
42.0-43.8	Split spoon	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
43.8-44.2	Split spoon	Gravel	Very fine to medium, subangular to subrounded limestone gravel, with fine- to medium-grained, poorly sorted, subangular to subrounded sand, damp, moderate brown (5YR 3/4)
44.2-45.0	Cuttings	Silty sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, damp, moderate brown (5YR 3/4)
45.0-47.0	Split spoon	Sand	Very fine- to fine-grained, moderately well sorted, subangular to subrounded, with minor gravel, wet, moderate brown (5YR 3/4)

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 3/3/93

Date Completed: 3/4/93

Boring No.: 5-57B

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

Drilling Method: Hollow Stem Auger

Total Depth Drilled: 76.2 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-5.0	Cuttings	Sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, moist, with minor silt and clay, dark reddish brown (2-5YR 3/4)
5.0-15.0	Cuttings	Sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, slightly moist, minor silt, reddish brown (5YR 4/4 to 5/4)
15.0-30.0	Cuttings	Sand	Fine grained, well sorted, subangular to subrounded, slightly moist, reddish brown (5YR 4/4 to 5/4)
30.0-35.0	Cuttings	Sand	Fine grained, moderately well sorted, subangular to subrounded, slightly moist, with 2-3% limestone cobbles (1.5-cm-diameter), reddish brown (5YR 4/4 to 5/4)
35.0-45.0	Cuttings	Sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, slightly moist, with minor silt and 2-3% limestone pebbles, red (10R 4/6)
45.0-55.0	Cuttings	Silty sand	Very fine to fine grained, moderately sorted, subangular to subrounded, with minor clay and 2-5% limestone cobbles (2-cm-diameter), red (10R 4/6)
55.0-60.0	Cuttings	Silty sand	Very fine to fine grained, moderately sorted, subangular to subrounded, approximately 10% clay, red (10R 4/6)
60.0-65.0	Cuttings	Silty sand and clayey silt	Very fine grained, moderately sorted, wet, red (10R 4/6)
65.0-76.2	___	___	No cuttings return

DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Project No.: 2105 2.2

Date Started: 3/2/93

Date Completed: 3/3/93

Boring No.: 5-58B

Drilling Contractor: Stewart Brothers Drilling
Grants, New Mexico

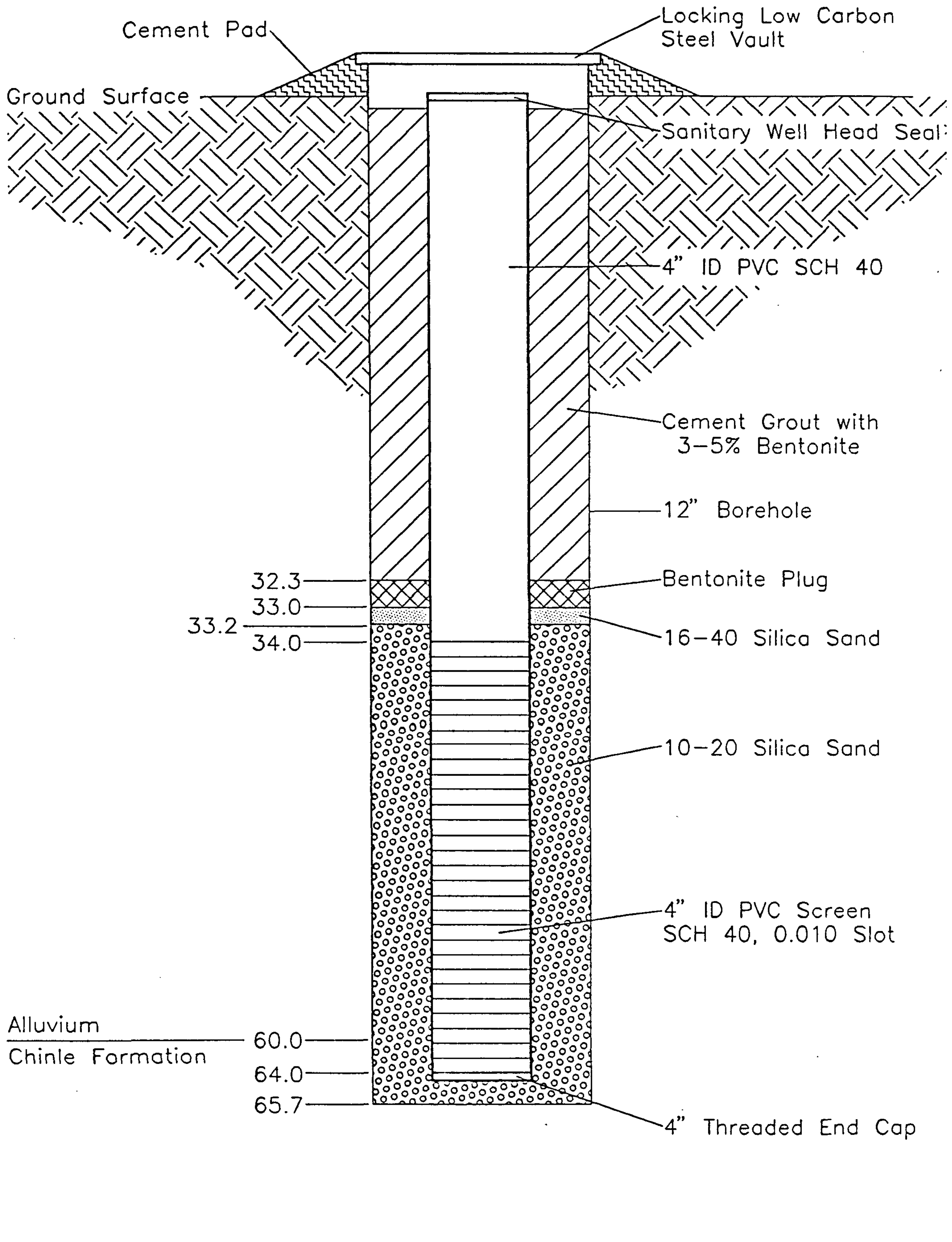
Drilling Method: Hollow Stem Auger

Total Depth Drilled: 78.1 ft

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0-10.0	Cuttings	Sand	Fine grained, well sorted, subangular to subrounded, frosted grains, moist, slightly moist to moist, with minor silt, yellowish red (5YR 4/6 to 5/6)
10.0-20.0	Cuttings	Sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, slightly moist, increase in silt and clay content, yellowish red (5YR 4/6 to 5/6)
20.0-25.0	Cuttings	Silty sand	Very fine to fine grained, moderately sorted, subangular to subrounded, slightly moist, continued increase in silt content, minor clay, yellowish red (5YR 4/6 to 5/6)
25.0-30.0	Cuttings	Sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, dry, very loose, reddish brown (5YR 6/4)
30.0-35.0	Cuttings	Gravelly sand	Very fine to fine grained, moderately sorted, subangular to subrounded, dry, 10-15% limestone gravel/cobbles (diameter 1.5-3.0 cm), reddish brown (5YR 6/4)
35.0-40.0	Cuttings	Sand	Very fine to fine grained, moderately sorted, subangular to subrounded, dry, 2-3% limestone gravel/cobbles, reddish brown (5YR 5/4)
40.0-45.0	Cuttings	Sand	Very fine to fine grained, moderately sorted, subangular to subrounded, dry, 2-3% gravel (0.2-cm-diameter), minor silt, reddish brown (5YR 5/4)

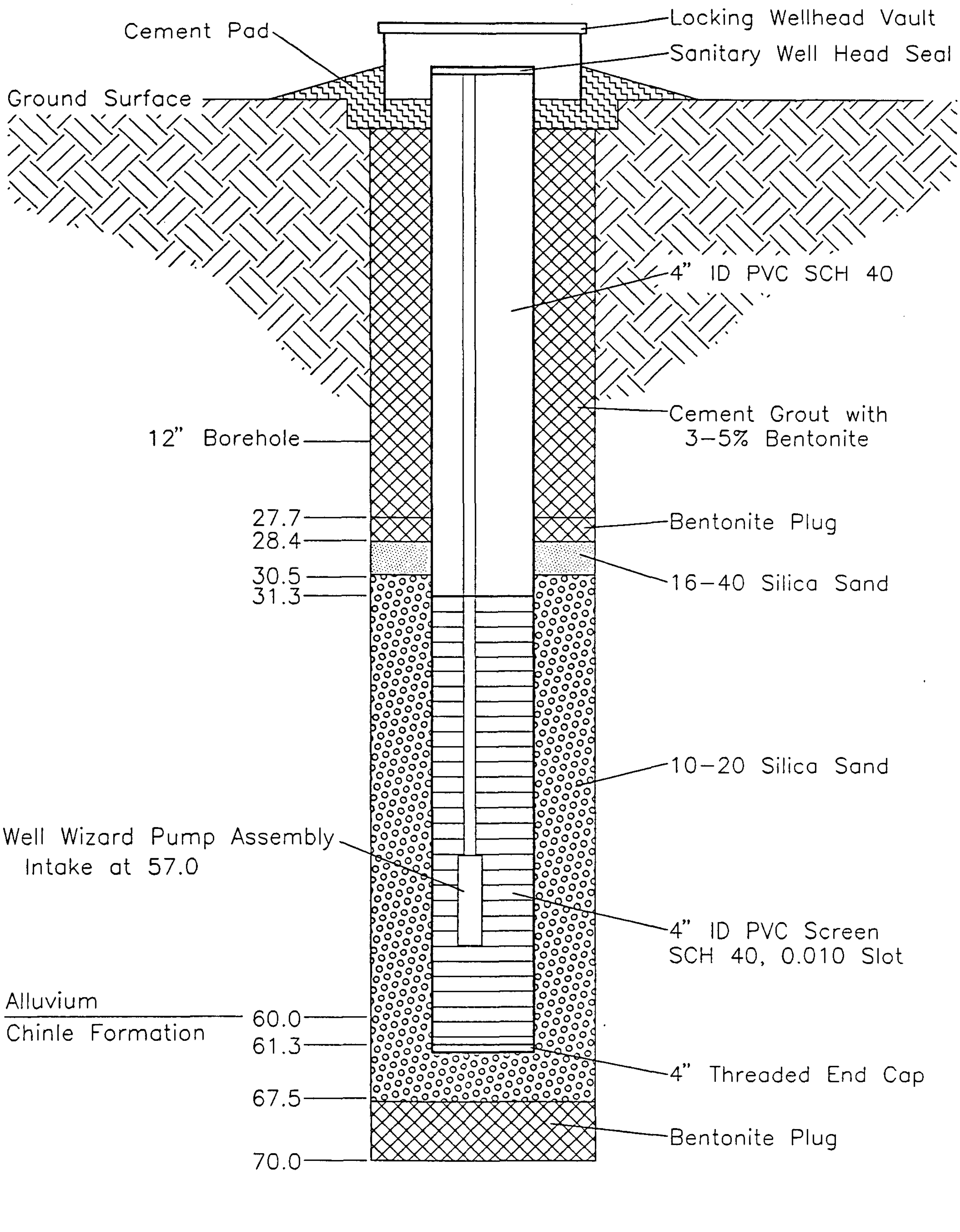
DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
45.0-55.0	Cuttings	Silty sand	Very fine to fine grained, moderately sorted, subangular to subrounded, minor clay, 2-3% limestone cobbles (2-cm-diameter), wet, red (2.5YR 4/6)
55.0-60.0	Cuttings	Sand	Fine grained, moderately sorted, subangular to subrounded, dry, loose, 10% coarse sand and gravel, red (2.5YR 4/6)
60.0-65.0	Cuttings	Silty sand	Very fine to fine grained, moderately well sorted, subangular to subrounded, moist, with minor clay, dark red (2.5YR 3/6)
65.0-78.1	Cuttings	Clayey sand	Very fine to fine grained, moderately sorted, subangular to subrounded, moist, dark red (2-5YR 3/6)

Well Completion Diagrams



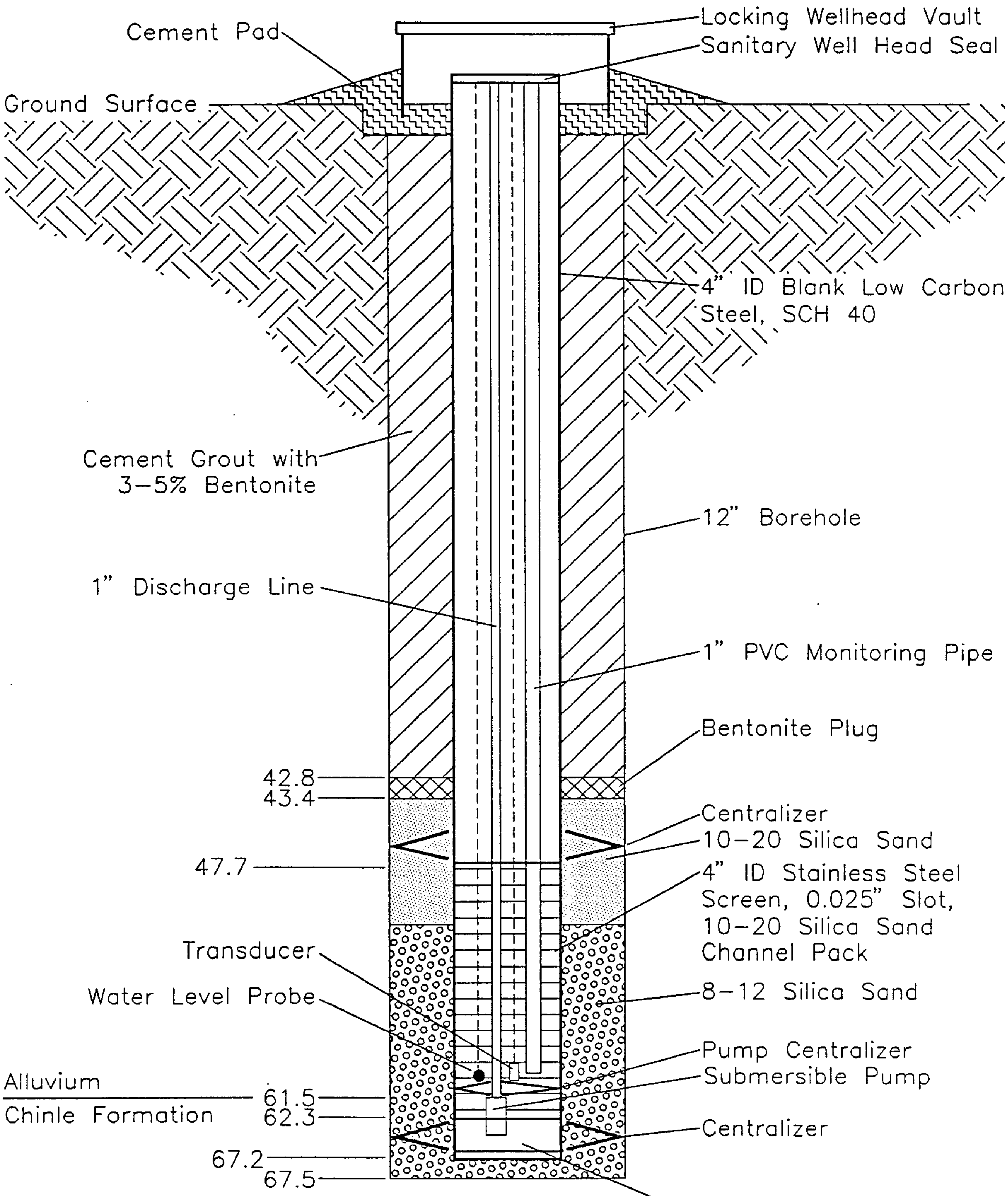
5-34B Well Construction
(Not to Scale)

DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92 JN 2105



5-35B Well Construction
(Not to Scale)

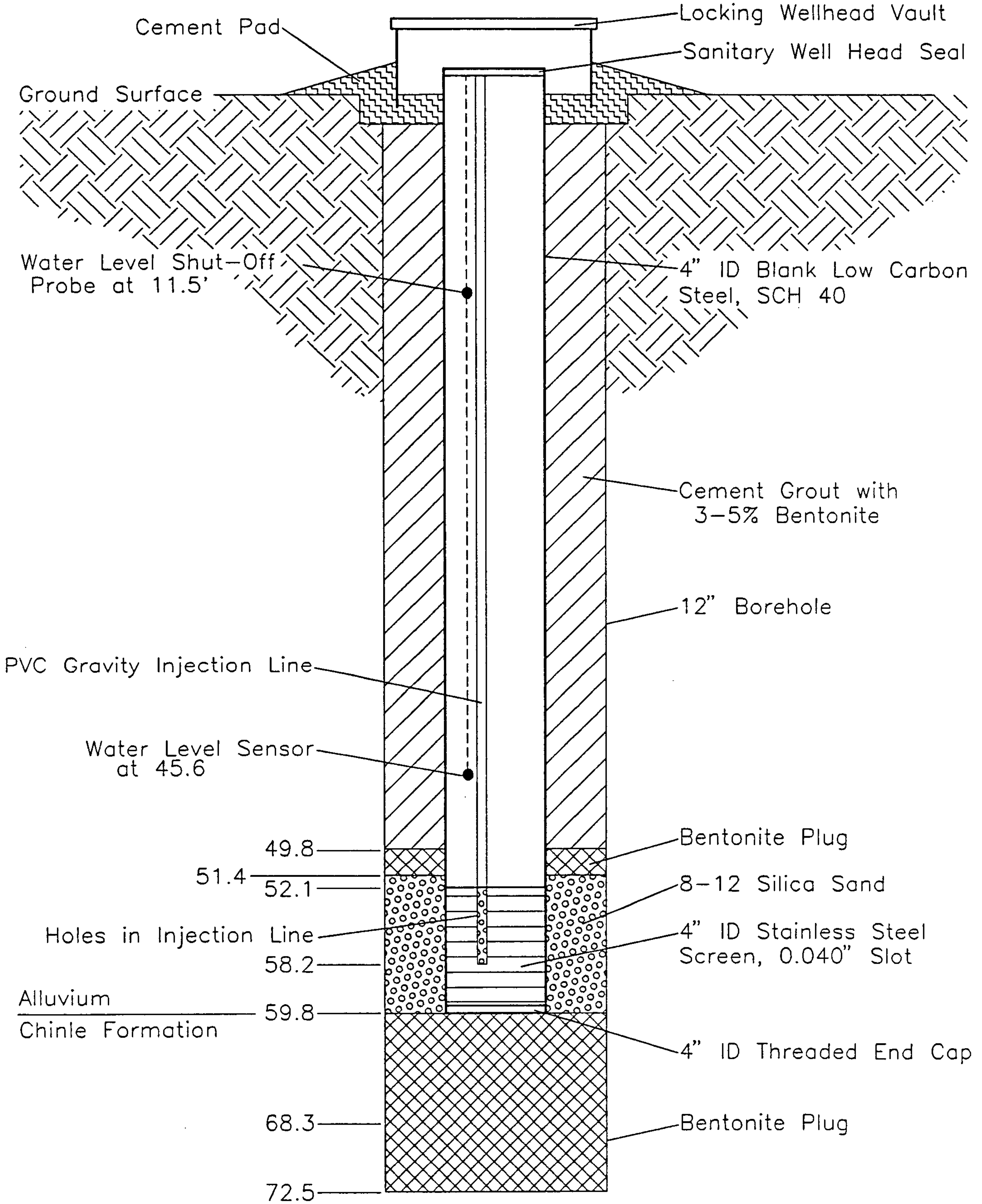
DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92
JN 2105



4" Casing Stickup = 2.0' above ground surface.
Pump Intake at 61.4' below ground surface
Water Level Sensor at 61.0' below ground surface
1" PVC Monitoring Pipe total depth 58.0' below ground surface
Centralizer at 59.0' below ground surface
Transducer at 58.3' below ground surface

5-36E Well Construction
(Not to Scale)

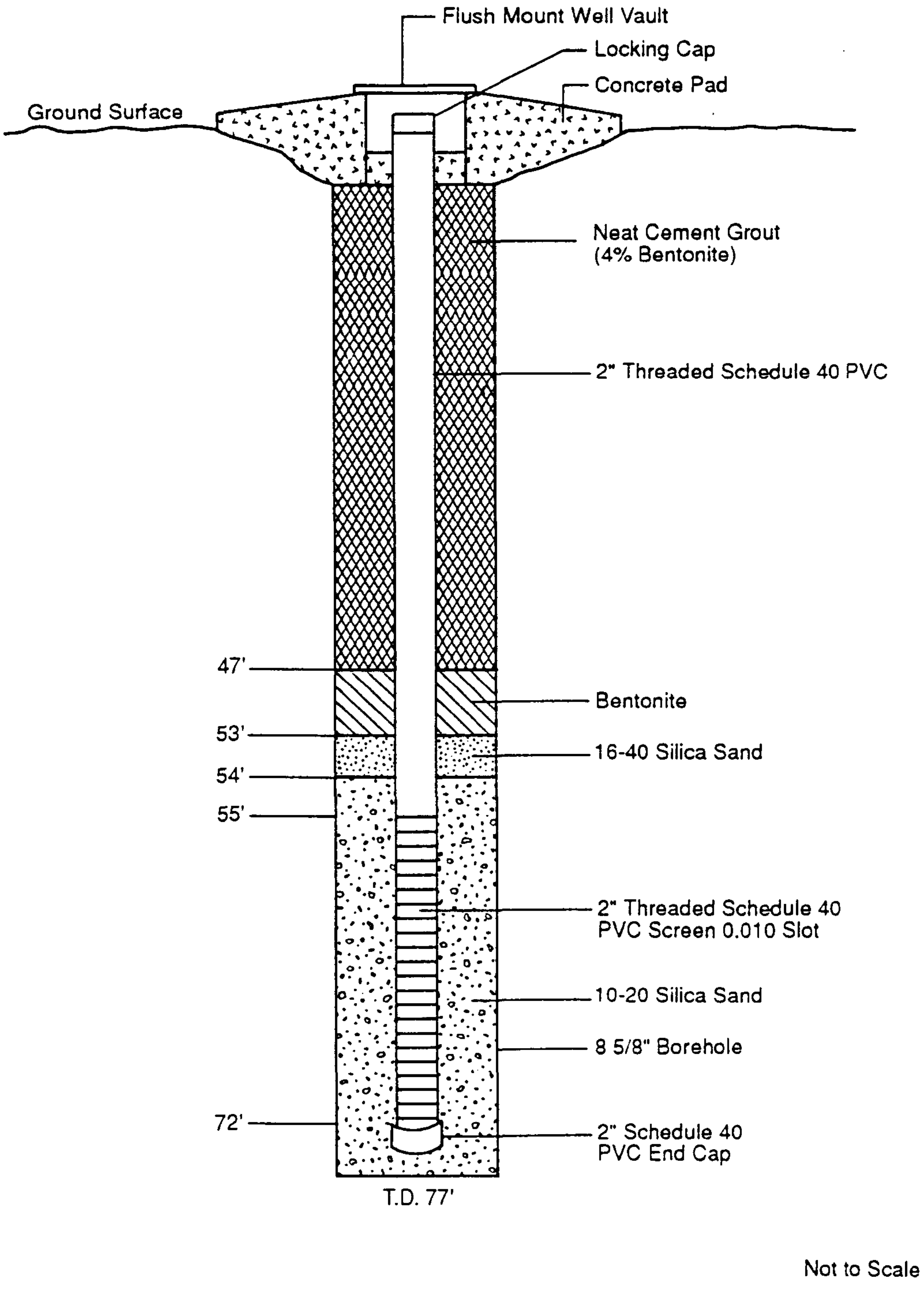
DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92 JN 2105



Transducer at 50.5 below ground surface
4" Casing Stickup 1.8' above ground surface.

5-371 Well Construction
(Not to Scale)

DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92 JN 2105

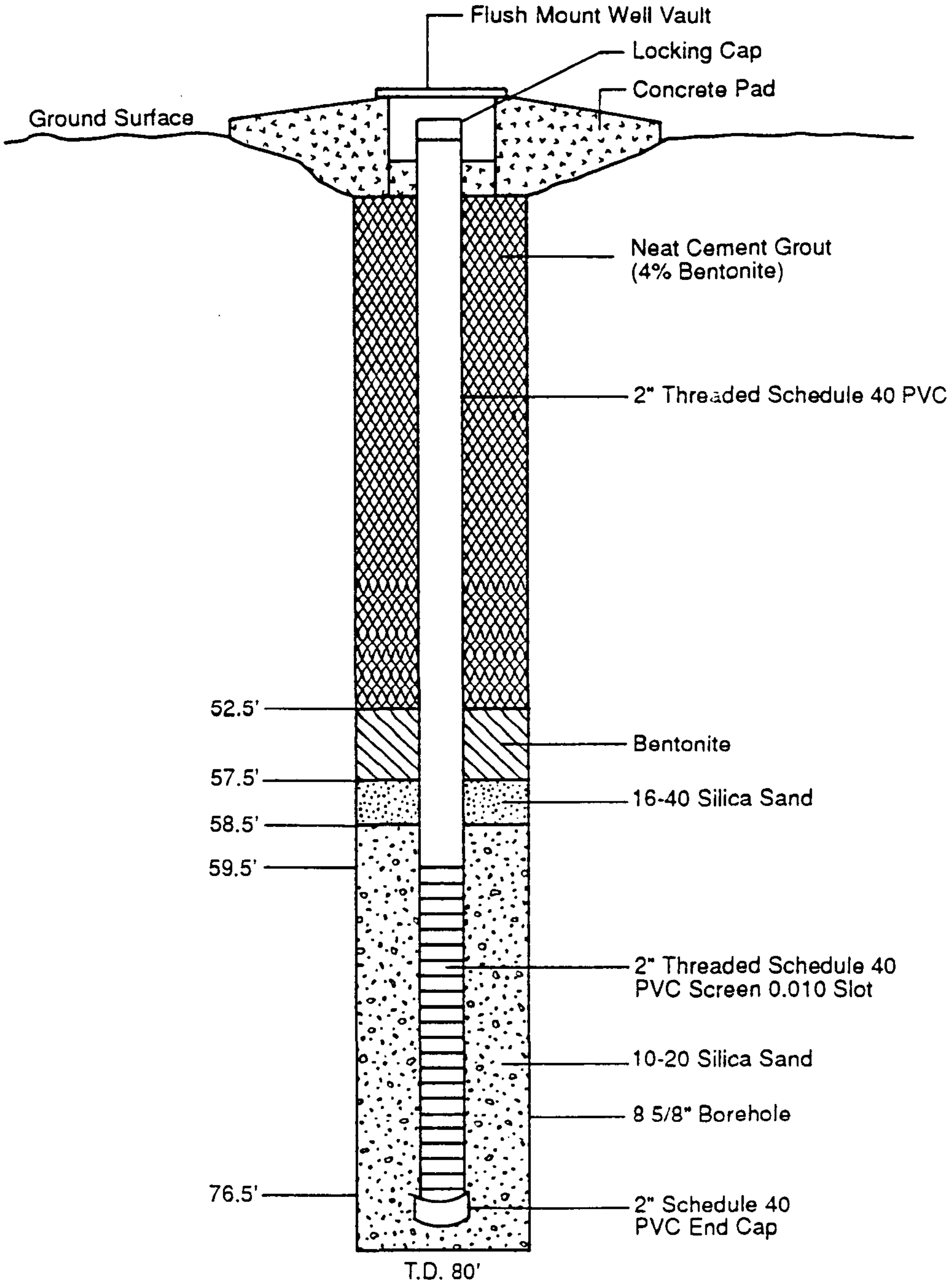


Date Completed: 8-18-92

Monitor Well 5-41B

DANIEL B. STEPHENS & ASSOCIATES, INC.

9-92 JN 2100

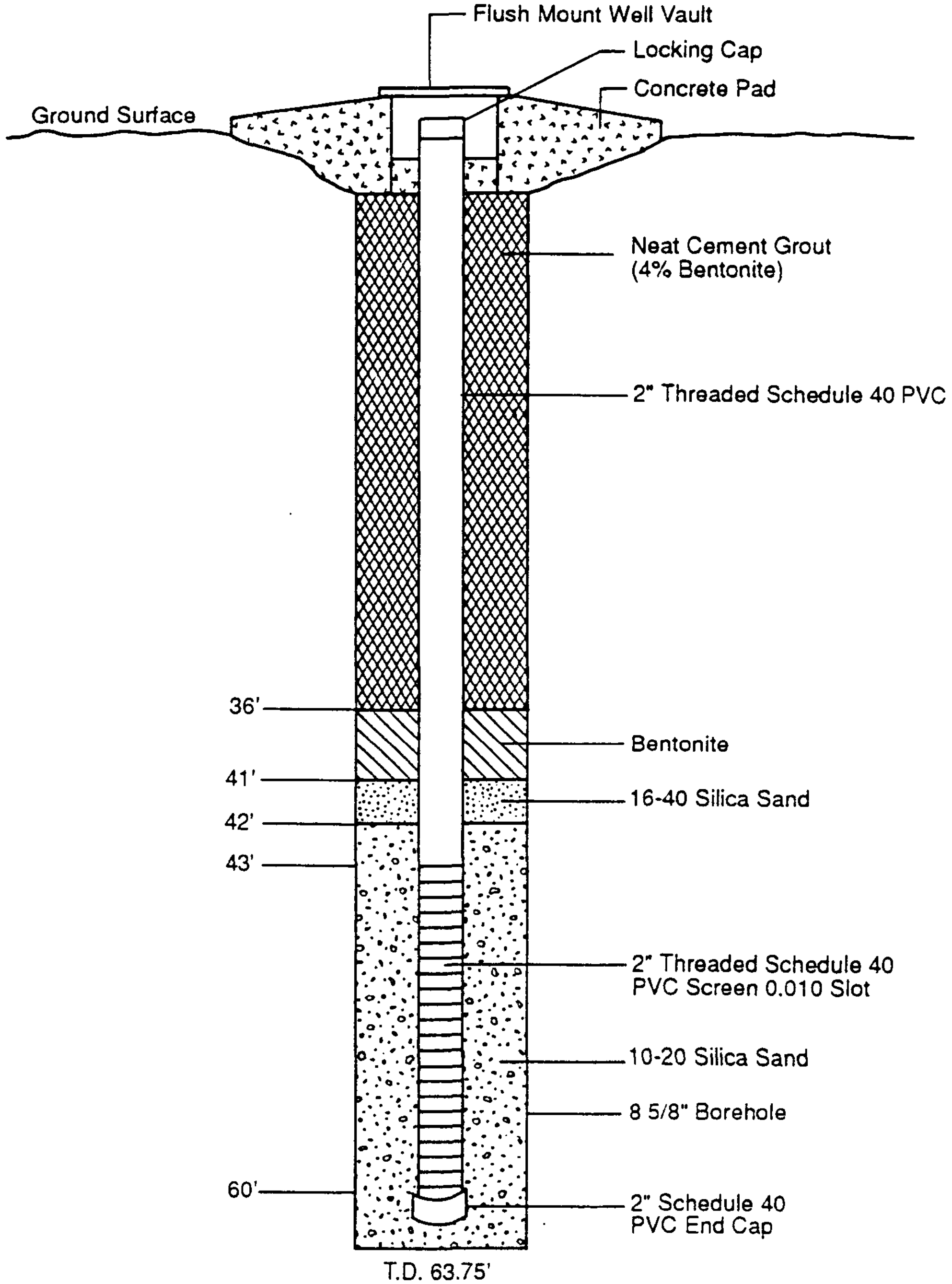


Not to Scale

Date Completed: 8-16-92

Monitor Well 5-47B

DANIEL B. STEPHENS & ASSOCIATES, INC.
9-92 JN 2100



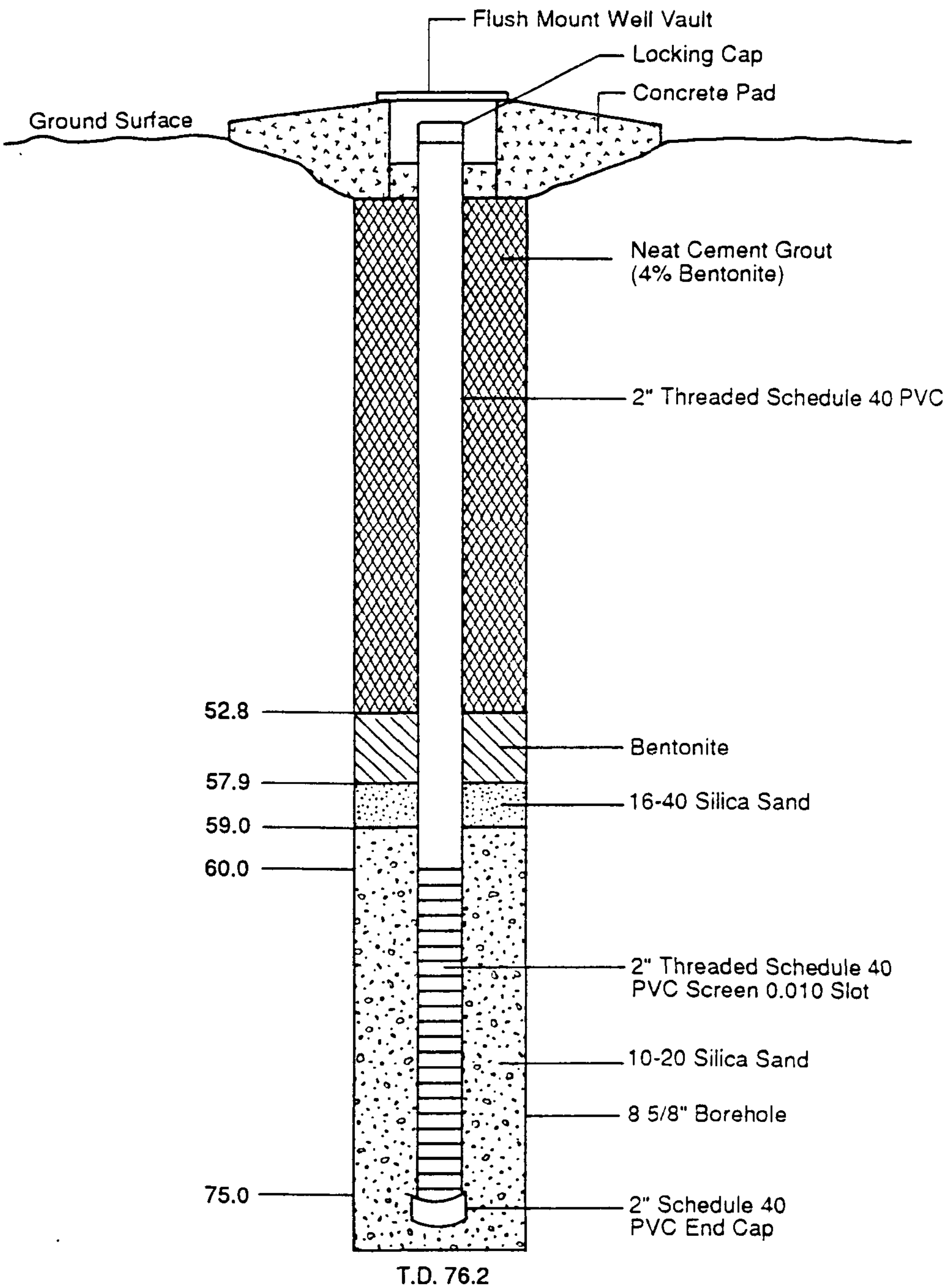
Not to Scale

Date Completed: 8-20-92

Monitor Well 5-48B

DANIEL B. STEPHENS & ASSOCIATES, INC.

9-92 JN 2100

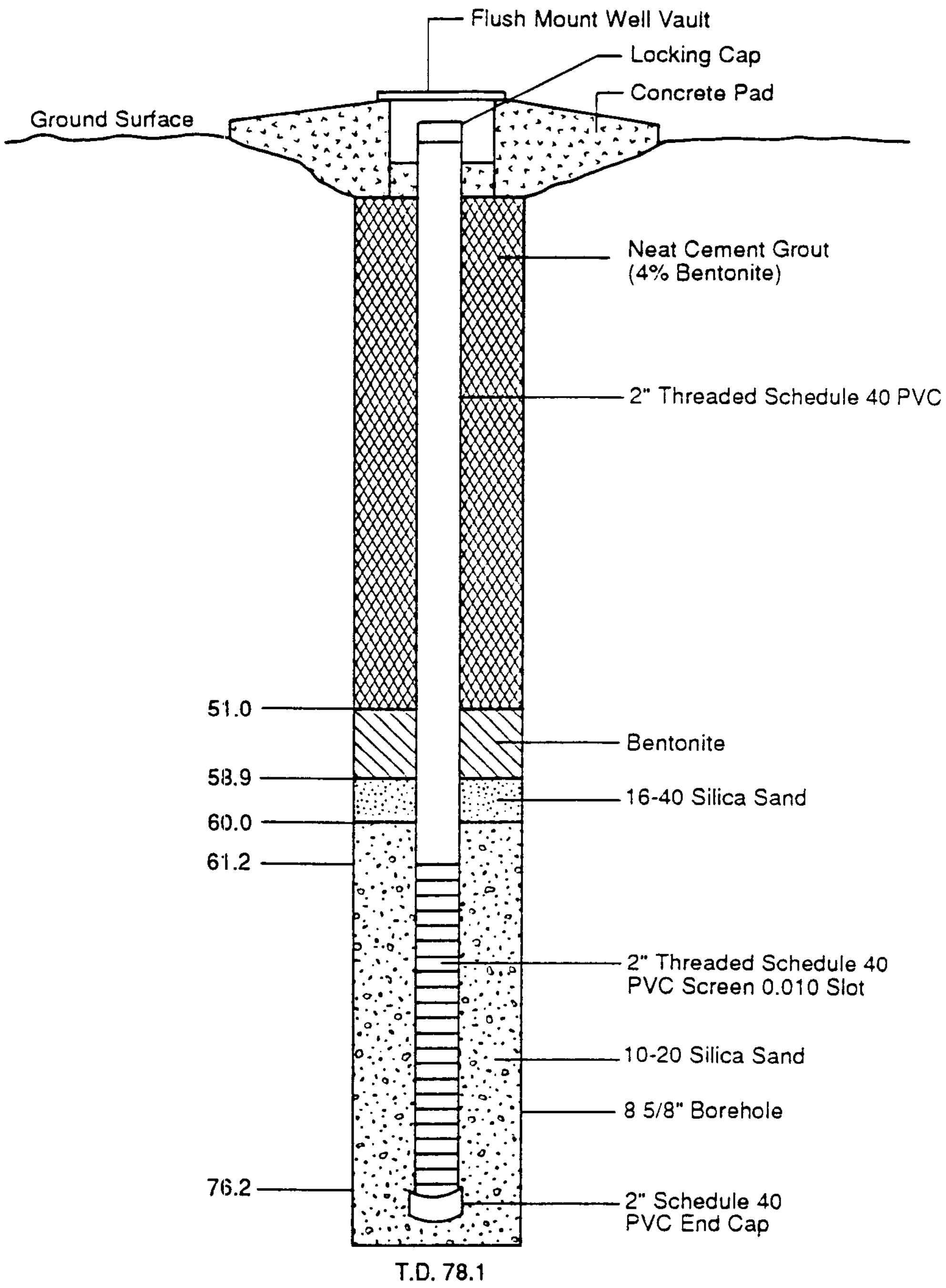


Not to Scale

Date Completed 3-4-93

Monitor Well 5-57B

DANIEL B. STEPHENS & ASSOCIATES, INC.
3-93 JN 2105



Not to Scale

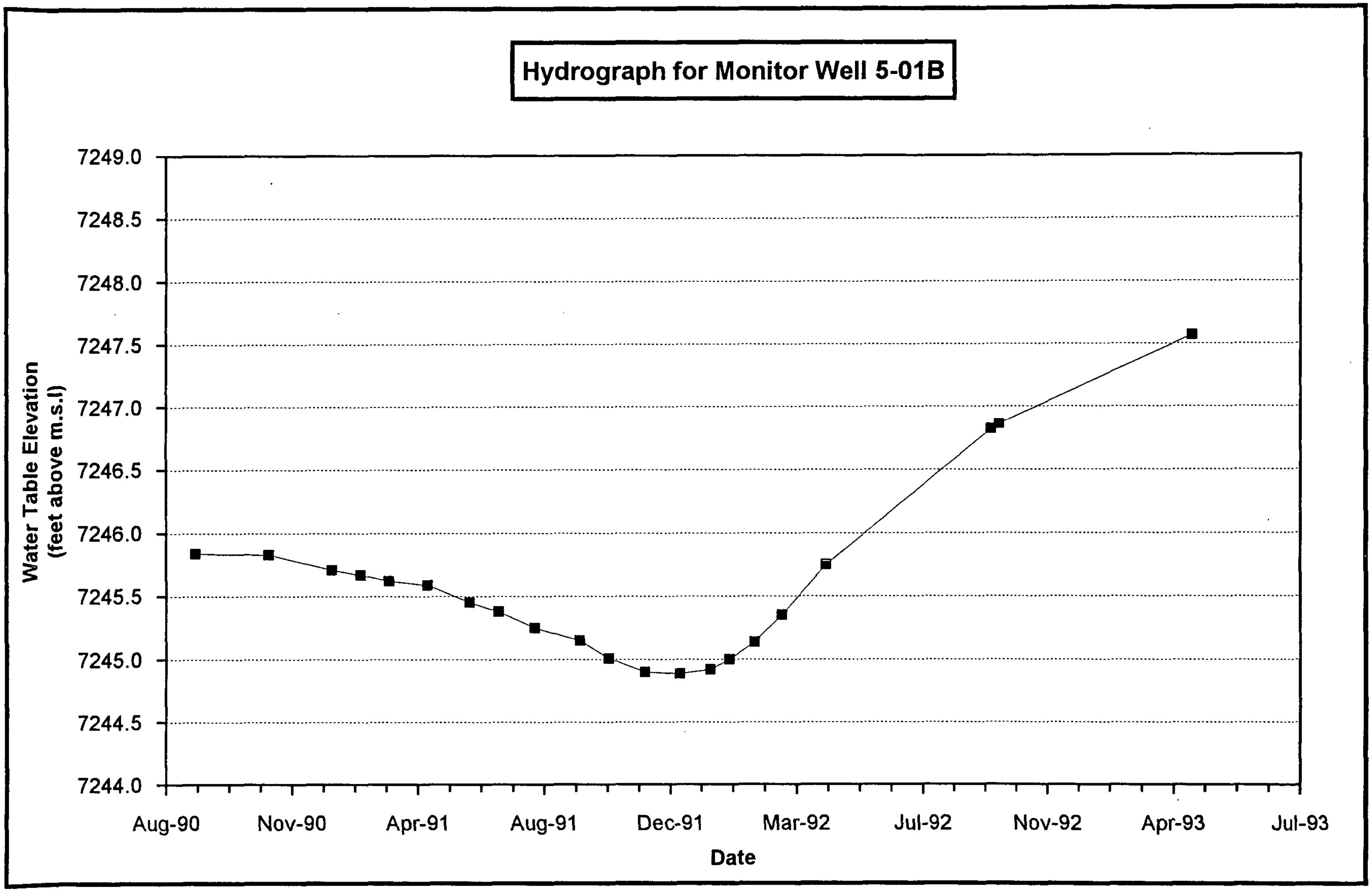
Date Completed 3-3-93

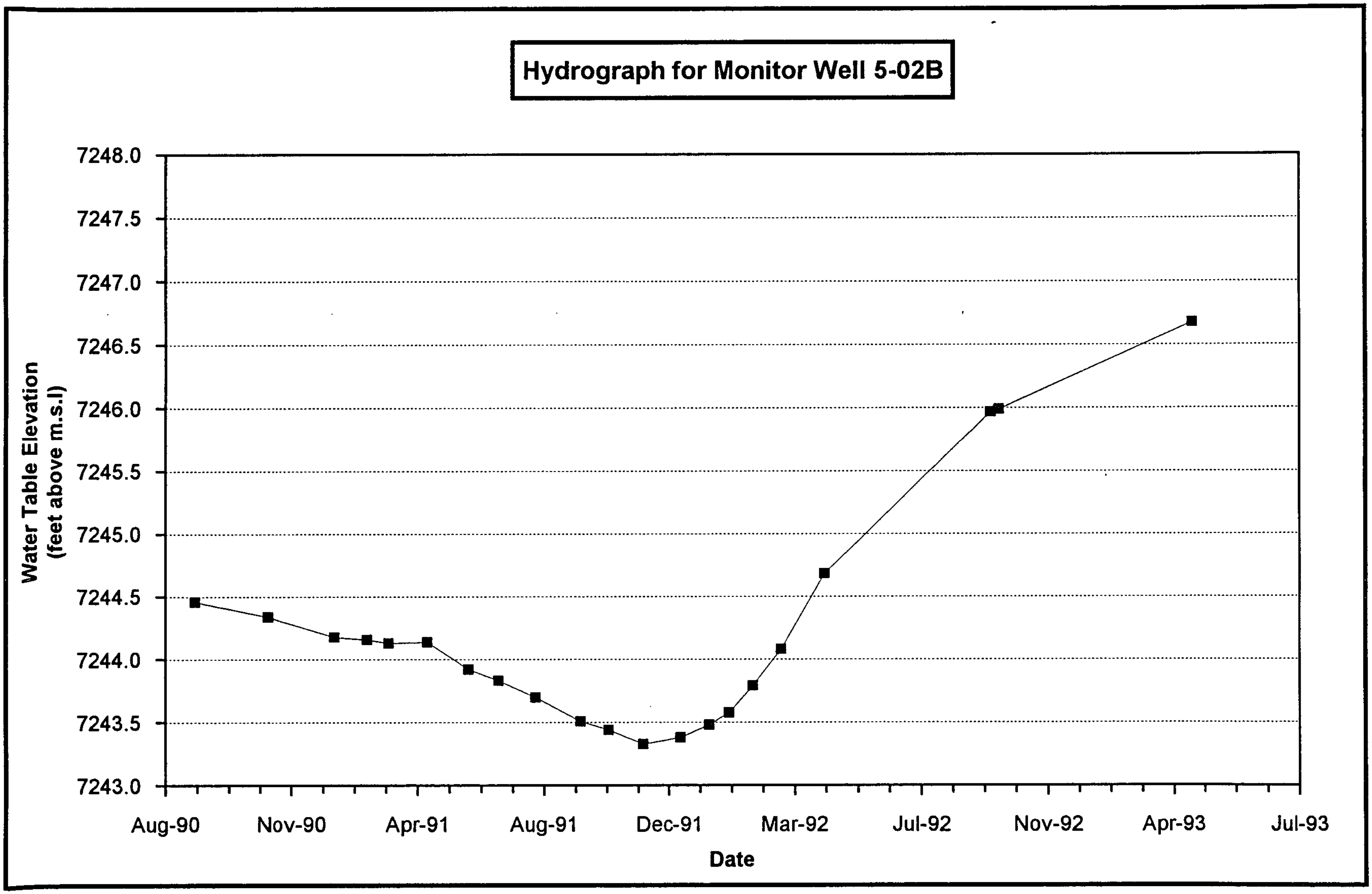
Monitor Well 5-58B

DANIEL B. STEPHENS & ASSOCIATES, INC.
3-93 JN 2105

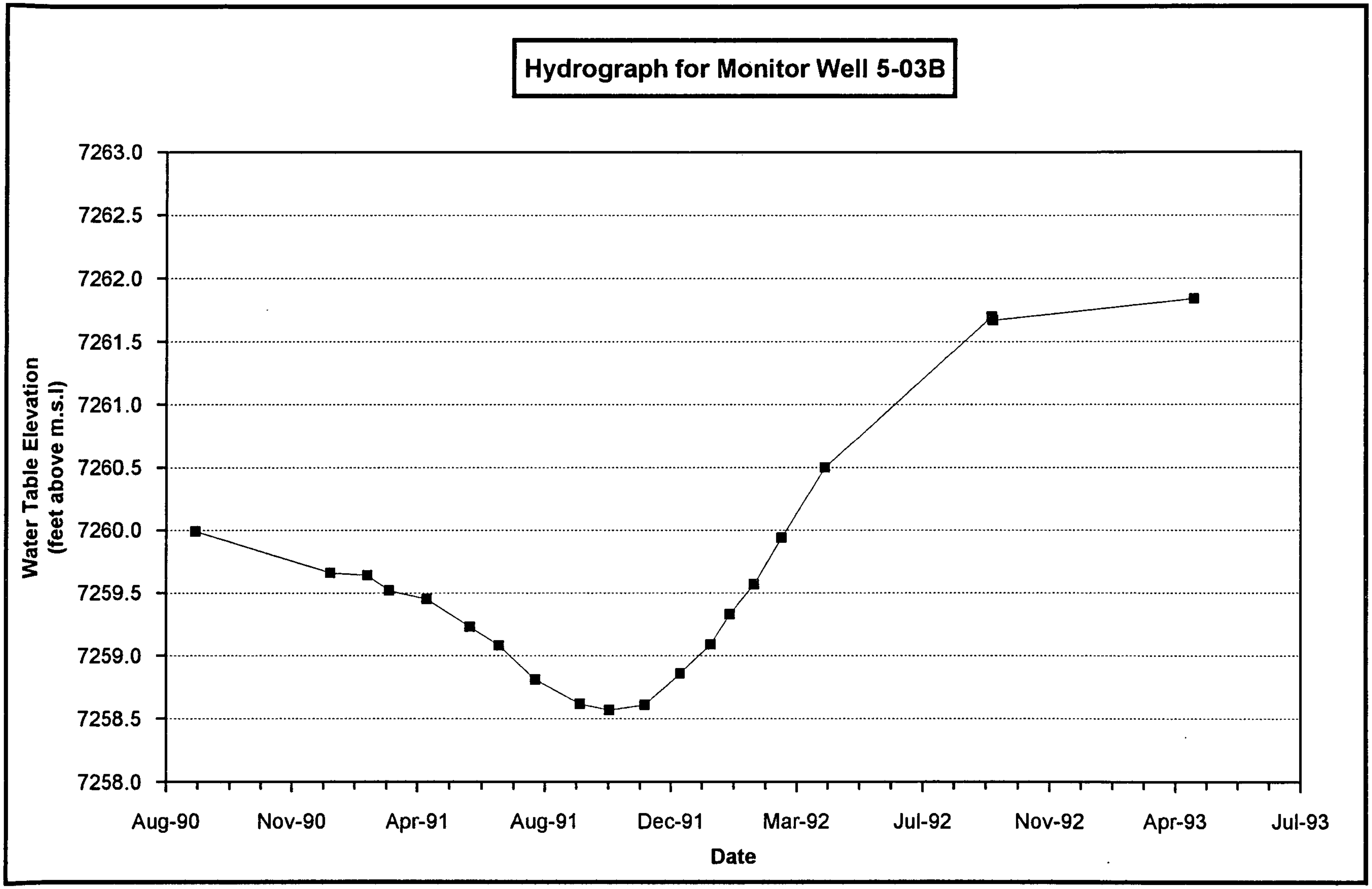
APPENDIX D

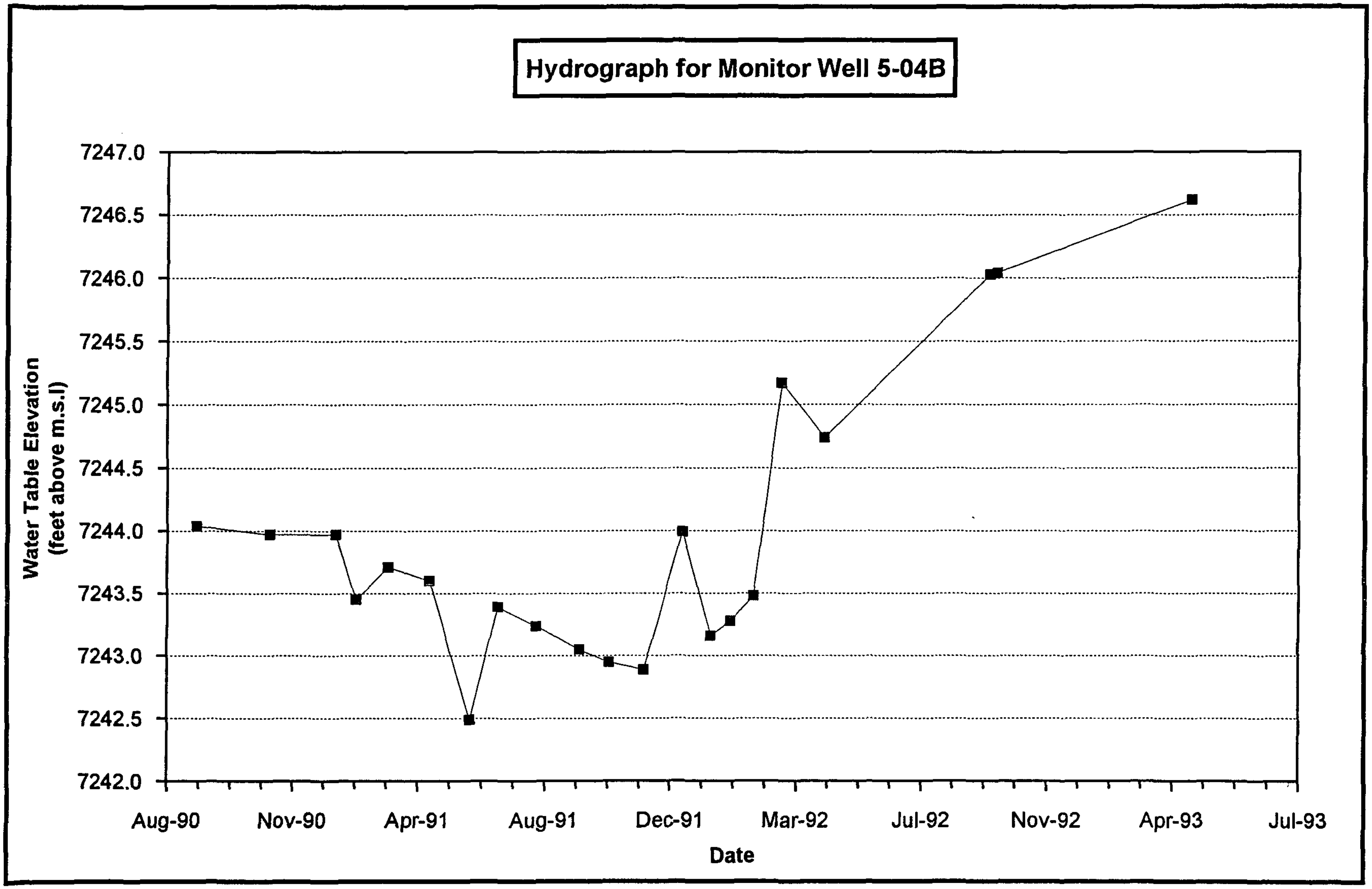
HYDROGRAPHS

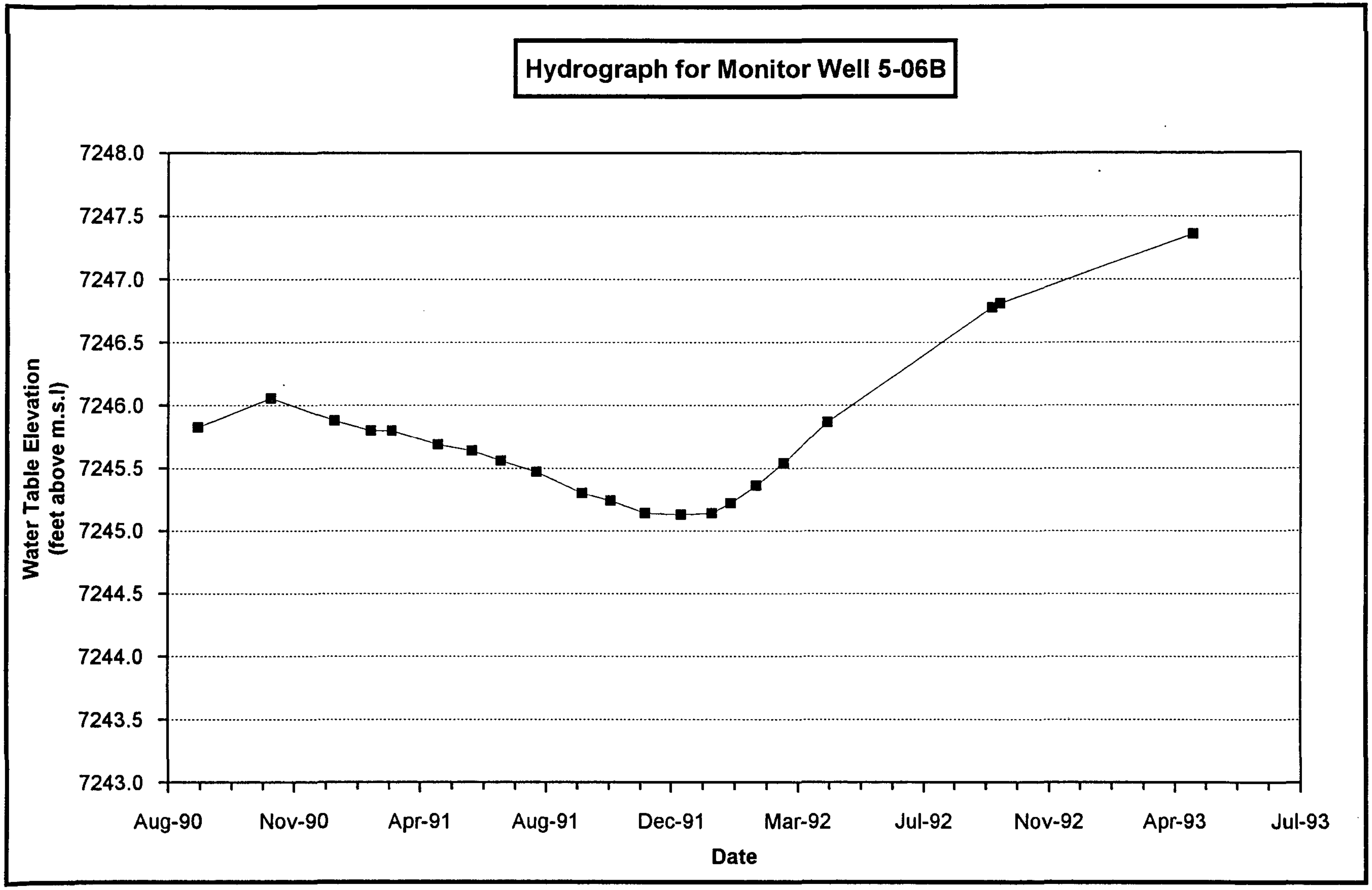

Hydrograph for Monitor Well 5-01B
7249.0
7248.5
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
Water Table Elevation
(feet above m.s.l)
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



Hydrograph for Monitor Well 5-02B
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
Water Table Elevation
(feet above m.s.l)
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-03B
Water Table Elevation
(feet above m.s.l)
7263.0
7262.5
7262.0
7261.5
7261.0
7260.5
7260.0
7259.5
7259.0
7258.5
7258.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-04B
Water Table Elevation
(feet above m.s.l)
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
7242.5
7242.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-06B
Water Table Elevation
(feet above m.s.l)
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
Aug-90
Nov-90
Apr-91
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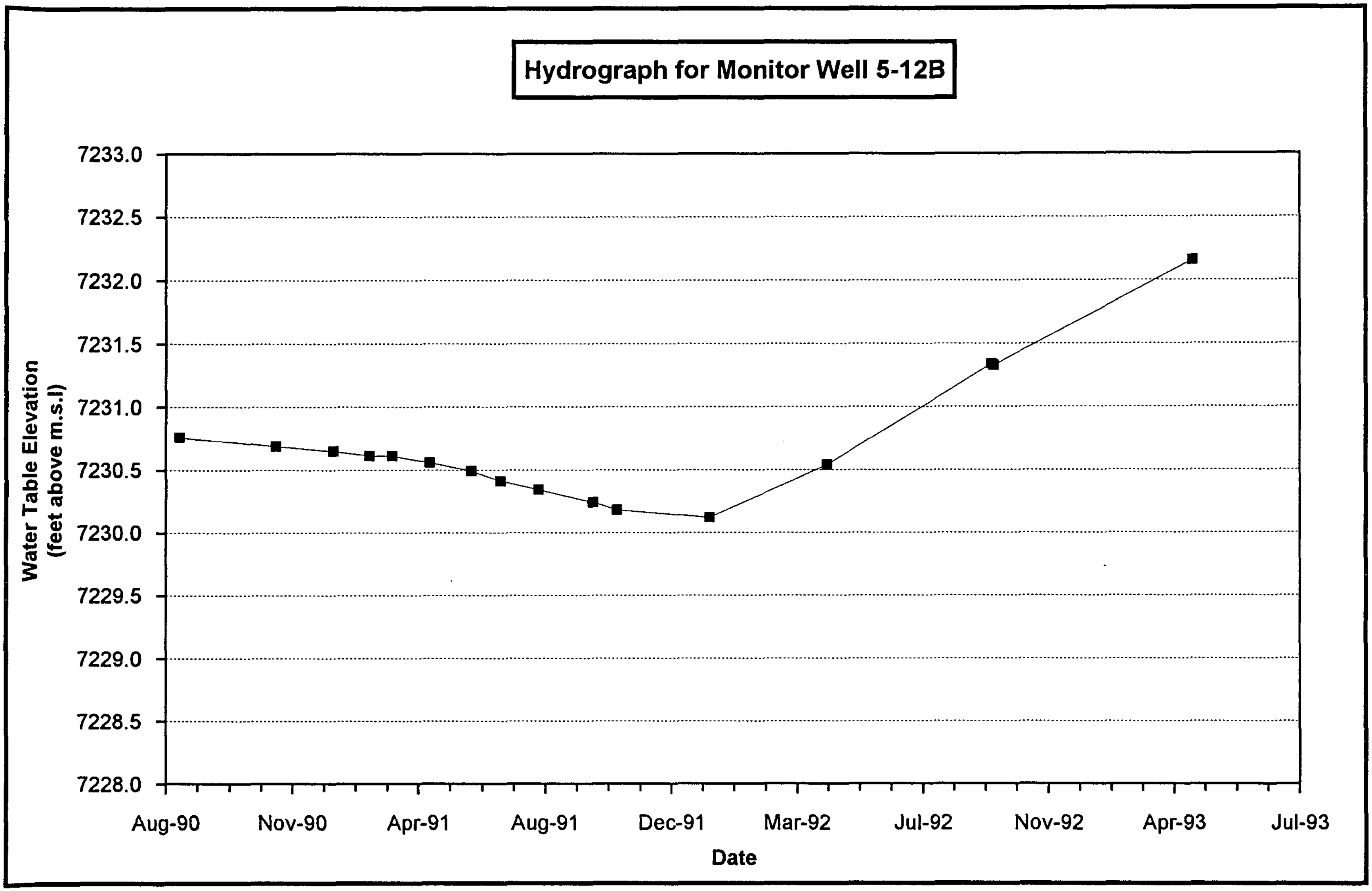
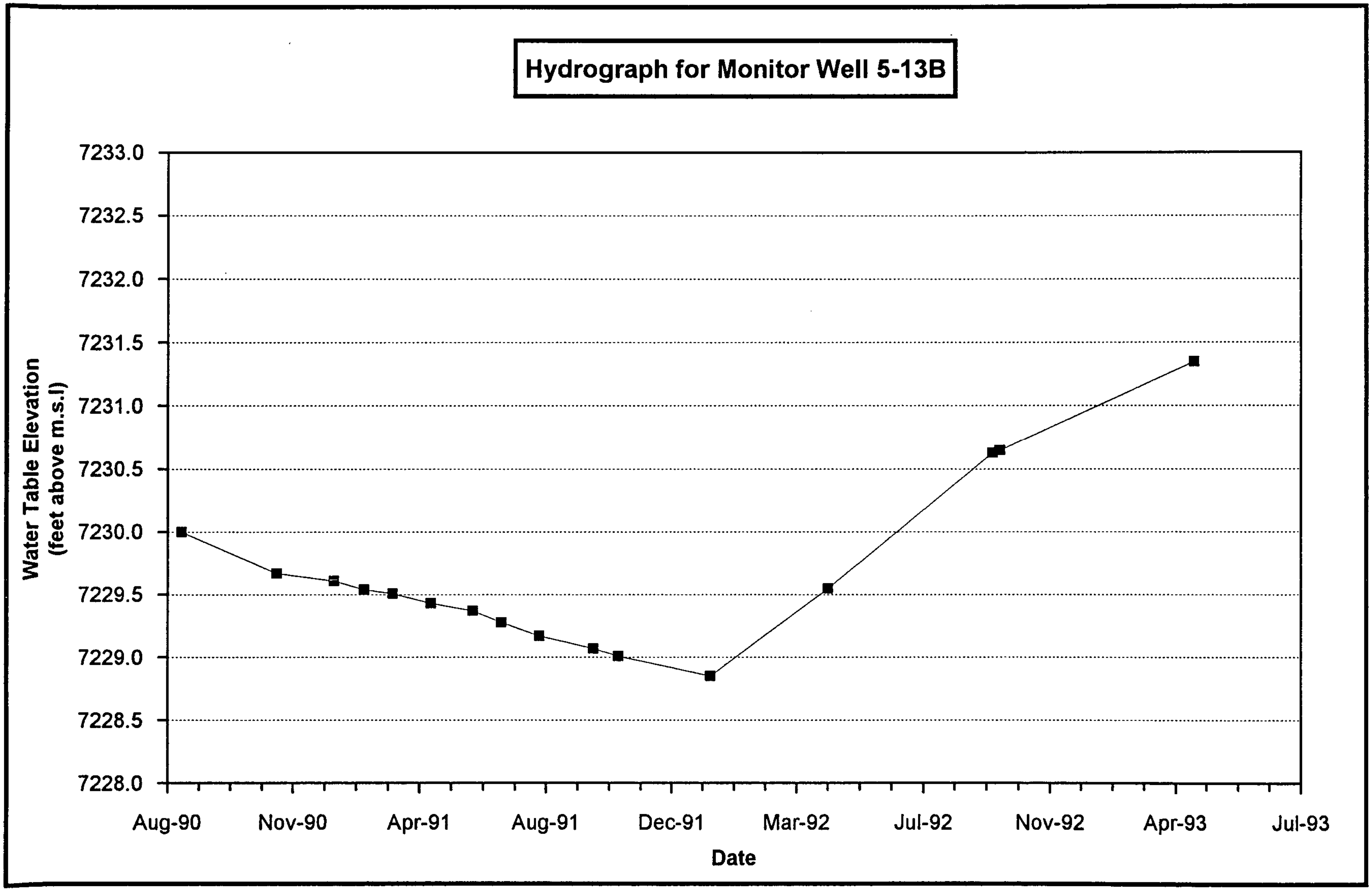
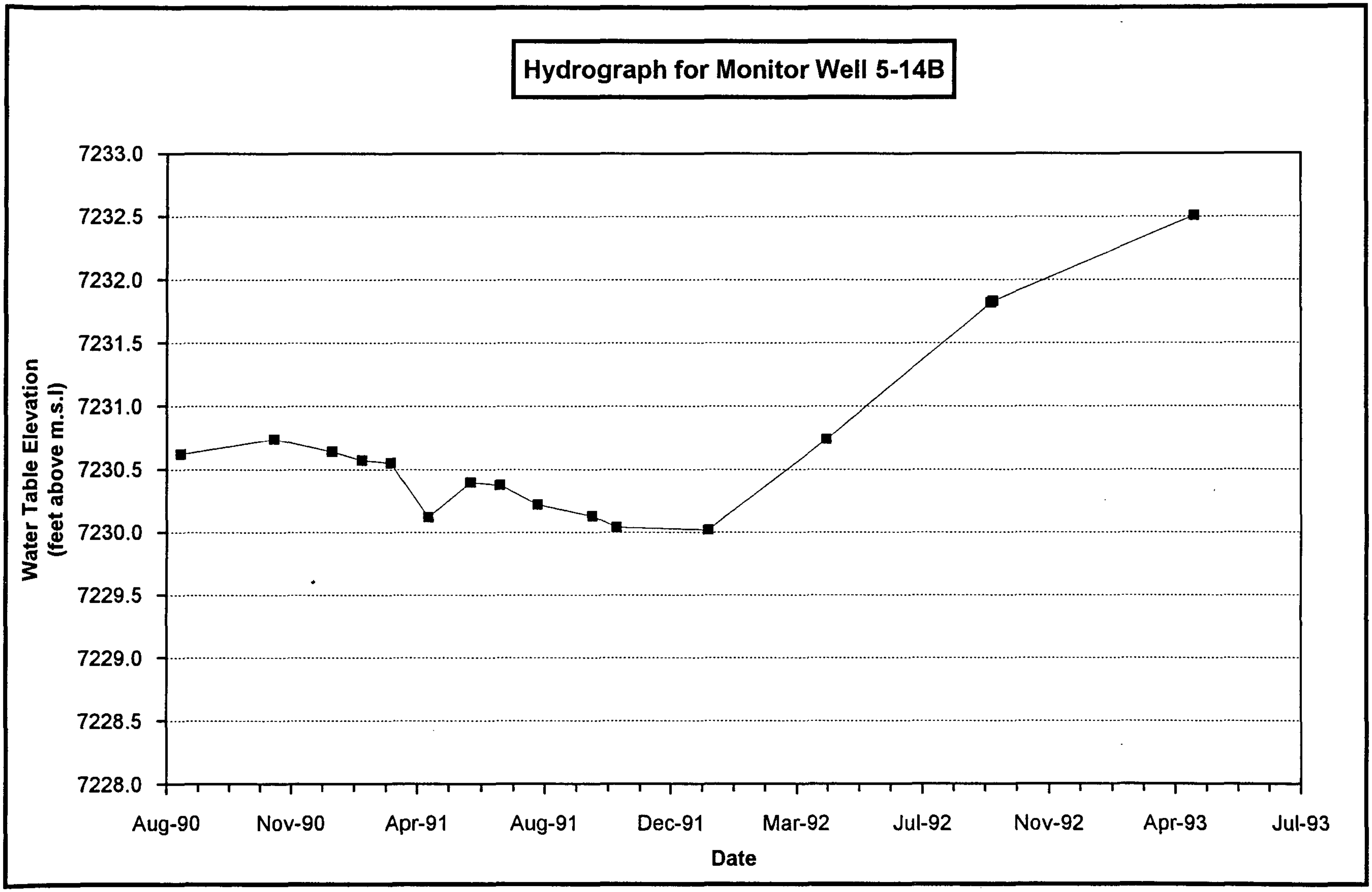
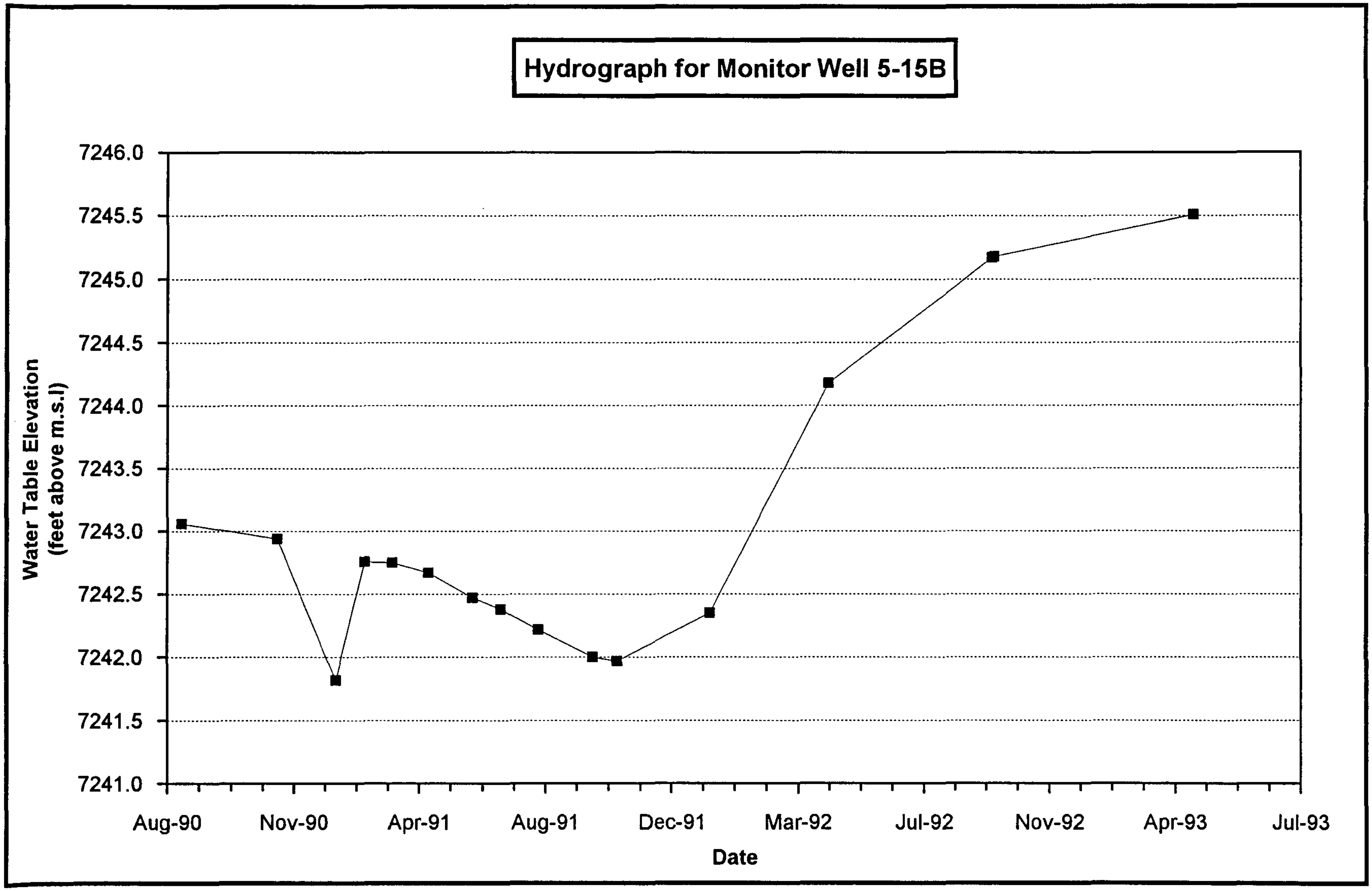
Jul-92
Nov-92
Apr-93
Jul-93
Date

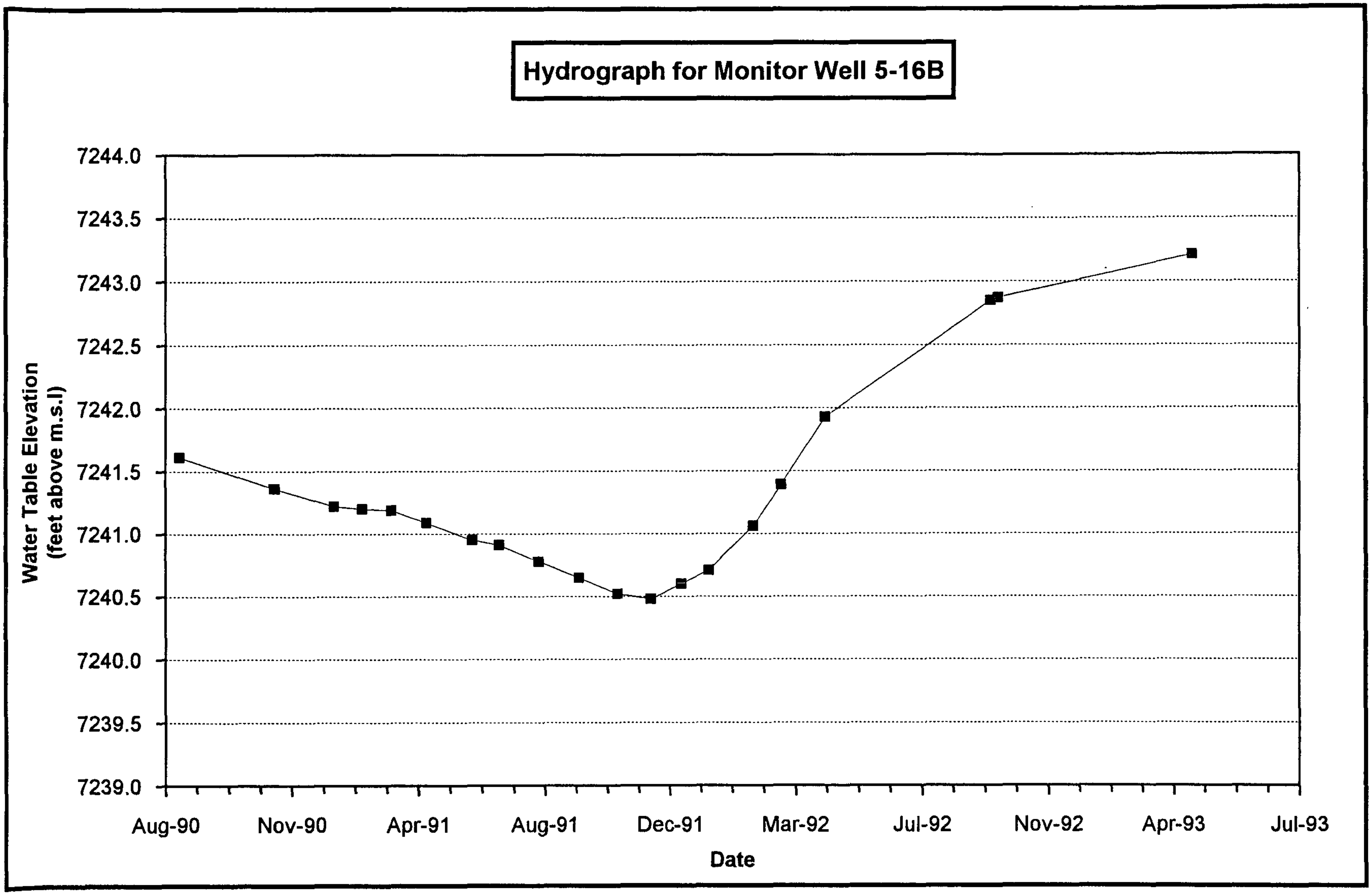

Hydrograph for Monitor Well 5-12B
Water Table Elevation
(feet above m.s.l)
7233.0
7232.5
7232.0
7231.5
7231.0
7230.5
7230.0
7229.5
7229.0
7228.5
7228.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

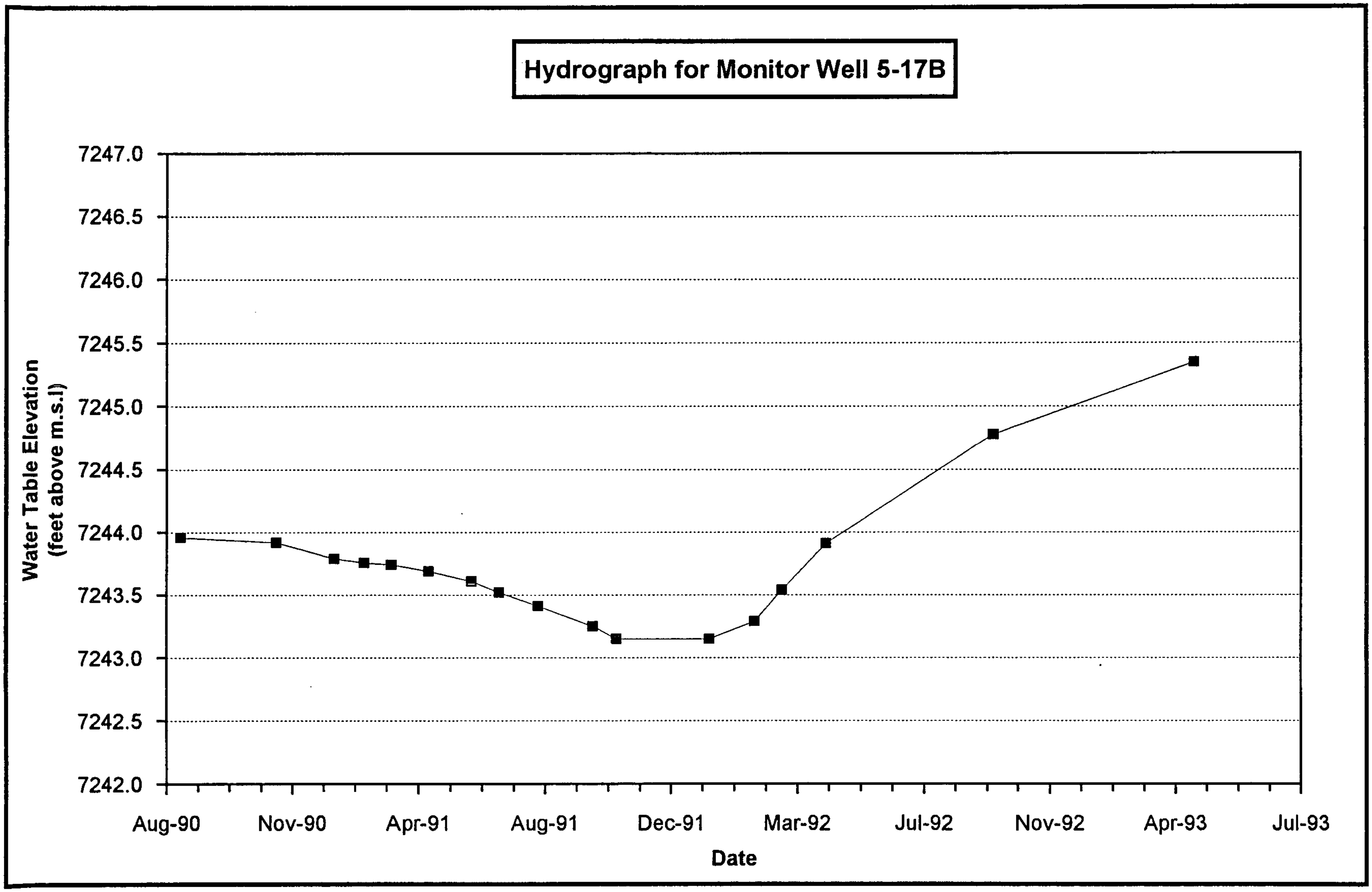

Hydrograph for Monitor Well 5-13B
Water Table Elevation
(feet above m.s.l)
7233.0
7232.5
7232.0
7231.5
7231.0
7230.5
7230.0
7229.5
7229.0
7228.5
7228.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-14B
Water Table Elevation
(feet above m.s.l)
7233.0
7232.5
7232.0
7231.5
7231.0
7230.5
7230.0
7229.5
7229.0
7228.5
7228.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

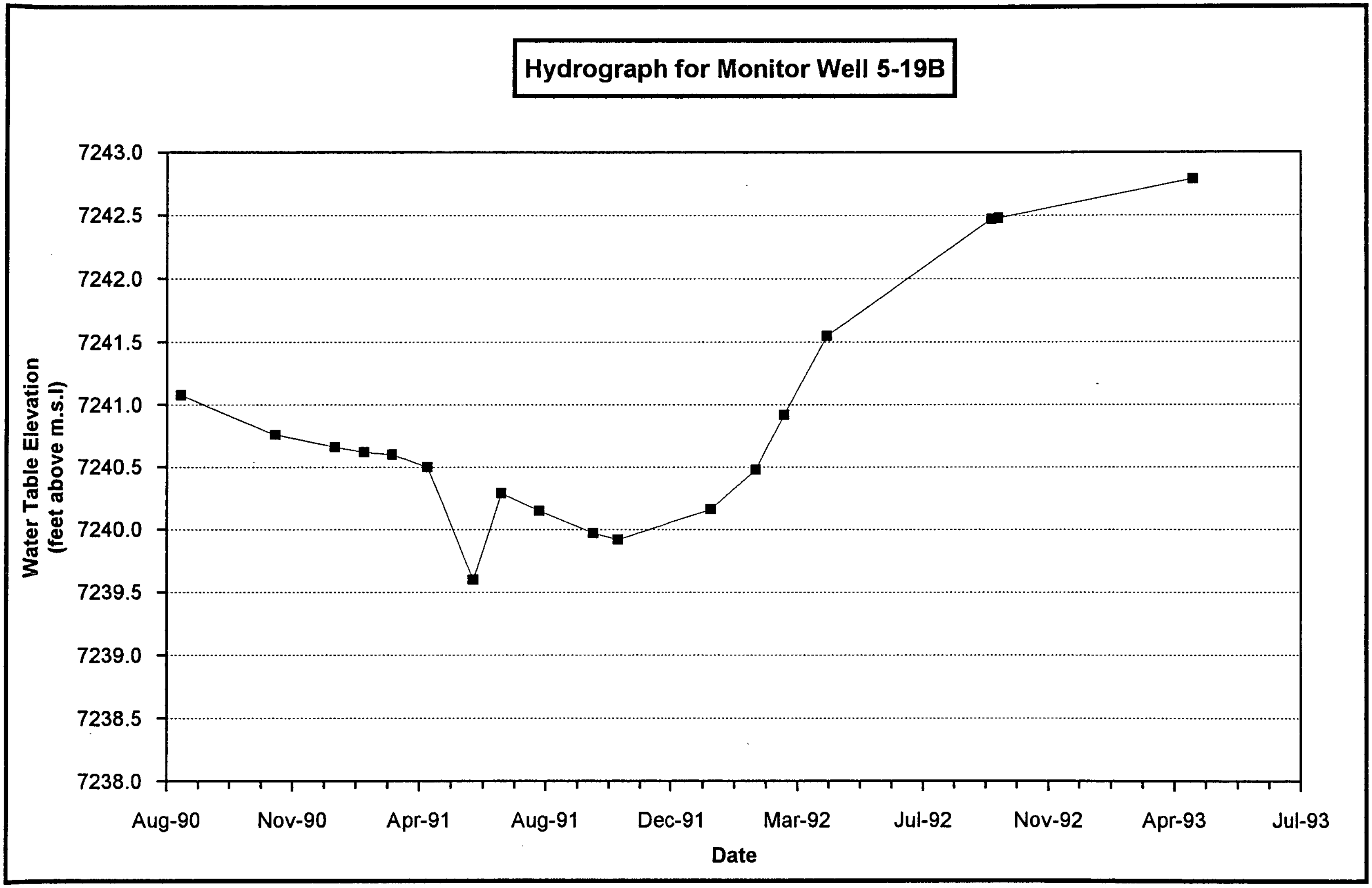


Hydrograph for Monitor Well 5-15B
Water Table Elevation
(feet above m.s.l)
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
7242.5
7242.0
7241.5
7241.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

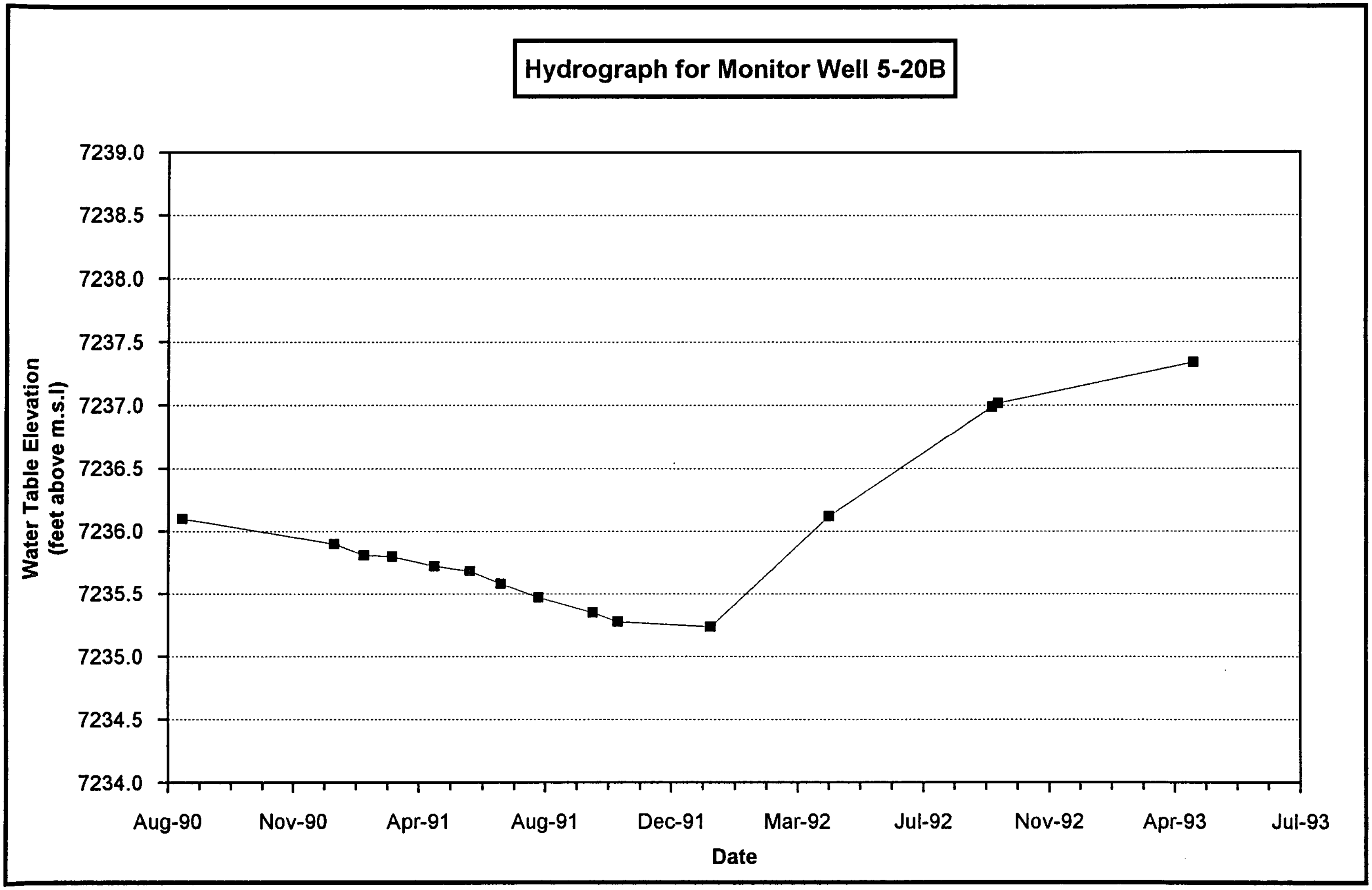

Hydrograph for Monitor Well 5-16B
7244.0
7243.5
7243.0
7242.5
7242.0
7241.5
7241.0
7240.5
7240.0
7239.5
7239.0
Water Table Elevation
(feet above m.s.l)
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



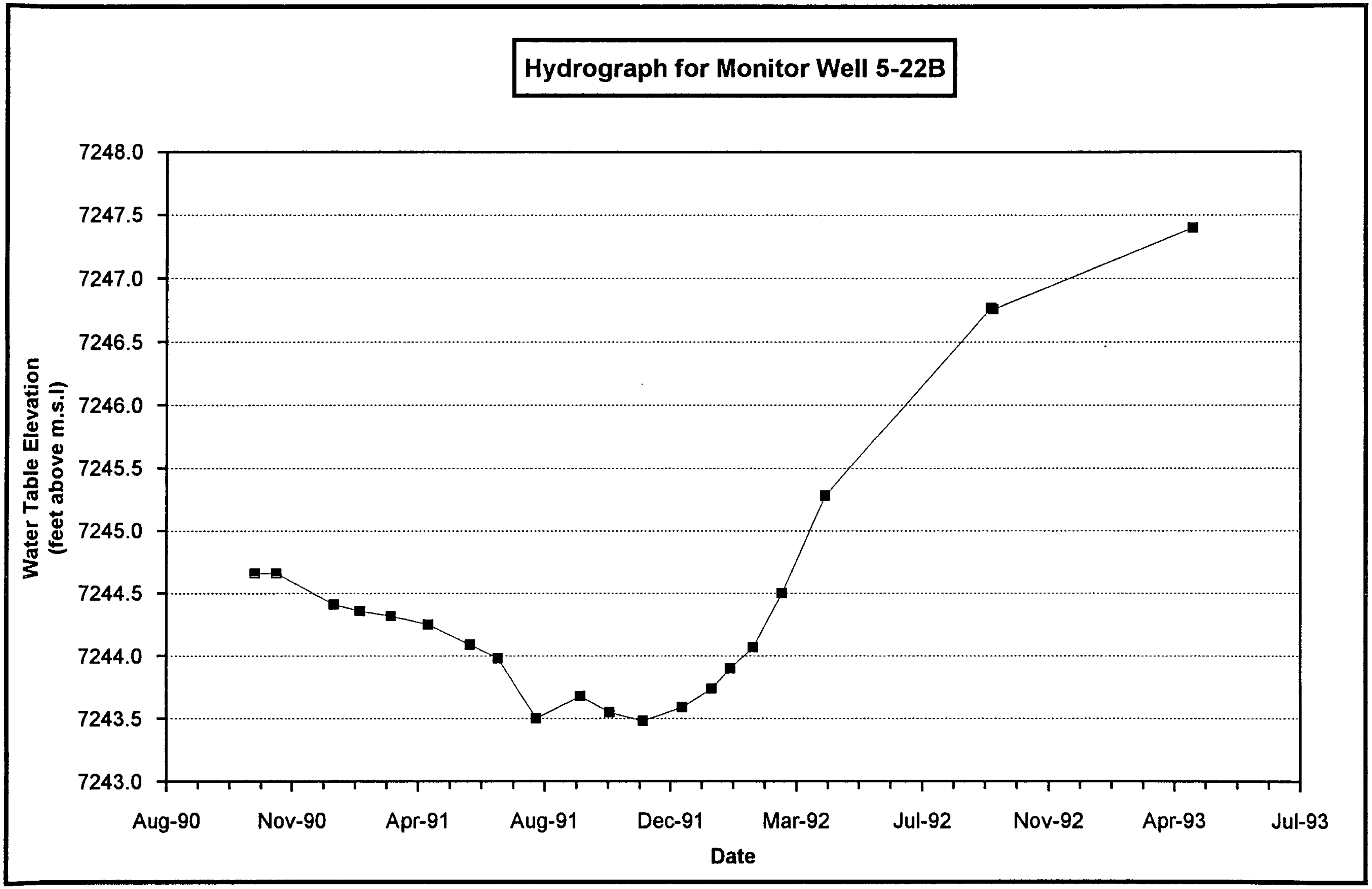
Hydrograph for Monitor Well 5-17B
Water Table Elevation
(feet above m.s.l)
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
7242.5
7242.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



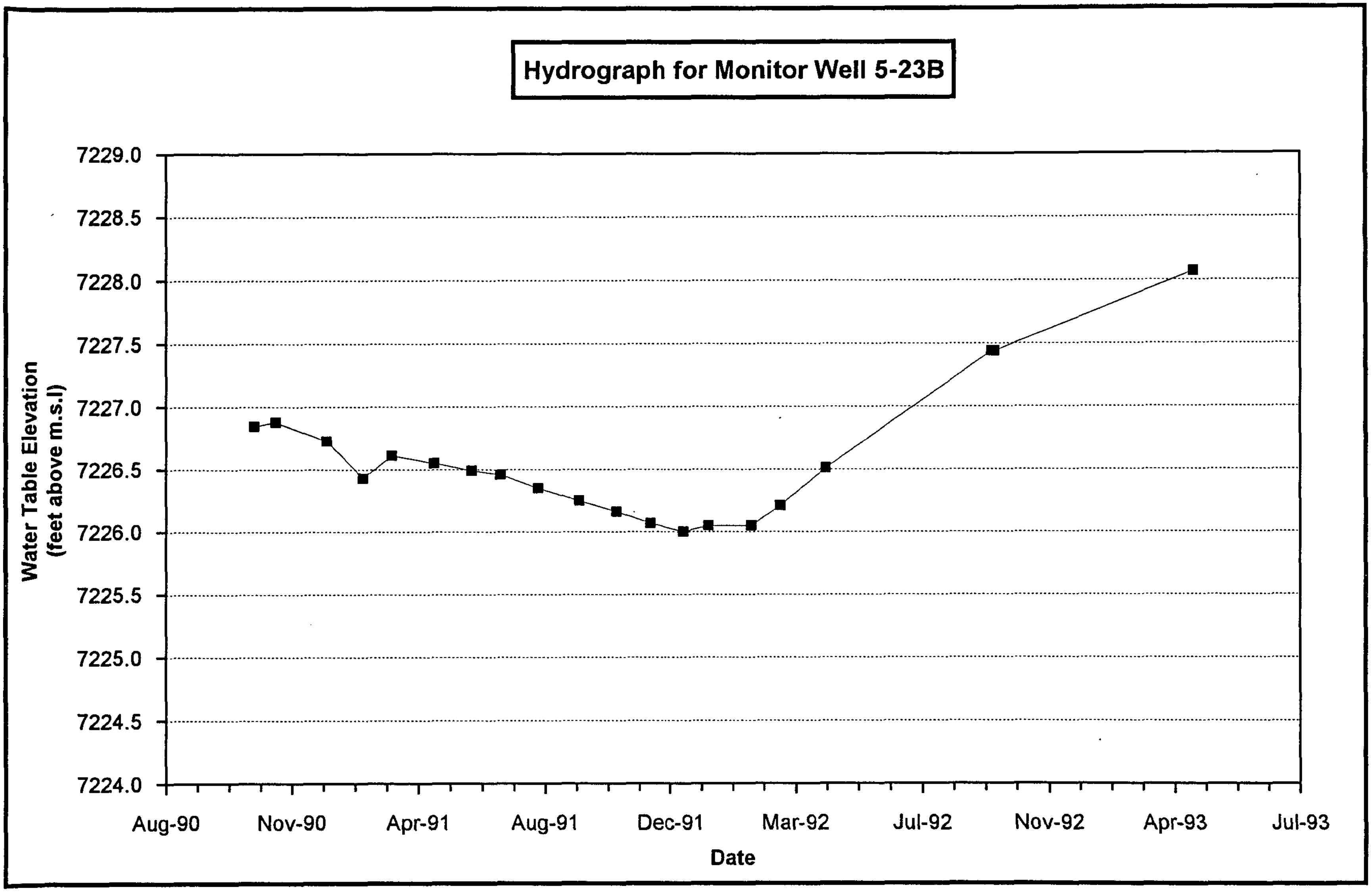
Hydrograph for Monitor Well 5-19B
Water Table Elevation (feet above m.s.l)
7243.0
7242.5
7242.0
7241.5
7241.0
7240.5
7240.0
7239.5
7239.0
7238.5
7238.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



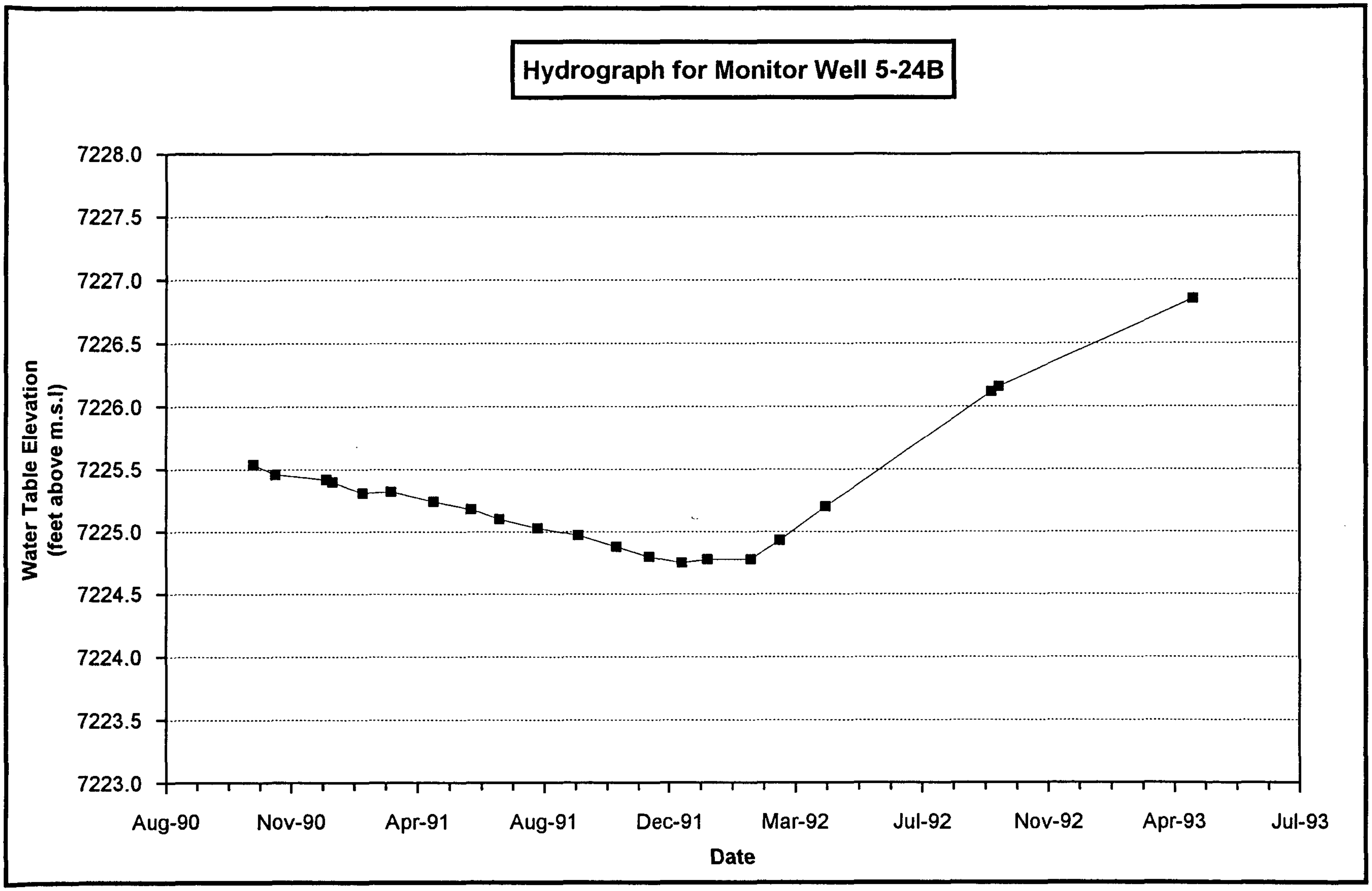
Hydrograph for Monitor Well 5-20B
Water Table Elevation
(feet above m.s.l)
7239.0
7238.5
7238.0
7237.5
7237.0
7236.5
7236.0
7235.5
7235.0
7234.5
7234.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

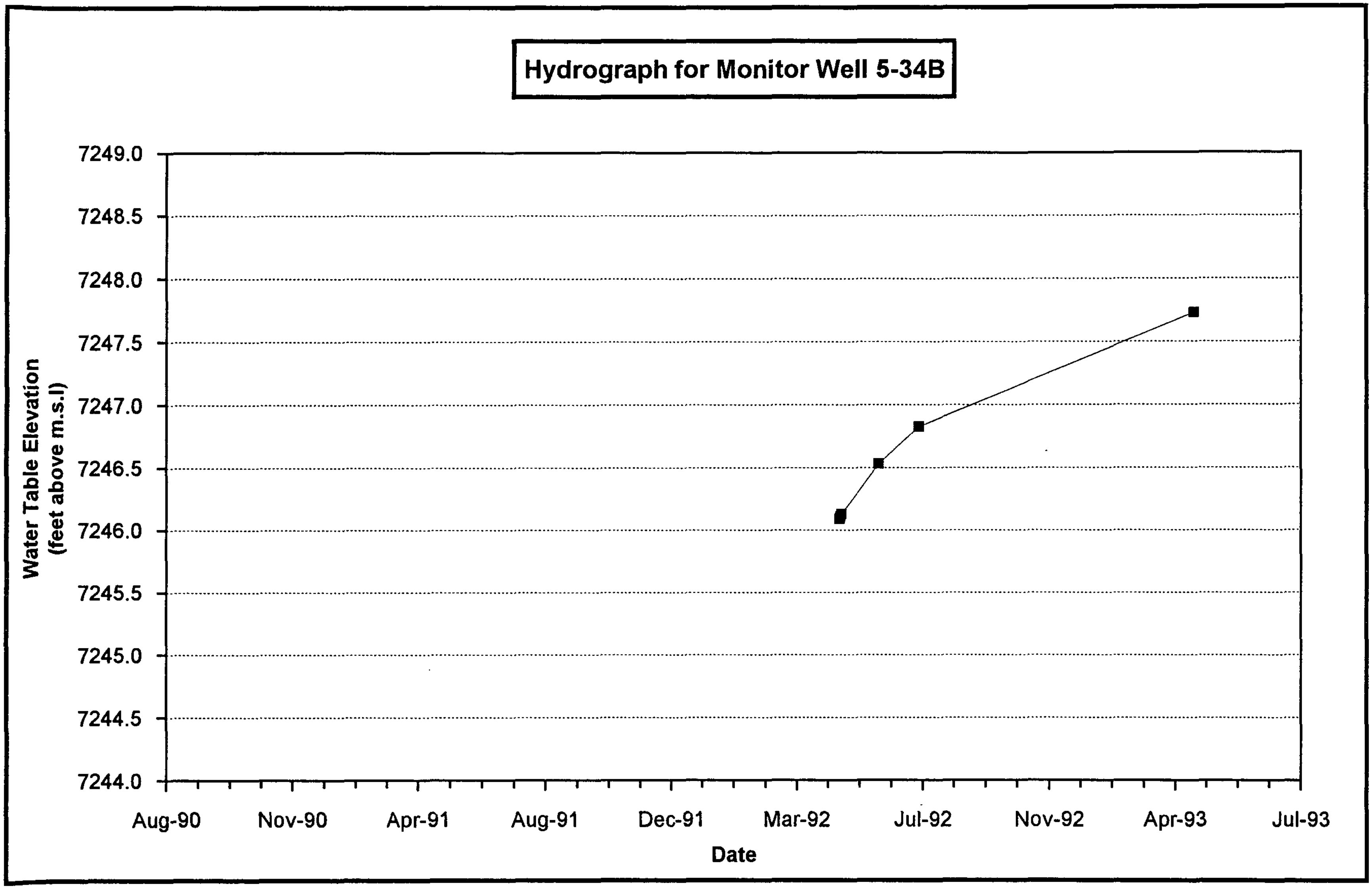


Hydrograph for Monitor Well 5-22B
Water Table Elevation
(feet above m.s.l)
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



Hydrograph for Monitor Well 5-23B
7229.0
7228.5
7228.0
7227.5
7227.0
7226.5
7226.0
7225.5
7225.0
7224.5
7224.0
Water Table Elevation (feet above m.s.l)
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-24B
7228.0
7227.5
7227.0
7226.5
7226.0
7225.5
7225.0
7224.5
7224.0
7223.5
7223.0
Water Table Elevation
(feet above m.s.l)
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-34B
Water Table Elevation
(feet above m.s.l)
7249.0
7248.5
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
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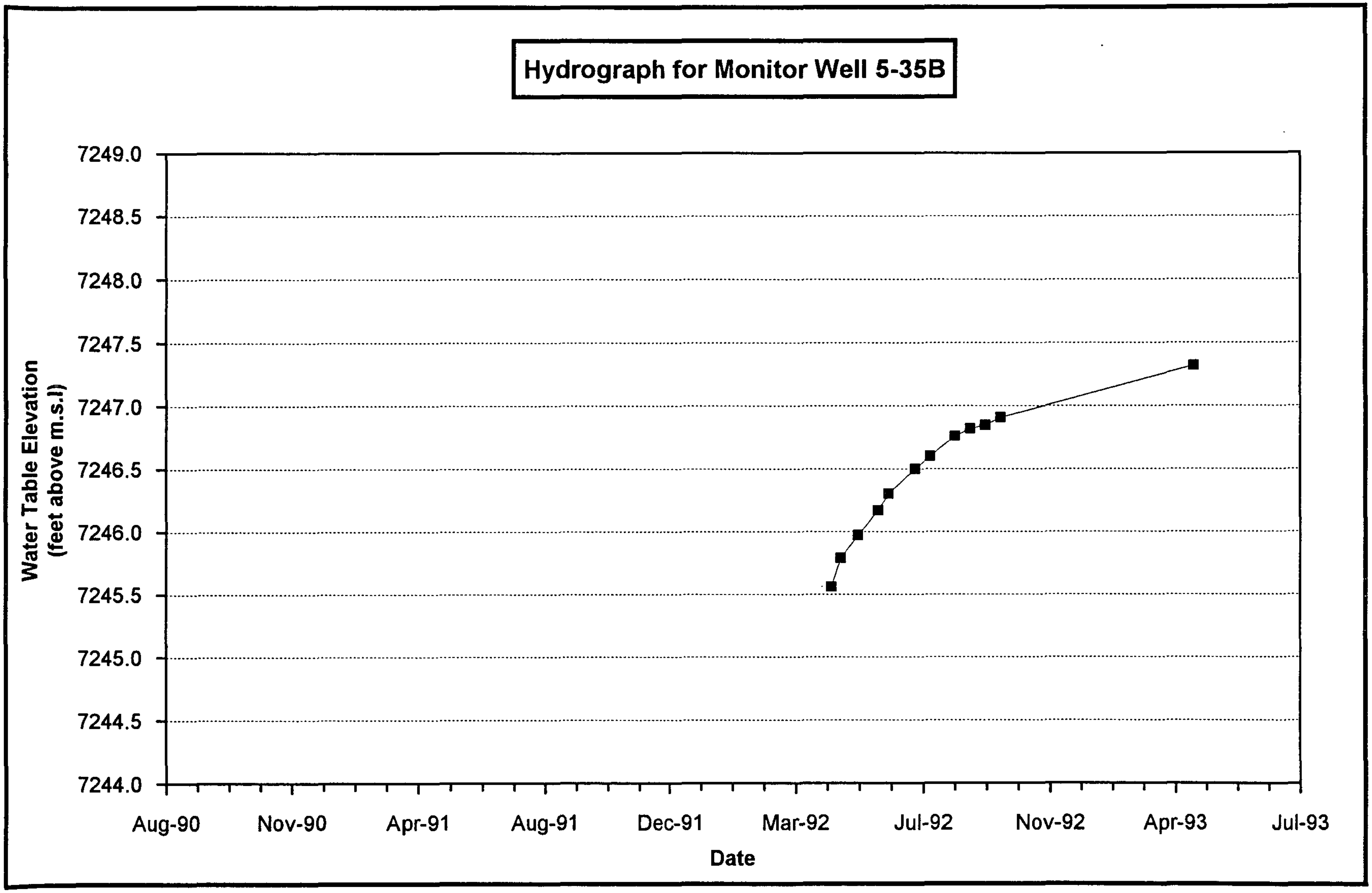
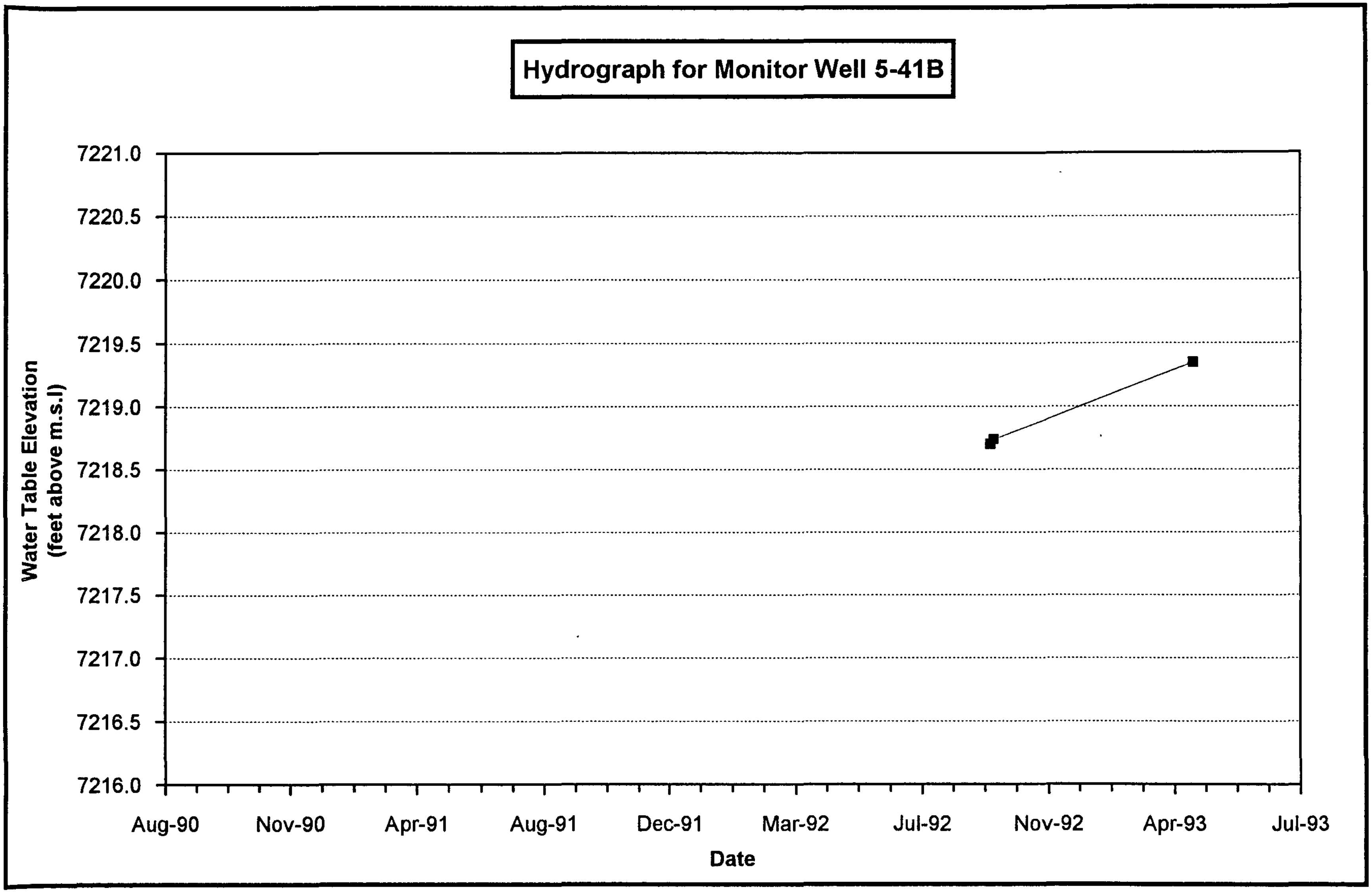
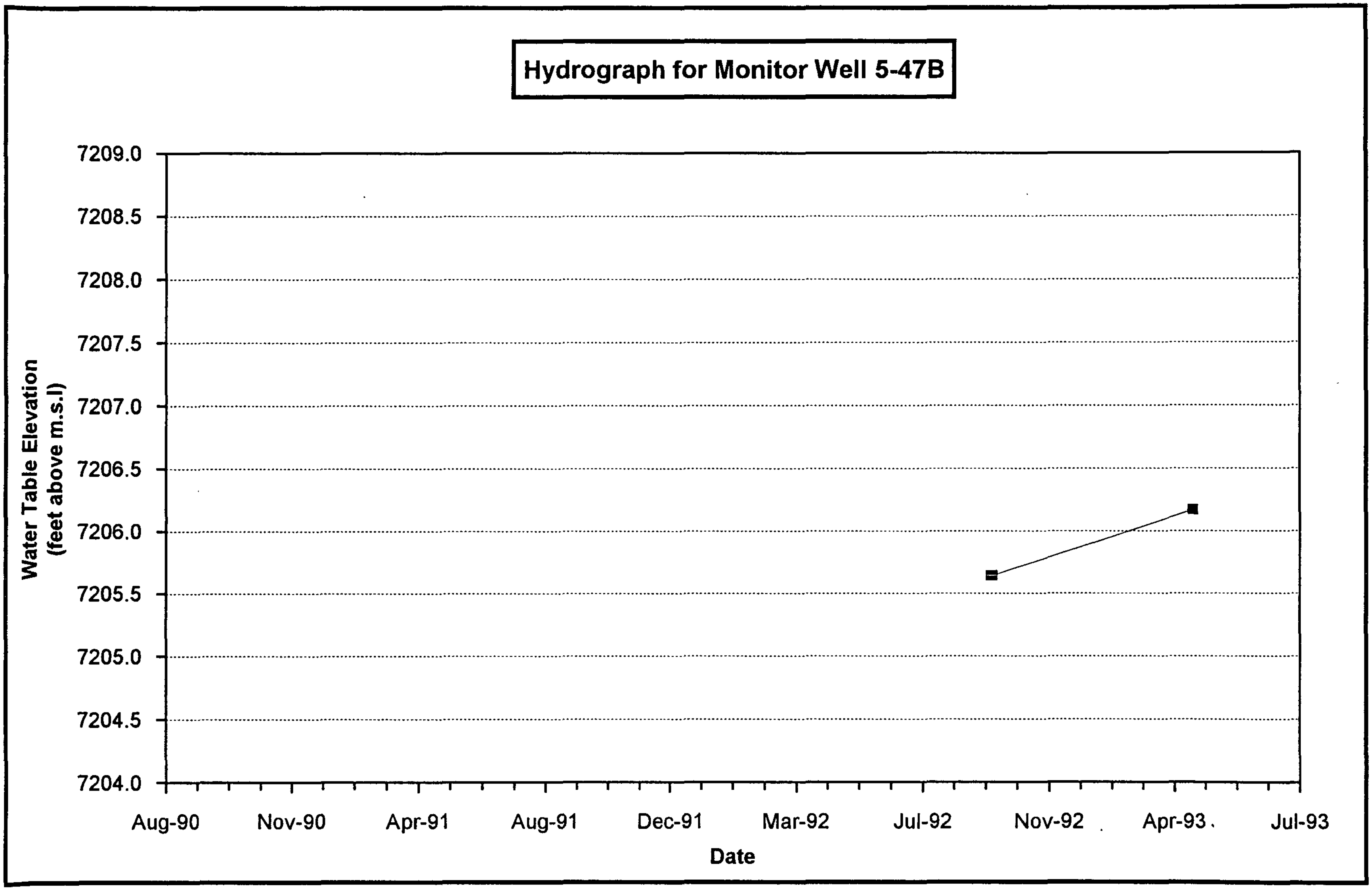
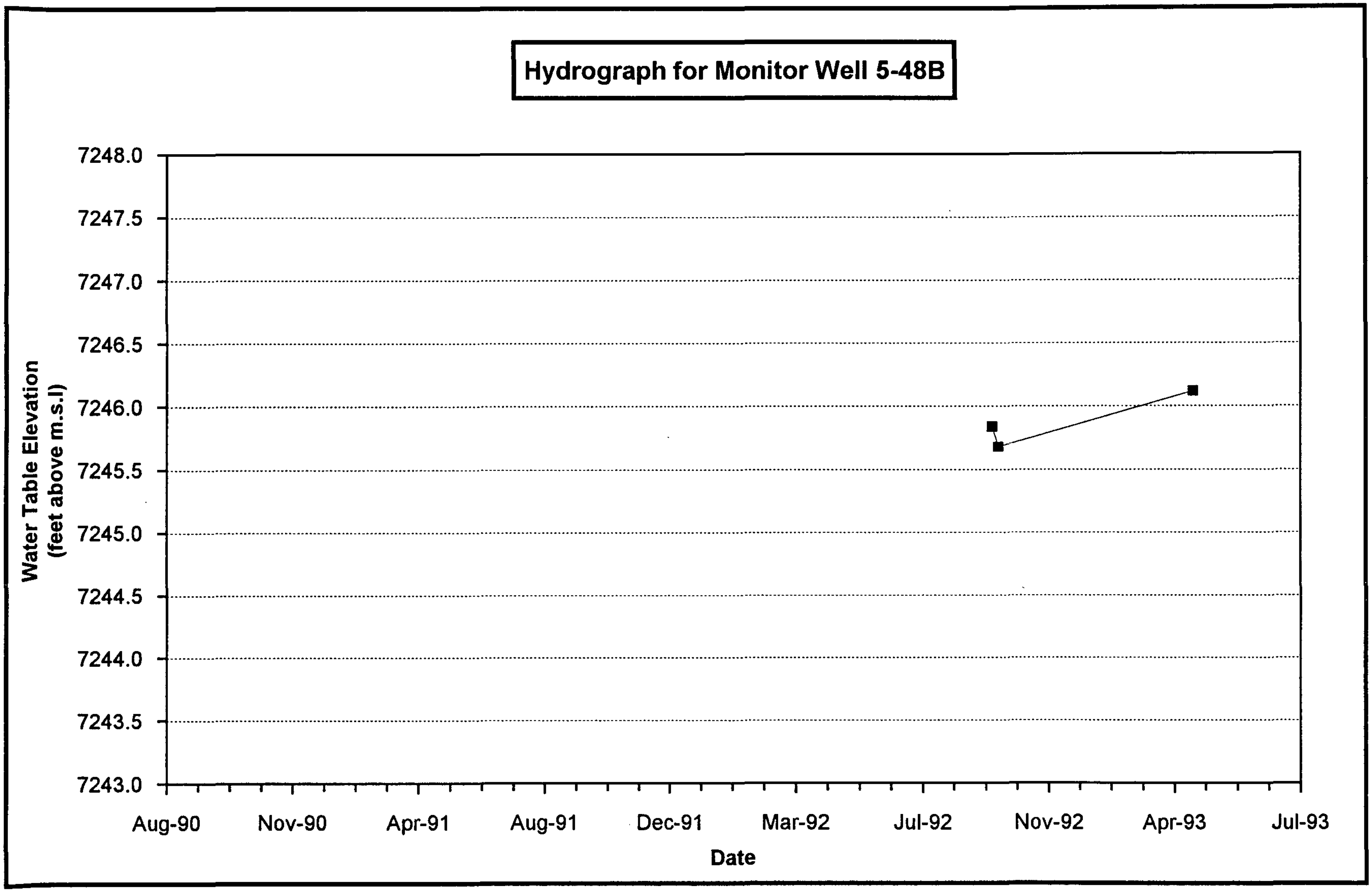
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



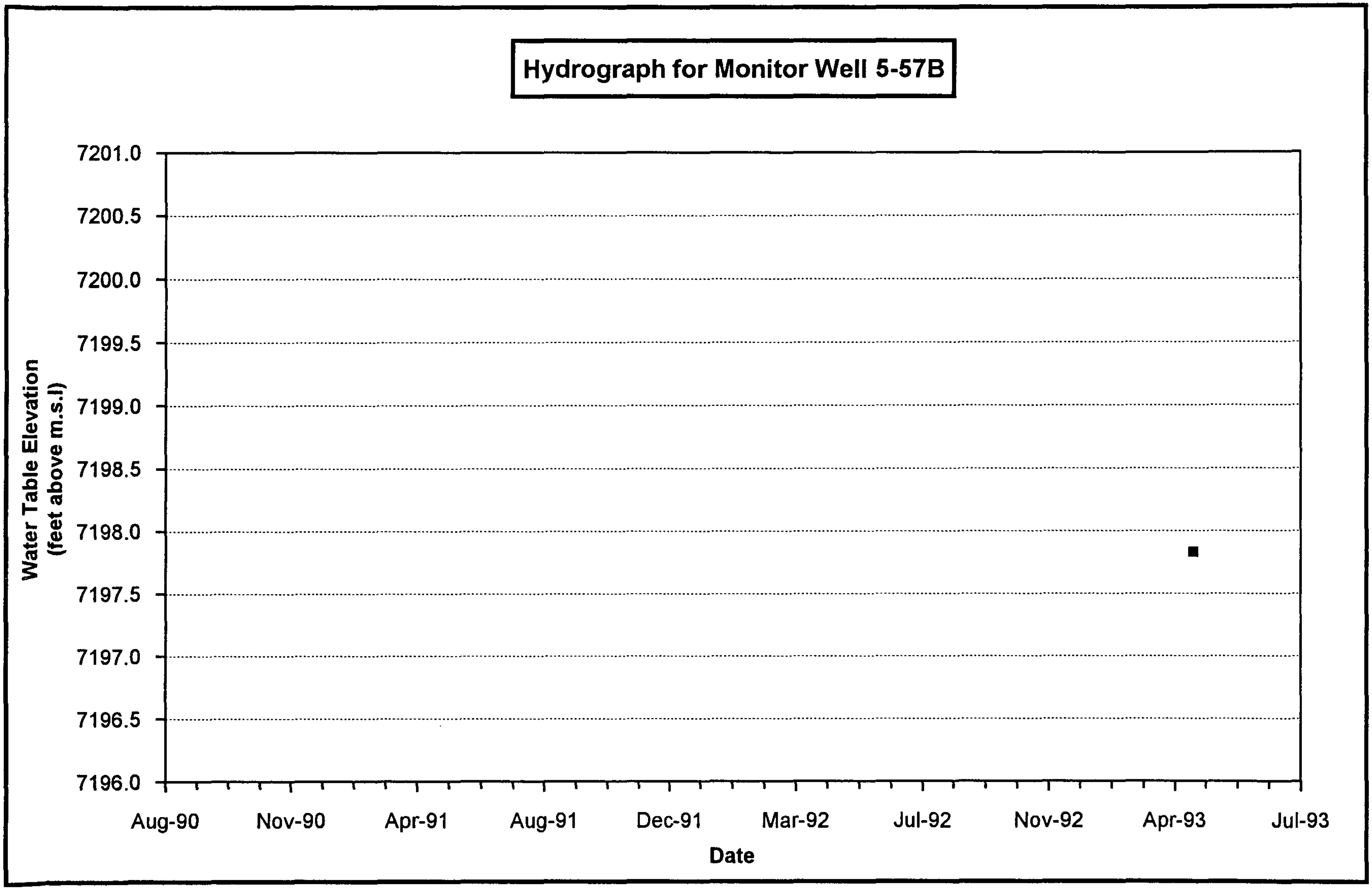
Hydrograph for Monitor Well 5-35B
Water Table Elevation
(feet above m.s.l)
7249.0
7248.5
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

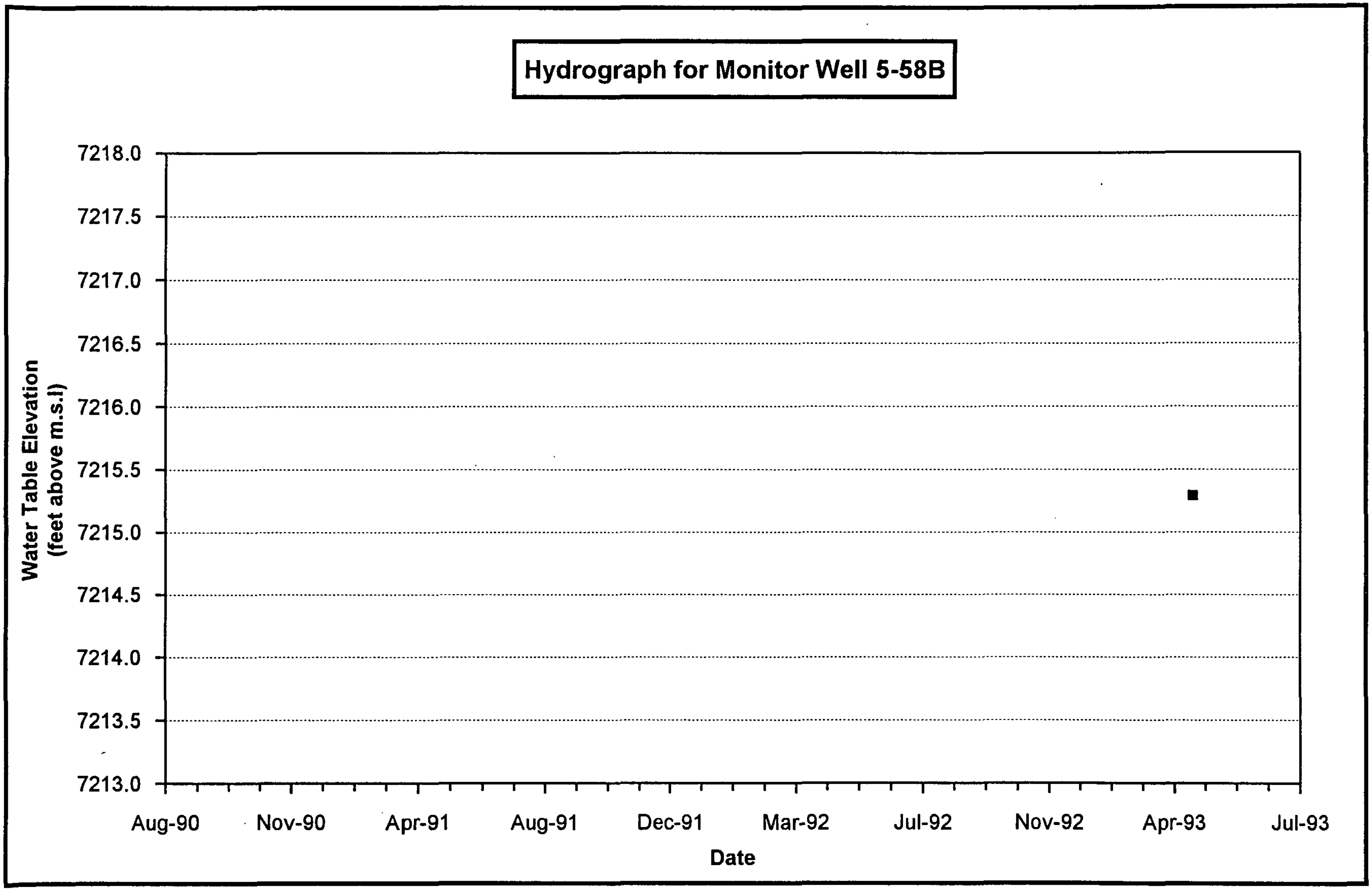

Hydrograph for Monitor Well 5-41B
Water Table Elevation
(feet above m.s.l)
7221.0
7220.5
7220.0
7219.5
7219.0
7218.5
7218.0
7217.5
7217.0
7216.5
7216.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-47B
Water Table Elevation
(feet above m.s.l)
7209.0
7208.5
7208.0
7207.5
7207.0
7206.5
7206.0
7205.5
7205.0
7204.5
7204.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



Hydrograph for Monitor Well 5-48B
Water Table Elevation
(feet above m.s.l)
7248.0
7247.5
7247.0
7246.5
7246.0
7245.5
7245.0
7244.5
7244.0
7243.5
7243.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date


Hydrograph for Monitor Well 5-57B
Water Table Elevation
(feet above m.s.l)
7201.0
7200.5
7200.0
7199.5
7199.0
7198.5
7198.0
7197.5
7197.0
7196.5
7196.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date



Hydrograph for Monitor Well 5-58B
Water Table Elevation (feet above m.s.l)
7218.0
7217.5
7217.0
7216.5
7216.0
7215.5
7215.0
7214.5
7214.0
7213.5
7213.0
Aug-90
Nov-90
Apr-91
Aug-91
Dec-91
Mar-92
Jul-92
Nov-92
Apr-93
Jul-93
Date

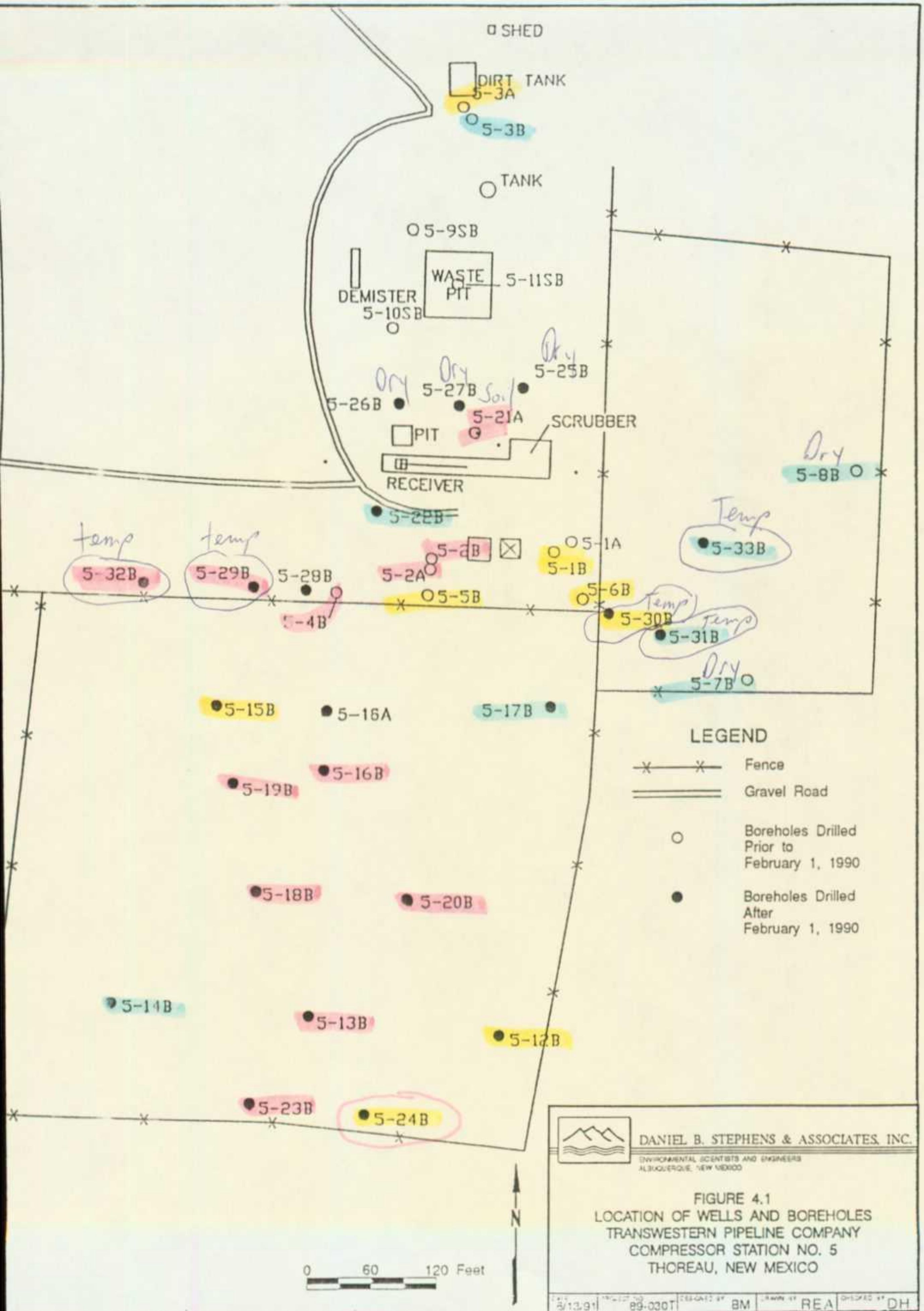


FIGURE 4.1
LOCATION OF WELLS AND BOREHOLES
TRANSWESTERN PIPELINE COMPANY
COMPRESSOR STATION NO. 5
THOREAU, NEW MEXICO

Up to 5/91

APPENDIX E

SVE PILOT TEST REPORTS AND CALCULATIONS

AcuVac Report

AcuVac Remediation

9111 Katy Freeway
Suite 303
Houston, TX 77024
(713) 468-6688: TEL
(713) 468-6689: FAX
Manufacturers Distributor
RSI S.A.V.E. System

November 15, 1993

Ms JoAnn Hilton
Hydrogeologist and Manager
Daniel B. Stephens & Associates, Inc.
6020 Academy N.E. Ste 100
Albuquerque, NM 87109

Dear Ms Hilton:

Enclosed is the report on Pilot Testing performed on November 3rd, 4th, and 5th, 1993 at DBS&A Project No. 2105, Enron Corporation, Transwestern Compressor Station #5, Thoreau, NM. During the tests, AcuVac used the S.A.V.E. Remediation System with various instrumentation including the Horiba Analyzer. The report is divided into six separate tests that were conducted over a three day period.

Project Scope:

Connect the S.A.V.E. System to observation wells B-35B, B-34B, B-4B, B-5B, B-2B and B-6B, and apply vacuum to these wells; record the vacuum and well flow and record all system data - including fuel flow (propane) - and estimate the fuel value from the well vapors. Install and observe the magnehelic gauges on the selected outer observation wells to determine vacuum radius of influence or if the selected recovery well is in vacuum communication with the outer observation wells. Take influent vapor samples to forward for laboratory analysis and provide on-site Horiba Analyzer data on HC ppmv, CO_2 and CO, % by volume. Operate the S.A.V.E. System in a manner that all well vapors are passed through the engine to destruct the contaminants and exhausted to meet air emission standards and comply with applicable State and Federal laws and safety standards.

Fuel Use Information:

When the S.A.V.E. System is running 100% on fuel from recovery well vapors at an altitude of 7,300 ft, the maximum contaminated fuel destruction or burn rate is approximately 9.3 lbs/hr or 1.4 gallons of gasoline per hour. Maximum propane flow at full load was 115 CFH at this altitude at ambient air temperatures from 30° to 50°F and engine speed at 2,700 RPM. Therefore, when the flow meter is on 60 CFH, the well vapors are contributing approximately 50% of the fuel value, or approximately 4.65 lbs/hr. Other percentages are calculated accordingly. Contaminant in the form of gasoline will produce approximately 125,000 BTU/hr. Therefore, the fuel requirement for these tests are estimated to produce 175,000 BTU/hr. Propane requirements without fuel value from well flow is 1.81 gals/hr.

Summary of Data: 6 Tests See Exhibit A.

Discussion of Data:

There will be variations in well distances compared to an accurate survey. Some well distances were measured while others were estimated from the scale plotted on a location map.

Test #1 was a 24 hour SVE test conducted from recovery well (RW) 5-35B. This well is constructed from 4" PVC pipe and screened from 31.3 to 61.3 ft bgs with a depth of groundwater at test time of 50.03 bmp. Prior to beginning the test, magnehelic gauges were used to check the static vacuum or pressure existing in the selected observation wells. With the exception of well 5-37I, all selected observation wells indicated a pressure under static conditions. From my experience in observing SVE test data, this is not uncommon. Observation wells 5-36E and 5-37I are reported to be screened below the groundwater level and erratic data may occur during SVE testing. Later, we found out during SVE Test #5, that 5-2B was a dead well (no well flow) and the observed vacuums /pressures were probably not influenced by the RW vacuum with the exception of groundwater level changes.

Prior to starting the test, the recovery well PVC connecter and boot were modified to accept transducers for sensing groundwater level changes. All S.A.V.E.'s systems were checked and magnehelic gauges set at "0".

The 24 hour test provided good steady data from observation wells 5-34B, 5-4B, 5-22B and 5-5B. This is presented in the Summary of Data. From this data, 5-34B and 5-4B should be considered within the radius of influence and it is highly probable that 5-22B and 5-5B will effectively be within the influence over time (see Figure 1). The HC, CO_2 and CO concentrations from well vapors as provided by the HORIBA Analyzer were consistent throughout the test period. This is confirmed by the consistent propane flow.

Test #2 was a 3 hour SVE test conducted from recovery well (RW) 5-34B. This well is constructed from 4" PVC pipe and screened from 34 to 64 ft bgs with depth of groundwater at 47.68 ft at the time of the test. The interface probe indicated a PSH sheen on the groundwater. The test was a very typical SVE test in that the RW vacuum and flow was almost constant throughout the test time. The propane flow and the HORIBA analysis of well vapors were also consistent and the progress of vacuum in the observation wells was steady. This is confirmed as shown in the Summary of Data and Figure 1.

Test #3 was a 2 hour SVE test conducted from recovery well (RW) 5-4B. This well is constructed from 2" PVC pipe and screened from 38.7 to 58.7 ft bgs with depth of groundwater at time of test of 46.12 ft. Prior to beginning the test, magnehelic gauges were used to check the static vacuum/pressure existing in the selected observations wells. With the exception of well 5-2B, all wells indicated a vacuum at 0730 hours on 11/05/93 as compared to a pressure at 1155 hours on 11/03/93. This occurred after 27.9 hours of SVE testing. The recorded data was consistent throughout the test as indicated in the Summary of Data and Figure 1.

Test #4 was a 2 hour SVE test from recovery well (RW) 5-5B. This well is constructed from 2" PVC pipe and screened from 39.5 to 58 ft bgs with depth of groundwater of 45.0 ft at time of test. The operating data was consistent throughout the test. The HORIBA analysis indicates the well vapors contained small amounts of hydrocarbon vapors. Observation wells 5-35B and 5-34B were too far from the RW to provide meaningful data. Two additional wells, 5-1B and 5-6B were added as observation wells. The data is presented in the Summary and Figure 1.

Test #5 was scheduled to be a 2 hour SVE test. However, after the initial vapor evacuation from the well, no flow was observed at a well vacuum of 283" H_2O. The test was aborted. The well should not be included as a SVE recovery well.

Test #6 was a 1.3 hour SVE test conducted from recovery well (RW) 5-6B. This well is constructed from 2" PVC pipe and reported screened from 38.7 to 58.7 ft bgs with the depth of groundwater at 42.0 ft at the time of test. All operating data was consistent throughout the test. Vacuum was held at near 90" H_20 to encourage well flow. Observation wells 5-1B and 5-5B responded to RW vacuum. HORIBA data indicates low hydrocarbon value from the well vapors. All other observation wells were dropped due to distances. The data was not included in the plot in Figure 1.

Figure 1 indicates the most conclusive data supporting a SVE system for this facility. As shown on the plot, a radius of influence from 40 to 60 ft could be incorporated in the design plan. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is 0.3 to 0.5" H_20. It is assumed that beyond these points, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence may continue to increase 1 to 10 days.

Additional Information (This should be read as vital part of the report):

- Summary of Operating Data
- Plot of observed Vacuum vs Distance at the Facility
- Field Operating Data and Notes
- Site Photographs

Conclusion:

The tests indicate that soil vacuum extraction (SVE) would be an effective method of remediation for this facility. Although the observed vacuum on the outer observation wells was relatively low, or in some cases pressure was recorded, the duration of the pilot tests #2 through #6 were short. However, the results give positive indication that the observed and reported wells were in vacuum communication with the selected SVE recovery wells. A properly installed SVE System should effectively remove contaminants from the soil.

The S.A.V.E. System performed as represented and should be considered a viable technology to use for the remediation of this location. We project it will take 1 to 5 days to establish a consistent vacuum and true radius of influence. The System is designed to consume heavy concentrations of vapors and meet air emission standards set by the NMED. The new S.A.V.E. II System which is presently being tested, can provide well flows of up to 250 cfm.

Once you have reviewed the report, please call me if you have any questions.

Sincerely,

James E. Sadler
Product Engineer

(50110.rep)

SCHEDULE A
ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #1

11/03/93	Initial Data Time 1230	Second Data Time 1315	Third Data Time 1330	Forth Data Time 1430	Fifth Data Time 1530	Sixth Data Time 1630	Seventh Data Time 1730
% Well Vapors As Fuel	13	22	17	22	22	22	22
Horiba-HC PPM	-	15,530	-	19,430	20,490	17,120	23,950
Recovery Well Vacuum "H_2O Well 5-35B	24	26	26	26	26	26	26
Recovery Well Flow-CFM Well 5-35B	19	20	19.5	19	20	21	21
Well 5-34B Vacuum "H_2O Dist. ft.	.25	.45	.48	.60	.64	.64	.70
Well 5-4B Vacuum "H_2O Dist. ft.	.17	.30	.35	.40	.52	.50	.48
Well 5-22B Vacuum "H_2O Dist. ft.	(.13)	0	.05	.05	.10	.10	.12
Well 5-2B Vacuum "H_2O Dist. ft.	(.41)	(1.00)	(1.00)	(.85)	(.70)	(.70)	(.54)
Well 5-5B Vacuum "H_2O Dist. ft.	(.10)	(.03)	(.01)	.03	.05	.04	.06

11/03/93 and 11/04/93	Eighth Data Time 1830	Ninth Data Time 1930	Tenth Data Time 2030	Eleventh Data Time 2130	Twelfth Data Time 2230	Thirteenth Data Time 2330	Fourteenth Data Time 0030
% Well Vapors As Fuel	26	17	17	17	17	17	17
Horiba-HC PPM	23,630	21,370	-	22,130	-	21,870	-
Recovery Well Vacuum "H_2O Well 5-35B	26	27	27	27	27	27	27
Recovery Well Flow-CFM Well 5-35B	20	21	21	21	21	21	22
Well 5-34B Vacuum "H_2O Dist. ft.	.70	.78	.80	.83	.85	.86	.88
Well 5-4B Vacuum "H_2O Dist. ft.	.52	.56	.60	.62	.60	.58	.60
Well 5-22B Vacuum "H_2O Dist. ft.	.15	.18	.18	.18	.18	.16	.14
Well 5-2B Vacuum "H_2O Dist. ft.	(.48)	(.30)	(.28)	(.24)	(.30)	(.32)	(.38)
Well 5-5B Vacuum "H_2O Dist. ft.	.07	.13	.12	.12	.12	.14	.14

ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #1 - Continued

11/04/93	Fifteenth Data Time 0130	Sixteenth Data Time 0230	Seventeenth Data Time 0330	Eighteenth Data Time 0430	Nineteenth Data Time 0530	Twentieth Data Time 0630	Twenty-first Data Time 0730
% Well Vapors As Fuel	17	17	17	22	22	17	17
Horiba-HC PPM	-	23,110	-	22,570	-	21,960	21,200
Recovery Well Vacuum "H_2O Well 5-35B	27	27	27	27	27	27	28
Recovery Well Flow-CFM Well 5-35B	22	22	21	22	22	22	26
Well 5-34B Vacuum "H_2O Dist. 21.6 ft.	.90	.90	.90	.90	.92	.95	.98
Well 5-4B Vacuum "H_2O Dist. 38.2 ft.	.62	.60	.64	.66	.66	.67	.70
Well 5-22B Vacuum "H_2O Dist. 80.3 ft.	.15	.15	.15	.16	.18	.20	.27
Well 5-2B Vacuum "H_2O Dist. 116.9 ft.	(.38)	(.34)	(.32)	(.30)	(.24)	(.20)	(.14)
Well 5-5B Vacuum "H_2O Dist. 118.8 ft.	.15	.14	.12	.10	.12	.15	.15

11/04/93	Twenty-second Data Time 0830	Twenty-third Data Time 0930	Twenty-forth Data Time 1030	Twenty-fifth Data Time 1130	Twenty-sixth Data Time 1235	Average Data 24:05 Hrs.	Maximum Data
% Well Vapors As Fuel	17	17	17	17	17	18.54	26
Horiba-HC PPM	-	20,398	21,394	22,470	21,860	21,205	23,950
Recovery Well Vacuum "H_2O Well 5-35B	28	29	29	30	31	27.12	31
Recovery Well Flow-CFM Well 5-35B	27	29	29	30	30	22.64	30
Well 5-34B Vacuum "H_2O Dist. 21.6 ft.	.97	.98	1.00	1.00	1.10	.81	1.10
Well 5-4B Vacuum "H_2O Dist. 38.2 ft.	.74	.68	.65	.72	.76	.57	.76
Well 5-22B Vacuum "H_2O Dist. 80.3 ft.	.24	.17	.18	.24	.26	.15	.27
Well 5-2B Vacuum "H_2O Dist. 116.9 ft.	(.18)	(.22)	(.24)	(.30)	(.50)	(.42)	(.14)
Well 5-5B Vacuum "H_2O Dist. 118.8 ft.	.15	.08	.10	.14	.15	.09	.15

ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #2

11/04/93	Initial Data Time 1415	Second Data Time 1515	Third Data Time 1615	Average Data 2:12 Hrs.	Maximum Data
% Well Vapors As Fuel	35	30	35	33.3	35
Horiba-HC PPM	28,770	32,570	31,670	31,003	32,570
Recovery Well Vacuum "H_2O Well 5-34B	6.0	6.0	6.2	6.07	6.2
Recovery Well Flow-CFM Well 5-34B	20	21	22	21	22
Well 5-35B Vacuum "H_2O Dist. 21.6 ft.	.80	.80	.85	.82	.85
Well 5-4B Vacuum "H_2O Dist. 54.0 ft.	.46	.48	.52	.49	.52
Well 5-22B Vacuum "H_2O Dist. 102.0 ft.	.12	.16	.20	.16	.20
Well 5-2B Vacuum "H_2O Dist. 134.0 ft.	(.66)	(.50)	(.36)	.51	(.36)
Well 5-5B Vacuum "H_2O Dist. 133.5 ft.	.10	.14	.18	.14	.18

ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #3

11/05/93	Initial Data Time 0755	Second Data Time 0855	Third Data Time 1000	Average Data 2:05 Hrs.	Maximum Data
% Well Vapors As Fuel	0	0	0	0	0
Horiba-HC PPM	898	1,178	1,205	1,094	1,205
Recovery Well Vacuum "H_2O Well 5-4B	42	42	43	42.33	43
Recovery Well Flow-CFM Well 5-4B	20	22	23	21.67	23
Well 5-35B Vacuum "H_2O Dist. 38.2 ft.	.38	.46	.52	.45	.52
Well 5-34B Vacuum "H_2O Dist. 54.0 ft	.22	.28	.34	.28	.34
Well 5-22B Vacuum "H_2O Dist. 83.0 ft.	.14	.19	.24	.19	.24
Well 5-2B Vacuum "H_2O Dist. 88.5 ft.	(.06)	(.04)	(.02)	(.04)	(.02)
Well 5-5B Vacuum "H_2O Dist. 79.5 ft.	.04	.20	.26	.17	.26

ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #4

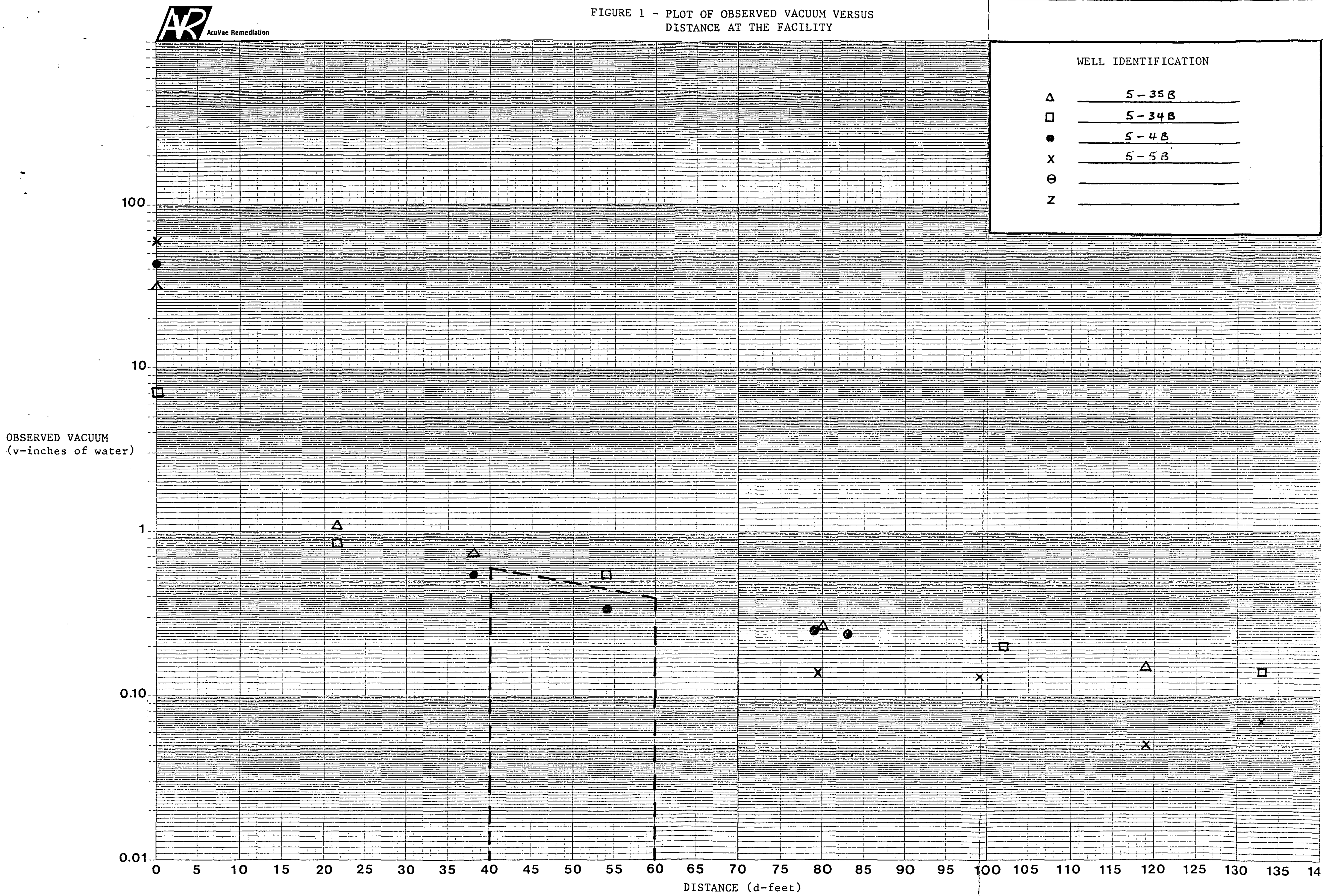
11/05/93	Initial Data Time 1015	Second Data Time 1115	Third Data Time 1225	Average Data 2:10 Hrs.	Maximum Data
% Well Vapors As Fuel	0	0	0	0	0
Horiba-HC PPM	56	64	22	47.33	64
Recovery Well Vacuum "H_2O Well 5-5B	82	60	60	67.33	82
Recovery Well Flow-CFM Well 5-5B	20	18	18	.67	20
Well 5-35B Vacuum "H_2O Dist. 118.8 ft.	.05	.05	.05	.05	.05
Well 5-34B Vacuum "H_2O Dist. 133.5 ft	.07	.07	.05	.06	.07
Well 5-4B Vacuum "H_2O Dist. 79.5 ft.	.14	.16	.18	.16	.18
Well 5-22B Vacuum "H_2O Dist. 99.0 ft.	.14	.14	.16	.15	.16
Well 5-2B Vacuum "H_2O Dist. 46.0 ft.	(.02)	.05	.05	.03	.05
Well 5-1B Vacuum "H_2O Dist. 123.0 ft.	(.22)	(.04)	.05	(.07)	.05
Well 5-6B Vacuum "H_2O Dist. 142.5 ft.	(.10)	(.05)	.08	(.02)	.08

ENRON CORPORATION/TRANSWESTERN COMPRESSOR STATION #5

DBS&A - Thoreau, NM Test #6

11/05/93	Initial Data Time 1305	Second Data Time 1405	Third Data Time 1420	Average Data 1:15 Min	Maximum Data
% Well Vapors As Fuel	0	0	0	0	0
Horiba-HC PPM	20	108	-	64	108
Recovery Well Vacuum "H_2O Well 5-6B	92	95	96	94.33	96
Recovery Well Flow-CFM Well 5-6B	4	8	9	7.0	9
Well 5-1B Vacuum "H_2O Dist. 49.5 ft.	0	.18	.20	.13	.20
Well 5-5B Vacuum "H_2O Dist. 142.5 ft	.04	.15	.18	.12	.18

FIGURE 1 - PLOT OF OBSERVED VACUUM VERSUS DISTANCE AT THE FACILITY



AcuVac Remediation

OPERATING DATA - TEST NO 1

S.A.V.E.™ SYSTEM

ENRON CORPORATION

Page 1 Location TRANSWESTERN COMPRESSOR STA #5 THOREAU NM Project Engr. J. SADLER

	Date	11/3/93	→	→	→	→	→
	Parameter	Time START UP 1005	Time WARM UP 1155	Time START 1230	Time 1315	Time 1330	Time 1430
		Hr. Meter 535.0	Hr. Meter 536.0	Hr. Meter 536.5	Hr. Meter 537.2	Hr. Meter 537.5	Hr. Meter 538.6
ENGINE	R.P.M.	2000	2000	2600	2750	2700	2700
ENGINE	Oil Press P.S.I.	60	55	55	50	50	50
ENGINE	Water Temp °F	120	170	190	190	190	190
ENGINE	Volts	13.5	13.5	13.5	13.5	13.5	13.5
ENGINE	Intake Vac Hg	6	6	8	6	6	4
FUEL/AIR	Gas Flow Fuel/Propane cfh	60	60	100	90	95	90
FUEL/AIR	Air Flow cfm	20	18	24	28	28	30
FUEL/AIR	Well Flow 5-35B cfm	—	—	19	20	19.5	19
FUEL/AIR	Recovery Well Vac 5-35B "H_2O	—	—	24	26	26	26
	Air Temp °F	38	52	55	56	56	58
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-36E "H_2O	-	(.90)	.05	.11	.12	(.18)
MONITOR WELL VACUUM	5-37 I "H_2O	-	0	.40	.90	.90	.90
MONITOR WELL VACUUM	5-34 B "H_2O	-	(.06)	.25	.45	.48	.60
MONITOR WELL VACUUM	5-4 B "H_2O	-	(.10)	.17	.30	.35	.40
MONITOR WELL VACUUM	5-22B "H_2O	-	(.13)	(.13)	0	.05	.05
MONITOR WELL VACUUM	5-2B "H_2O	-	(.16)	(.41)	(1.00)	(1.00)	(.85)
MONITOR WELL VACUUM	5-5B "H_2O	-	(.10)	(.10)	(.03)	(.01)	.03
MONITOR WELL VACUUM	"H_2O		STATIC WELL VACUUM/PRESSURE PRIOR TO WELL VACUUM OR FLOW				
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O			( ) INDICATES WELL PRESSURE			
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MANIFOLD	Vapor Wells On/Off	OFF	ON	ON	ON	ON	ON
MANIFOLD	Groundwater Wells On/Off	OFF	→	→	→	→	→
MANIFOLD	Discharge Flow Meter gals	OFF	→	→	→	→	→
	Samples				HORIBA Influent		HORIBA Influent

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TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Time	1310	1430	1545			
VAPOR INFLUENT	H-C ppmv	15,530	19,430				
	C-O %	.04	.04				
	CO_2 %	5.16	5.70				
SAVE EMISSIONS	H-C ppmv			18			
	C-O %			.05			
	CO_2 %			4.16			
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/3/93 TEST NO. 1

0905	Arrived at location - Met with Robert Morley, Daniel
	B. Stephens & Associates
0915	Positioned S.A.V.E. System near well 5-35B for recovery well (RW)
	and connected S.A.V.E to RW via flex hose and boot and PVC well
0945	extention. Connected air/water separator and installed
	individual well plugs for magnehelic gages - H_2O level 51.75'
1005	Started S.A.V.E. for warm-up and system check - Ran 9 hour
1100	Helped remove monitoring well pumps and installing transducers in RW
1155	Recorded static pressures on outer wells - Restart for warm-up
1215	DBS&A recorded initial groundwater levels and set readings on transducers
1230	START TEST - Initial well flow @ 18 cfm, well vacuum @ 22" H_2O
	Recorded Data - All outer wells responding to vacuum X 5-2B & 5-5B
1315	Recorded Operating and HORIBA Data - All system functions
	normal - Vac. increase on outer wells X 5-2B, with press. inc.
1330	Recorded Data - All normal - Slight increases on outer wells
1430	HORIBA Data - Recorded increase in HC value
1430	Recorded Data - Note that 5-36E changed from vacuum to press.
	Difficult to provide reason since well screened below H_2O level.

AcuVac Remediation

OPERATING DATA - TEST NO 1

S.A.V.E.™ SYSTEM

Page 2 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M Project Engr. J. SADLER

	Parameter						
	Date	11/3/93	→	→	→	→	→
	Time	1530	1630	1730	1830	1930	2030
	Hr. Meter	539.6	540.6	541.6	542.6	543.6	544.6
ENGINE	R.P.M.	2700	2700	2700	2600	2700	2700
	Oil Press P.S.I.	50	50	50	50	50	50
	Water Temp °F	190	190	190	190	185	185
	Volts	13.5	13.5	13.5	13.5	13.5	13.5
	Intake Vac Hg	4	4	4	4	5	5
FUEL/AIR	Gas Flow Fuel/Propane cfh	90	90	90	85	95	95
	Air Flow cfm	30	32	32	32	35	35
	Well Flow 5-35B cfm	20	21	21	20	21	21
	Recovery Well Vac 5-35B "H_2O	26	26	26	26	27	27
	Air Temp °F	52	48	43	40	38	38
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-36E "H_2O	(.17)	(.12)	(.02)	.03	.15	.08
	5-37I "H_2O	.90	.90	1.00	(1.2)	(.60)	(.60)
	5-34B "H_2O	.64	.64	.70	.70	.78	.80
	5-4B "H_2O	.52	.50	.48	.52	.56	.60
	5-22B "H_2O	.10	.10	.12	.15	.18	.18
	5-2B "H_2O	(.70)	(.70	(.54)	(.48)	(.30)	(.28)
	5-5B "H_2O	.05	.04	.06	.07	.13	.12
	"H_2O						
	"H_2O						
	"H_2O			( ) INDICATES WELL PRESSURE			
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON	ON	ON	ON
	Groundwater Wells On/Off	OFF	→	→	→	→	→
	Discharge Flow Meter gals	OFF	→	→	→	→	→
	Samples	HORIBA EMISSIONS		HORIBA INFLUENT & EMISSIONS	HORIBA INFLUENT	HORIBA INFLUENT	

933107)

TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
	Time	1600	1700	1730	1850	1945	
VAPOR INFLUENT	H-C ppmv	20,490	17,120	23,950	23,630	21,370	
	C-O %	.07	.06	.07	.07	.06	
	CO_2 %	6.24	5.20	5.95	5.81	5.60	
SAVE EMISSIONS	H-C ppmv		20				
	C-O %		.03				
	CO_2 %		3.22				
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/3/93 TEST NO. 1

1530	Recorded Data - All S.A.V.E functions normal - Outer wells
	indicating increased vacuum x 5-36B.
	NOTE: Observation wells 5-36E and 5-37I are
	reported to be screened below the groundwater level
	and eratic data may occur during SVE testing
1600	HORIBA Data: Note increase in volume % of CO_2.
1630	Recorded Data - All system functions normal
1645	Adjusted for slight increase in RW vacuum and flow
1730	Recorded Operating and HORIBA Data
1830	Recorded Data - System will not consume any higher
	RW vapors. Fresh air flow must remain 30-35 cfm to
	provide proper air/fuel ratio. System can consume much
	higher fuel concentrations, therefore well vapors probably have low O_2.
	NOTE Well 5-37I has changed from .90" H_2O vac. to 1.2" H_2O pressure
1930	Recorded Operating & HORIBA Data - All outer wells
	indicating continued increased vacuum
1945	HORIBA Data - HC down slightly
2030	Recorded Data - SAVE System functions normal.

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AcuVac Remediation

OPERATING DATA - TEST NO 1

S.A.V.E.™ SYSTEM

Page 3 Location ENRON CORPORTION TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M. Project Engr. J. SADLER

		Date	11/3/93	→	→	11/4/93	→	→
	Parameter	Time	2130	2230	2330	0030	0130	0230
		Hr. Meter	545.5	546.5	547.5	548.5	549.5	550.5
ENGINE	R.P.M.		2700	2700	2800	2700	2700	2700
	Oil Press	P.S.I.	50	50	50	50	50	50
	Water Temp	°F	185	185	185	185	185	185
	Volts		13.5	13.5	13.5	13.5	13.5	13.5
	Intake Vac	Hg	5	5	5	5	5	5
FUEL/AIR	Gas Flow Fuel/Propane	cfh	95	95	95	95	95	95
	Air Flow	cfm	34	34	34	34	34	34
	Well Flow 5-35B	cfm	21	21	21	22	22	22
	Recovery Well Vac 5-35B	"H_2O	27	27	27	27	27	27
	Air Temp	°F	37	37	36	36	36	35
	Barometric Pressure	"Hg						
MONITOR WELL VACUUM	5-36E	"H_2O	.06	.08	.10	.12	.12	.10
	5-37I	"H_2O	(.70)	(.70)	(.75)	(.80	(.80)	(.60)
	5-34B	"H_2O	.83	.85	.86	.88	.90	.90
	5-4B	"H_2O	.62	.60	.58	.60	.62	.60
	5-22B	"H_2O	.18	.18	.16	.14	.15	.15
	5-2B	"H_2O	(.24)	(.30)	(.32)	(.38)	(.38)	(.34)
	5-5B	"H_2O	.12	.12	.14	.14	.15	.14
		"H_2O						
		"H_2O						
		"H_2O			( ) INDICATES WELL PRESSURE			
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	Vapor Wells	On/Off	ON	ON	ON	ON	ON	ON
	Groundwater Wells	On/Off	OFF	→	→	→	→	→
	Discharge Flow Meter	gals	OFF	→	→	→	→	→
	Samples		HORIBA INFLUENT		HORIBA INFLUENT			HORIBA INFLUENT

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TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Time	2140	2345	0245			
VAPOR INFLUENT	H-C ppmv	22,130	21,870	23,110			
	C-O %	.06	.06	.07			
	CO_2 %	5.78	5.64	6.08			
SAVE EMISSIONS	H-C ppmv						
	C-O %						
	CO_2 %						
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/3-4/93 TEST NO. 1

2130	Recorded Data - All S.A.V.E. System functions normal - Outer well vacuum steady.
2140	HORIBA DATA - HC in 20,000 ppm range throughout test
2230	Recorded Data - All steady
2245	Increased well vacuum slightly, but well vapors at maximum flow, requiring high propane and fresh air flow to provide 120 to 140 thousand BTU/HR.
2330	Recorded Data - All systems normal - NOTE Very windy chill factor low - blowing sand.
2345	HORIBA Data - -
0030	THURSDAY 11/4/93 - Recorded Data - All systems normal Checked calibration of magnehelic gages - Minor adjustments for temperature.
0130	Recorded Data - All steady - Slight variance in outer wells vacuum
0230	Recorded Data - Outer wells vacuum off slightly All system functions normal - Switched to full propane tanks.

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AcuVac Remediation

OPERATING DATA - TEST NO 1

S.A.V.E.™ SYSTEM

Page 4 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M. Project Engr. J. SADLER

	Date	11/4/93	→	→	→	→	→
	Parameter	Time 0330 Hr. Meter 551.5	Time 0930 Hr. Meter 552.5	Time 0530 Hr. Meter 553.5	Time 0630 Hr. Meter 554.5	Time 0730 Hr. Meter 555.5	Time 0830 Hr. Meter 556.5
ENGINE	R.P.M.	2700	2700	2700	2700	2700	2700
ENGINE	Oil Press P.S.I.	50	50	50	50	50	50
ENGINE	Water Temp °F	185	185	185	185	185	185
ENGINE	Volts	13.5	13.5	13.5	13.5	13.5	13.5
ENGINE	Intake Vac Hg	5	5	5	5	5	6
FUEL/AIR	Gas Flow Fuel/Propane cfh	95	90	90	95	95	95
FUEL/AIR	Air Flow cfm	34	32	33	34	32	32
FUEL/AIR	Well Flow 5-35B cfm	21	22	22	22	26	27
FUEL/AIR	Recovery Well Vac 5-35B "H_2O	27	27	27	27	28	28
	Air Temp °F	34	33	32	34	35	36
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-36E "H_2O	.07	.08	.10	.10	.12	.08
MONITOR WELL VACUUM	5-37I "H_2O	(.60)	(.50)	(.50)	(.50)	(.50)	(.60)
MONITOR WELL VACUUM	5-34B "H_2O	.90	.90	.92	.95	.98	.97
MONITOR WELL VACUUM	5-4B "H_2O	.64	.66	.66	.67	.70	.74
MONITOR WELL VACUUM	5-22B "H_2O	.15	.16	.18	.20	.27	.24
MONITOR WELL VACUUM	5-2B "H_2O	(.32)	(.30)	(.24)	(.20)	(.14)	(.18)
MONITOR WELL VACUUM	5-5B "H_2O	.12	.10	.12	.15	.15	.15
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O			( ) INDICATES WELL PRESSURE			
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON	ON	ON	ON
MANIFOLD	Groundwater Wells On/Off	OFF	→	→	→	→	→
MANIFOLD	Discharge Flow Meter gals	OFF	→	→	→	→	→
	Samples		HORIBA INFLUENT		HORIBA INFLUENT	HORIBA INFLUENT	

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TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Time	0450	0700	0745			
VAPOR INFLUENT	H-C ppmv	22,570	21,960	21,200			
	C-O %	.06	.06	.05			
	CO_2 %	5.94	6.02	6.84			
SAVE EMISSIONS	H-C ppmv						
	C-O %						
	CO_2 %						
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/4/93 TEST NO. 1

0330	Recorded Data - All systems normal - Outer wells steady
0430	Recorded Data - No major changes - HORIBA Data
0530	Recorded Data - All SAVE System functions normal
	Very windy and cold
0630	Recorded Data - All functions normal
0700	HORIBA DATA - CO_2 continuing to increase
0710	Increased well flow to 27 cfm and well vacuum to 28" H_2O
0730	Recorded Data - Outer wells responding to RW
	vacuum and flow increase.
0745	SAVE engine experiences roughness - HORIBA Data
	indicates CO_2 increased to 6.84% - Probable
	reason is that increased vacuum and flow opened
	new zones - Also, natural and induced bio-remediation
	produces CO_2.
0830	Recorded Data - All steady - Engine still little
	rough - Adjusted propane and air flow slightly

AcuVac Remediation

OPERATING DATA - TEST NO 1

S.A.V.E.™ SYSTEM

Page 5 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M. Project Engr. J. SADLER

	Date	11/4/93	→	→	→		
	Parameter	Time 0930 Hr. Meter 557.5	Time 1030 Hr. Meter 558.5	Time 1130 Hr. Meter 559.5	Time STOP 1235 Hr. Meter 560.6	Time Hr. Meter	Time Hr. Meter
ENGINE	R.P.M.	2800	2700	2700	2700		
ENGINE	Oil Press P.S.I.	50	50	50	50		
ENGINE	Water Temp °F	190	190	190	190		
ENGINE	Volts	13.5	13.5	13.5	13.5		
ENGINE	Intake Vac Hg	5	5	5	5		
FUEL/AIR	Gas Flow Fuel/Propane cfh	95	95	95	95		
FUEL/AIR	Air Flow cfm	33	34	34	34		
FUEL/AIR	Well Flow 5-35 B cfm	29	29	30	30		
FUEL/AIR	Recovery Well Vac 5-35 B "H_2O	29	29	30	31		
	Air Temp °F	39	44	48	54		
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-36 E "H_2O	.05	.05	.05	(.20)		
MONITOR WELL VACUUM	5-37 I "H_2O	(.6)	(.65)	(.88)	(1.1)		
MONITOR WELL VACUUM	5-34 B "H_2O	.98	1.00	1.00	1.10		
MONITOR WELL VACUUM	5-4 B "H_2O	.68	.65	.72	.76		
MONITOR WELL VACUUM	5-22 B "H_2O	.17	.18	.24	.26		
MONITOR WELL VACUUM	5-2 B "H_2O	(.22)	(.24)	(.30)	(.50)		
MONITOR WELL VACUUM	5-5 B "H_2O	.08	.10	.14	.15		
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O		( )	INDICATES	WELL PRESSURE		
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON	ON		
MANIFOLD	Groundwater Wells On/Off	OFF	→	→	→		
MANIFOLD	Discharge Flow Meter gals	OFF	→	→			
	Samples	HORIBA INFLUENT	HORIBA INFLUENT AND EMISSIONS	HORIBA INFLUENT	HORIBA INFLUENT		

933107)

TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA		
	Time	0945	1100	1155	1230		
VAPOR INFLUENT	H-C ppmv	20,398	21,394	22,470	21,860		
	C-O %	.06	.07	.07	.06		
	CO_2 %	5.74	6.10	6.23	6.25		
SAVE EMISSIONS	H-C ppmv		36				
	C-O %		4.85				
	CO_2 %		.04				
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/4/93 TEST NO. 1

0930	Recorded Data - All SAVE Systems normal
	Well flow at maximum - Calculation from
	Flow Sensor data indicates well flow
	at 35 ACFM.
0945	HORIBA Data - Steady.
1030	Recorded Data - All systems normal.
	Wind estimated steady 25 mph, gusts 30 mph +
	Blowing sand
1100	HORIBA Data - Influent & Emissions
1130	Recorded Data - RW vacuum and flow up to 30
	Increase vacuum in outer wells
1155	HORIBA DATA — Slight inc in CO_2 - Lab samples
1230	HORIBA DATA - Final sample - Lab samples
1235	Recorded Data - Final data - Test completed
	Recovery well groundwater 50.86
	Increase in groundwater .89'
	Total Test Time - 24.1 hours

AcuVac Remediation

OPERATING DATA - TEST NO 2

S.A.V.E.™ SYSTEM

Page 1 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA # 5 THOREAU N.M Project Engr. J. SADLER

	Date	11/4/93	→	→	→	→	
	Parameter	Time START 1315 / Hr. Meter 560.7	Time 1415 / Hr. Meter 561.7	Time 1515 / Hr. Meter 562.7	Time 1615 / Hr. Meter 563.8	Time STOP 1627 / Hr. Meter 563.9	Time / Hr. Meter
ENGINE	R.P.M.	2700	2700	2700	2700		
	Oil Press P.S.I.	50	50	50	50		
	Water Temp °F	190	190	190	190		
	Volts	13.5	13.5	13.5	13.5		
	Intake Vac Hg	5	5	5	5		
FUEL/AIR	Gas Flow Fuel/Propane cfh	90	75	80	75		
	Air Flow cfm	34	34	34	34		
	Well Flow 5-34B cfm	20	20	21	22		
	Recovery Well Vac 5-34B "H_2O	5.6	6.0	6.0	6.2		
	Air Temp °F	56	57	56	54		
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-35B "H_2O	.68	.80	.80	.85		
	5-36E "H_2O	(.56)	(.54)	(.36)	(.12)		
	5-37I "H_2O	(1.7)	(1.5)	(1.4)	(1.2)		
	5-4B "H_2O	.26	.46	.48	.52		
	5-22B "H_2O	.02	.12	.16	.20		
	5-2B "H_2O	(.58)	(.66)	(.50)	(.36)		
	5-5B "H_2O	0	.10	.14	.18		
	"H_2O						
	"H_2O						
	"H_2O			( ) INDICATES WELL PRESSURE			
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON	ON	OFF	
	Groundwater Wells On/Off	OFF	→	→	→	→	
	Discharge Flow Meter gals	OFF	→	→	→		
	Samples	HORIBA INFLUENT	HORIBA INFLUENT EMISSIONS	HORIBA INFLUENT	HORIBA INFLUENT		

933107)

TEST							
	Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
	Time	1340	1425	1435	1500	1540	1615
VAPOR INFLUENT	H-C ppmv	33,180	28,770		32,590	30,198	31,670
	C-O %	.07	.07		.06	.06	.07
	CO_2 %	6.51	5.82		6.43	5.80	6.12
SAVE EMISSIONS	H-C ppmv			46			
	C-O %			.04			
	CO_2 %			3.87			
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/9/93 TEST NO. 2

1250	Positioned SAVE System near well 5-34B for recovery well (RW)
	4" well screened from 34' to 64 ft bgs - H_2O @ 47.68
	Interface probe indicated PSH sheen on groundwater
1315	START TEST - Recorded Data - Initial RW vac. @ 5.6" H_2O and
	flow @ 20 cfm - Propane @ 90 cfh - Initial vac. reading - 3 wells
1340	HORIBA Data - with propane flow @ 75 to 80 cfh, HC
	level in ppmv expected to be 30,000 ppm +
1415	Recorded Data - All SAVE functions normal - Good vacuum
	response on outer wells & pressure wells.
	NOTE - Outer wells 5-36E & 5-37I are reported to be screened
	below groundwater level and erratic data may occur during SVE
1425	HORIBA INFLUENT Data - 1435 HORIBA Emissions Data
1500	HORIBA " Data - HC values steady within range
1515	Recorded Operating Data - System functions normal - Outer wells
	indicating good response to steady vacuum and flow
1540	HORIBA Influent Data
1615	Recorded Operating and HORIBA Data - RW vac & flow up
1627	STOP TEST - H_2O level 47.38 - Increase 0.30' - Good Test

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AcuVac Remediation

OPERATING DATA - TEST NO 3

S.A.V.E.™ SYSTEM

Page 1 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA #5 THOREAU NM Project Engr. J. SADLER

	Date	11/5/93	→	→	→		
	Parameter	Time WARMUP 0730	Time START 0755	Time 0855	Time STOP 1000	Time	Time
		Hr. Meter 564.0	Hr. Meter 564.5	Hr. Meter 565.5	Hr. Meter 566.6	Hr. Meter	Hr. Meter
ENGINE	R.P.M.	1500	2500	2750	2700		
	Oil Press P.S.I.	60	55	50	50		
	Water Temp °F	120	180	190	190		
	Volts	13.5	13.5	13.5	13.5		
	Intake Vac Hg	4	11	7	7		
FUEL/AIR	Gas Flow Fuel/Propane cfh	60	115	115	115		
	Air Flow cfm	20	27	23	24		
	Well Flow 5-4B cfm	OFF	20	22	23		
	Recovery Well Vac 5-4B "H_2O	OFF	42	42	43		
	Air Temp °F	33	34	36	39		
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-35B "H_2O	.05	.38	.46	.52		
	5-36E "H_2O	.40	(.60)	(.60)	(.64)		
	5-37I "H_2O	.40	(.40)	(.44)	(.40)		
	5-34B "H_2O	.05	.22	.28	.34		
	5-22B "H_2O	.10	.14	.19	.24		
	5-2B "H_2O	(.2)	(.06)	(.04)	(.02)		
	5-5B "H_2O	.07	.04	.20	.26		
	"H_2O	INITIAL OUTER WELL DATA PRIOR TO RW VACUUM & FLOW					
	"H_2O						
	"H_2O						
	"H_2O			( ) INDICATES WELL PRESSURE			
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	Vapor Wells On/Off	OFF	ON	ON	ON		
	Groundwater Wells On/Off	OFF	→	→	→		
	Discharge Flow Meter gals	OFF	→	→	→		
	Samples		HORIBA INFLUENT	HORIBA INFLUENT & EMISSIONS	HORIBA INFLUENT		

933107)

TEST	Instrument	HORIBA	HORIBA	HORIBA	HORIBA		
	Time	0810	0905	0920	0955		
VAPOR INFLUENT	H-C ppmv	898	1178		1205		
	C-O %	.03	.02		.02		
	CO_2 %	3.94	3.44		3.50		
SAVE EMISSIONS	H-C ppmv			34			
	C-O %			00			
	CO_2 %			2.74			
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/5/93 TEST NO. 3

0700	Arrived at location - positioned SAVE near well 5-4B as
	recovery well (RW) - 2" well along fence line - Screened
	from 38.7 to 58.7 ft bgs and water depth @ 46.12'
0715	Set up SAVE System and plug outer wells for magnehlic gages
0730	SAVE System warm up - All systems normal - Recorded static well data
	NOTE Outer wells 5-36E & 5-37I are reported to be screened
	below groundwater level and erratic data may occur during SVE tests
0755	START TEST - Recorded Initial Data - RW flow @ 20 cfm, vac @ 42" H_2O
	Good vacuum response on outer wells 5-35B and 5-34B
	Note: Wells 5-36E and 5-37I changed from vacuum to pressure
0810	HORIBA DATA - HC low - very little BTU value
0830	Increased RW flow to 22 cfm and vacuum to 43" H_2O
0855	Recorded Data - All systems normal - Good response on outer wells
0905	HORIBA Data - Little change in HC - 0920 HORIBA EMISSION DATA
0955	HORIBA Influent Data - HC low - Propane near max @ 115 cfh
1000	Recorded Data - All systems normal - Continued good response
	on outer wells 5-35B, 5-34B & 5-5B
1005	TEST COMPLETED - H_2O @ 45.05 - Increase during test - 1.07'

AcuVac Remediation

OPERATING DATA - TEST NO 4

S.A.V.E.™ SYSTEM

ENRON CORPORATION

Page 1 Location TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M. Project Engr.

	Parameter						
	Date	11/5/93	→	→			
		Time START 1015	Time 1115	Time STOP 1225	Time	Time	Time
		Hr. Meter 566.9	Hr. Meter 567.9	Hr. Meter 569.0	Hr. Meter	Hr. Meter	Hr. Meter
ENGINE	R.P.M.	2500	2500	2500			
ENGINE	Oil Press P.S.I.	50	50	50			
ENGINE	Water Temp °F	190	190	190			
ENGINE	Volts	13.5	13.5	13.5			
ENGINE	Intake Vac Hg	11	11	11			
FUEL/AIR	Gas Flow Fuel/Propane cfh	115	115	115			
FUEL/AIR	Air Flow cfm	12	14	14			
FUEL/AIR	Well Flow 5-5B cfm	20	18	18			
FUEL/AIR	Recovery Well Vac 5-5B "H_2O	82	60	60			
	Air Temp °F	40	43	47			
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-35B "H_2O	.05	.05	.05			
MONITOR WELL VACUUM	5-34B "H_2O	.07	.07	.05			
MONITOR WELL VACUUM	5-4B "H_2O	.14	.16	.18			
MONITOR WELL VACUUM	5-22B "H_2O	.14	.14	.16			
MONITOR WELL VACUUM	5-2B "H_2O	(.02)	.05	.05			
MONITOR WELL VACUUM	5-1B "H_2O	(.22)	(.04)	.05			
MONITOR WELL VACUUM	5-6B "H_2O	(.10)	(.05)	.08			
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O			( ) INDICATES WELL PRESSURE			
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON			
MANIFOLD	Groundwater Wells On/Off	OFF	→	→			
MANIFOLD	Discharge Flow Meter gals	OFF	→	→			
	Samples	HORIBA INFLUENT	HORIBA INFLUENT	HORIBA INFLUENT			

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TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Time	1040	1120	1225			
VAPOR INFLUENT	H-C ppmv	56	64	22			
	C-O %	00	00	00			
	CO_2 %	2.16	1.96	2.12			
SAVE EMISSIONS	H-C ppmv						
	C-O %						
	CO_2 %						
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/5/93 TEST NO. 4

1010	Moved SAVE to well 5-5B as (RW) recovery well
	2" well screened from 39.5 to 58' bgs, H_2O @ 45.0'
1015	START TEST - Recorded Data - Initial vacuum @ 82" H_2O, flow
	@ 20 cfm - Held vacuum below 100" H_2O to encourage flow.
	Dropped wells 5-36E and 5-37I - Good initial vac. response
1030	RW vacuum @ 130" H_2O - Surging - Probably ground water
	rising above upper screened area.
1035	Reduced RW vacuum to 20" H_2O and increased to 60" H_2O @ 1040
1045	HORIBA Data - HC very low - No engine fuel value
1050	Vacuum increased to 90" H_2O - Reduced flow to 18 cfm and
	reset RW vacuum @ 60" H_2O - Propane @ max.
1115	Recorded Data - All systems normal - Not much vacuum
	response on outer wells - Well vac. holding @ 60" H_2O
1120	HORIBA Data - HC low
1225	Recorded Data - All systems normal - Limited response
	on outer wells
1227	HORIBA DATA - HC lower
1230	TEST COMPLETED - H_2O level @ 44.05 - H_2O level inc. 0.95'

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AcuVac Remediation

OPERATING DATA - TEST NO 5

S.A.V.E.™ SYSTEM

Page 1 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA #5 THOREAU N.M. Project Engr. J. SADLER

	Date	11/5/93	→	→			
	Parameter	Time START 1245 / Hr. Meter 569.3	Time 1250 / Hr. Meter 569.4	Time STOP 1255 / Hr. Meter 569.5	Time / Hr. Meter	Time / Hr. Meter	Time / Hr. Meter
ENGINE	R.P.M.	2600	2700	2700			
ENGINE	Oil Press P.S.I.	50	–	–			
ENGINE	Water Temp °F	190	–	–			
ENGINE	Volts	13.5	–	–			
ENGINE	Intake Vac Hg	16	–	–			
FUEL/AIR	Gas Flow Fuel/Propane cfh	115	115	115			
FUEL/AIR	Air Flow cfm	15	15	16			
FUEL/AIR	Well Flow 5-2B cfm	0	0	0			
FUEL/AIR	Recovery Well Vac 5-2B "H_2O	250	280	285			
	Air Temp °F	48	49	49			
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-35B "H_2O	NO WELL FLOW – NO TEST					
MONITOR WELL VACUUM	5-34B "H_2O						
MONITOR WELL VACUUM	5-4B "H_2O						
MONITOR WELL VACUUM	5-22B "H_2O						
MONITOR WELL VACUUM	5-5B "H_2O						
MONITOR WELL VACUUM	5-1B "H_2O						
MONITOR WELL VACUUM	5-6B "H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MONITOR WELL VACUUM	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON			
MANIFOLD	Groundwater Wells On/Off	OFF	→	→			
MANIFOLD	Discharge Flow Meter gals	OFF	→	→			
	Samples						

(933107)

TEST	Instrument						
	Time						
VAPOR INFLUENT	H-C ppmv						
	C-O %						
	CO_2 %						
SAVE EMISSIONS	H-C ppmv						
	C-O %						
	CO_2 %						
	Air/Fuel Ratio %						

OPERATING DATA AND NOTES

DATE 11/5/93 TEST NO. 5

1235	Positioned SAVE near well 5-2B as recovery well (RW)
	2" well - Screened from 37.5 to 52.5' bgs - H_2O @ 45.2'
1245	START TEST - RW vacuum immediately @ 250" H_2O
	Initial well flow was evacuation of vapors from
	RW; well flow then went to 0.
1250	RW vacuum @ 280" H_2O - No well flow.
1255	RW vacuum @ 285' H_2O - No well flow.
	Test was aborted - This well should not be
	used as a SVE recovery well

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AcuVac Remediation

OPERATING DATA - TEST NO 6

S.A.V.E.™ SYSTEM

Page 1 Location ENRON CORPORATION TRANSWESTERN COMPRESSOR STA. #5 THOREAU N.M. Project Engr. J. SADLER

	Date	11/5/93	→	→	→		
	Parameter	Time START 1305 / Hr. Meter 569.7	Time 1405 / Hr. Meter 570.7	Time STOP 1420 / Hr. Meter 570.9	Time SHUT OFF 1425 / Hr. Meter 571.0	Time / Hr. Meter	Time / Hr. Meter
ENGINE	R.P.M.	2500	2600	2600			
	Oil Press P.S.I.	50	50	50			
	Water Temp °F	190	190	190			
	Volts	13.5	13.5	13.5			
	Intake Vac Hg	13	13	13			
FUEL/AIR	Gas Flow Fuel/Propane cfh	115	115	115			
	Air Flow cfm	18	18	20			
	Well Flow 5-6B cfm	4	8	9			
	Recovery Well Vac 5-6B "H_2O	92	95	96			
	Air Temp °F	49	49	50			
	Barometric Pressure "Hg						
MONITOR WELL VACUUM	5-1B "H_2O	0	.18	.20			
	5-5B "H_2O	.04	.15	.18			
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	Vapor Wells On/Off	ON	ON	ON			
	Groundwater Wells On/Off	OFF	→	→			
	Discharge Flow Meter gals	OFF	→	→			
	Samples						

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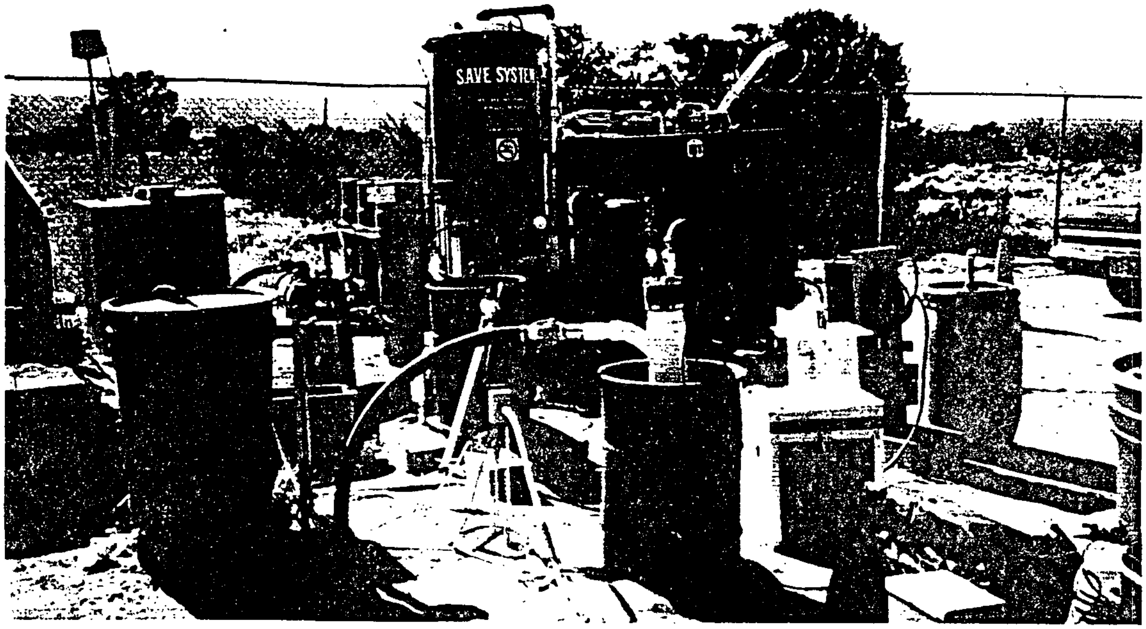
TEST	Instrument	HORIBA	HORIBA				
	Time	1320	1405				
VAPOR INFLUENT	H-C ppmv	20	108				
	C-O %	00	00				
	CO_2 %	.84	1.45				
SAVE EMISSIONS	H-C ppmv						
	C-O %						
	CO_2 %						
	Air/Fuel Ratio %						

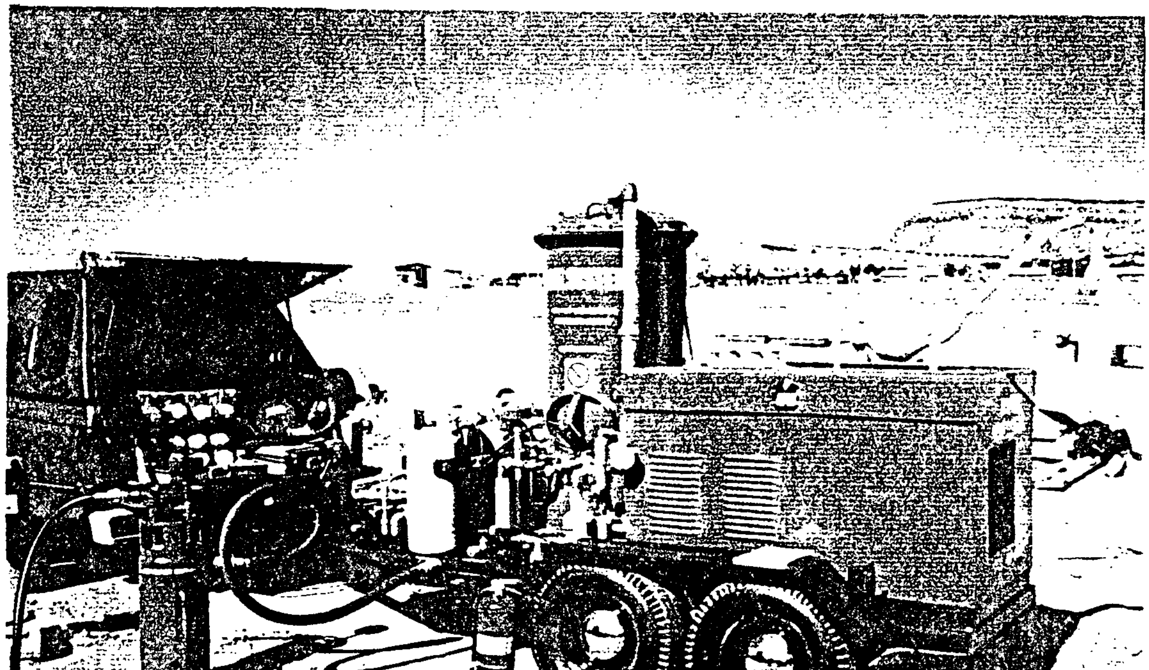
OPERATING DATA AND NOTES

DATE 11/5/93 TEST NO. 6

1300	Moved SAVE near well 5-6B as recovery well (RW)
	2" well - Reported screened from 38.7 to 58.7 ft bgs
	Groundwater level @ 42.00'
1305	START TEST - Recorded Data - Initial RW flow @ 4 cfm
	and vacuum at 92" H_2O - Propane @ 115 cfh
1320	HORIBA Data - HC very low - well almost clean
1405	Recorded Data - All SAVE System functions normal
1410	HORIBA Data - HC slighty higher
1420	Recorded Data - Outer wells indicating vacuum response
	H_2O level @ 40.58 - Increase 1.42'
	TEST COMPLETED
1445	Cleaned and loaded all equipment -
1500	Reviewed test data
1545	Departed location

ENRON CORPORATION, TRANSWESTERN COMPRESSOR STATION #5





Emissions Calculations

Computation of Maximum Uncontrolled Emissions for Soil Vapor Extraction
Thoreau Compressor Station
Well 5-34B

1. Maximum anticipated soil gas concentrations (from pilot test gas analysis [Core Laboratories]):

Benzene:	192 ppmv
Toluene:	969 ppmv
Ethylbenzene:	96 ppmv
Xylene:	552 ppmv
NMHC*:	20,000 ppmv

Convert concentrations from ppmv to µg/L

$$C_{(\mu g/L)} = C_{ppmv}\ x\ \frac{M_W\ x\ P}{R\ x\ T}$$

where C_{ppmv} = concentration of vapor in parts per million
M_W = Molecular weight of compound of interest (gm/mole)
P = Atmospheric pressure (atm) (assumed to be 0.83 atm)
R = Gas constant (0.08205 L-atm/degree-mole)
T = Temperature (K) (assumed to be 293 K)

$$C_{benzene\ (\mu g/L)} = 192\ ppmv\ x\ \frac{78.1\ gm/mole\ x\ 0.83\ atm}{0.08205\ L\text{-}atm/K\text{-}mole\ x\ 293\ K} = 518\ \mu g/L$$

$$C_{toluene\ (\mu g/L)} = 969\ ppmv\ x\ \frac{92.1\ gm/mole\ x\ 0.83\ atm}{0.08205\ L\text{-}atm/K\text{-}mole\ 293\ K} = 3081\ \mu g/L$$

$$C_{ethylbenzene\ (\mu g/L)} = 96\ ppmv\ x\ \frac{106.2\ gm/mole\ x\ 0.83\ atm}{0.08205\ L\text{-}atm/K\text{-}mole\ x\ 293\ K} = 352\ \mu g/L$$

$$C_{xylene\ (\mu g/L)} = 552\ ppmv\ x\ \frac{106.2\ gm/mole\ x\ 0.83\ atm}{0.08205\ L\text{-}atm/K\text{-}mole\ x\ 293\ K} = 2024\ \mu g/L$$

$$C_{NMHC\ (\mu g/L)} = 20{,}000\ ppmv\ x\ \frac{102\ gm/mole\ x\ 0.83\ atm}{0.08205\ L\text{-}atm/K\text{-}mole\ x\ 293\ K} = 70{,}430\ \mu g/L$$

* NMHC = Non-methane hydrocarbons

2. Compute emission rates for 22-cfm flow rate:

$$M_i = C_i \times Q$$

where M_i = the emission rate of the ith compound
C_i= the concentration of the ith compound (C_i in µg/L = C_i in mg/m^3)
Q = the process flow rate (22 ft^3/min, based on SVE pilot test)

$$C_i \left(\frac{mg}{m^3}\right) x \frac{1\,kg}{1{,}000{,}000\ mg}\ x\ \frac{2.2\,lb}{kg}\ x\ \frac{m^3}{35.3\ ft^3} = C_i\ (lb/ft^3)$$

or

$$C_i\ (lb/ft^3) = 6.23\ x\ 10^{-8}\ C_i\ (mg/m^3)$$

Emission rates are thus calculated as

$M_{benzene}$ = 518 x (6.23 x 10^{-8}) x 22 ft^3/min x 60 min/hr = 0.04 lb/hr

$M_{toluene}$ = 3081 x (6.23 x 10^{-8}) x 22 ft^3/min x 60 min/hr = 0.25 lb/hr

$M_{ethylbenzene}$ = 352 x (6.23 x 10^{-8}) x 22 ft^3/min x 60 min/hr = 0.03 lb/hr

M_{xylene} = 2024 x (6.23 x 10^{-8}) x 22 ft^3/min x 60 min/hr = 0.17 lb/hr

M_{NMHC} = 70,430 x (6.23 x 10^{-8}) x 22 ft^3/min x 60 min/hr = 5.80 lb/hr

Field and Laboratory Chemical Analyses

BTEX Vapor Concentrations Measured with the Hand-Held Gas Chromatograph Thoreau SVE Pilot Tests

Well No.	Date	Time	Concentration (ppmv)				
			Benzene	Toluene	Ethyl-benzene	M-Xylene	O-Xylene
5-35B	11/03/93	1312	<0.1	>200	<5.0	69.5	19.8
		1332	<0.1	>200	<5.0	71.2	21.3
		1445	<0.1	>200	<5.0	62.4	14.7
		1530	<0.1	>200	<5.0	70.7	21.3
		1825	<0.1	>200	<5.0	70.9	18.4
	11/04/93	0840	<0.1	>200	<5.0	47.5	12.2
		0945	<0.1	>200	<5.0	64.2	15.2
		1055	<0.1	>200	<5.0	80.3	22.3
		1150	<0.1	>200	<5.0	79.2	17.6
		1230	<0.1	>200	<5.0	89.2	27.0
5-34B	11/04/93	1400	<0.1	>200	<5.0	106	20.6
		1455	<0.1	>200	<5.0	92.3	19.9
		1535	<0.1	>200	<5.0	141	33.9
		1610	<0.1	>200	<5.0	87.2	18.9
5-04B	11/05/93	0905	<0.1	90.5	<5.0	39.0	12.9
		0950	<0.1	59.1	<5.0	32.9	11.7
5-05B	11/05/93	1050	<0.1	56.0	<5.0	28.0	7.5
		1150	<0.1	15.3	<5.0	5.5	<5.0
		1215	<0.1	<5.0	<5.0	<5.0	<5.0
5-06B	11/05/93	1318	<0.1	17.1	<5.0	9.1	<5.0
		1410	<0.1	14.3	<5.0	7.3	<5.0

Note: Concentrations may not be accurate, as indicated by comparison with laboratory results.

Hall Environmental
Analysis Laboratory

Hall Environmental Analysis Laboratory
2403 San Mateo N.E., Suite P-13
Albuquerque, N.M. 87110
(505) 880-1803

11/10/93

Daniel B. Stephens and Associates, Inc.
6020 Academy NE, Suite 100
Albuquerque, NM 87109

Dear Mr. Bob Marley:

Enclosed are the results for the analyses that were requested. These were done according to E.P.A. procedures or the equivalent.

Please don't hesitate to contact me for any additional information or clarifications.

Sincerely,

Scott Hallenbeck 11/10/93

Scott Hallenbeck, Lab Manager

Project: Enron-Thoreau

Results for sample : 5-35B (See date collected)

Date collected: 11/3/93 Date received: 11/5/93
Date extracted: NA Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.
Project Name: Enron-Thoreau HEAL #: 931119-1
Project Manager: Bob Marley Sampled by: B. Marley
Matrix: Air

Method: EPA 602

Compound	Amount	Units
Benzene	74	UG/L
Toluene	480	UG/L
Ethylbenzene	18	UG/L
Total-Xylene	150	UG/L

BFB (Surrogate) Recovery = 99 %

Dilution Factor = 100

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	52,000	UG/L

BFB (Surrogate) Recovery = 104 %

Dilution Factor = 100

Results for sample : 5-35B (See date collected)

Date collected: 11/4/93 Date received: 11/5/93
Date extracted: NA Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.
Project Name: Enron-Thoreau HEAL #: 931119-2
Project Manager: Bob Marley Sampled by: B. Marley
Matrix: Air

Method: EPA 602

Compound	Amount	Units
Benzene	67	UG/L
Toluene	450	UG/L
Ethylbenzene	21	UG/L
Total-Xylene	190	UG/L

BFB (Surrogate) Recovery = 100 %

Dilution Factor = 100

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	53,000	UG/L

BFB (Surrogate) Recovery = 108 %

Dilution Factor = 100

Results for sample : 5-34B

Date collected: 11/4/93	Date received: 11/5/93
Date extracted: NA	Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.	
Project Name: Enron-Thoreau	HEAL #: 931119-3
Project Manager: Bob Marley	Sampled by: B. Marley
Matrix: Air	

Method: EPA 602

Compound	Amount	Units
Benzene	200	UG/L
Toluene	580	UG/L
Ethylbenzene	19	UG/L
Total-Xylene	160	UG/L

BFB (Surrogate) Recovery = 104 %

Dilution Factor = 50

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	51,000	UG/L

BFB (Surrogate) Recovery = 100 %

Dilution Factor = 100

Results for sample : 5-4B

Date collected: 11/5/93 Date received: 11/5/93
Date extracted: NA Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.
Project Name: Enron-Thoreau HEAL #: 931119-4
Project Manager: Bob Marley Sampled by: B. Marley
Matrix: Air

Method: EPA 602

Compound	Amount	Units
Benzene	4.8	UG/L
Toluene	44	UG/L
Ethylbenzene	6.2	UG/L
Total-Xylene	38	UG/L

BFB (Surrogate) Recovery = 102 %

Dilution Factor = 25

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	6,800	UG/L

BFB (Surrogate) Recovery = 119 %

Dilution Factor = 25

Results for sample : 5-5B

Date collected: 11/5/93	Date received: 11/5/93
Date extracted: NA	Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.	
Project Name: Enron-Thoreau	HEAL #: 931119-5
Project Manager: Bob Marley	Sampled by: B. Marley
Matrix: Air	

Method: EPA 602

Compound	Amount	Units
Benzene	0.39	UG/L
Toluene	6.0	UG/L
Ethylbenzene	0.68	UG/L
Total-Xylene	6.6	UG/L

BFB (Surrogate) Recovery = 105 %

Dilution Factor = 2

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	210	UG/L

BFB (Surrogate) Recovery = * %

Dilution Factor = 2

* Indicates surrogate recovery indeterminate due to matrix effects.

Results for QC: Air Blank

Date extracted: NA Date injected: 11/8/93
Client: Daniel B. Stephens and Associates, Inc.
Project Name: Enron-Thoreau HEAL #: RB 11/8
Project Manager: Bob Marley
Matrix: Air

Method: EPA 602

Compound	Amount	Units
Benzene	<0.05	UG/L
Toluene	<0.05	UG/L
Ethylbenzene	<0.05	UG/L
Total-Xylene	<0.05	UG/L

BFB (Surrogate) Recovery = 99 %

Method: EPA 8015 Modified

Compound	Amount	Units
Gasoline	<10	UG/L

BFB (Surrogate) Recovery = 95 %

Results for QC: Matrix Spike/Matrix Spike Dup
Blank Spike/Blank Spike Dup

Date extracted: NA | Date injected: 11/5,8/93
Client: Daniel B. Stephens and Associates, Inc.
Project Name: Enron-Thoreau | HEAL #: BS/BSD 11/8
Project Manager: Bob Marley | 93112-1 11/5
Matrix: Air | Units: UG/L

Method: EPA 602

Compound	Sample Result	Amount Added	Matrix Spike	MS %	MS Dup	MSD %	RPD
Benzene	<0.05	2.00	2.03	102	2.07	104	2
Toluene	<0.05	2.00	2.08	104	2.12	106	2
Ethylbenzene	<0.05	2.00	2.04	102	2.09	105	2
Total Xylenes	<0.05	6.00	6.21	104	6.37	106	3

Method: EPA 8015

Compound	Sample Result	Amount Added	Blank Spike	BS %	BS Dup	BSD %	RPD
Gasoline	<10	50	51	96	54	102	6

CHAIN-OF-CUSTODY RECORD

HALL ENVIRONMENTAL ANALYSIS LABORATORY
2403 San Mateo NE, Suite P-13
Albuquerque, New Mexico 87110
505.880.1803

Client: Daniel B. Stephens & Assoc.

Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Phone #: 505 822 9400

Fax #: 505 822 8877

Project Name: Enron - Thoreau

Project #: 2105 2.2

Project Manager: Bob Marley

Sampler: Bob Marley

Samples Cold? ☐ Yes ~~☐ No~~

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative: HgCl2	Preservative: HCl	Preservative: Other	HEAL No.
11/3/93	1440	Air	5-35B	1L / 1600cc				931119-01
11/4/93	1230	Air	5-35B	1L				-02
11/4/93	1610	Air	5-34B	1L				-03
11/5/93	0950	Air	5-4B	1L				-04
11/5/93	1215	Air	5-5B	1L				-05

ANALYSIS REQUEST

HEAL No.	BTEX (Method 602/8020)	BTEX + MTBE (602/8020)	TPH Method 8015 MOD (Gas/Diesel)	BTEX + ~~MTBE~~ + TPH (Gasoline Only)	BTEX + MTBE + TPH (Gas + Diesel)	TPH (Method 418.1)	601/602 Volatiles	EDB (Method 504.1)	EDC	610 (PNA or PAH)	extended refinery Gasses		Air Bubbles or Headspace (Y or N)
931119-01				X							X		Y
-02				X							X		
-03				X							X		
-04				X							X		
-05				X							X		

Date:	Time:	Relinquished By: (Signature)	Received By: (Signature)
11/5/93	1745	Bob Marley	[signature]
11/5/93	1745	[signature]	

Remarks:

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A N A L Y T I C A L   R E P O R T

Job Number: 935571
Prepared For:

HALL ENVIRONMENTAL ANALYTICAL
**SCOTT HALLENBECK*
2403 SAN MATEO N E
ALBUQUERQUE, NM 87110

Date: 11/19/93

Signature: Larry Scott

Date: 11-19-93

Name: Larry Scott

Title: Laboratory Supervisor

CORE LABORATORIES
P O BOX 34766
HOUSTON, TX 77234-4282

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LABORATORY TESTS RESULTS
11/19/93

JOB NUMBER: 935571 CUSTOMER: HALL ENVIRONMENTAL ANALYTICAL ATTN: **SCOTT HALLENBECK*

CLIENT I.D........: 210522
DATE SAMPLED.......: 11/03/93
TIME SAMPLED.......: 14:40
WORK DESCRIPTION...: 5-35B

LABORATORY I.D...: 935571-0001
DATE RECEIVED....: 11/09/93
TIME RECEIVED....: 08:23
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Benzene, Toluene, Xylenes in Gas		*1			11/17/93	PKT
Benzene	30	1	ppm v/v			
Toluene	220	1	ppm v/v			
Ethyl Benzene	48	1	ppm v/v			
m+p-Xylenes	501	1	ppm v/v	GC		
ortho-Xylene	21	1	ppm v/v			
Refinery Gas Analysis, Extended		*1			11/17/93	PKT
Hydrogen	<0.01	0.01	Mol %	ASTM D-1945		
Oxygen	2.95	0.01	Mol %	ASTM D-1945		
Nitrogen	84.29	0.01	Mol %	ASTM D-1945		
Carbon Monoxide	<0.01	0.01	Mol %	ASTM D-1946		
Carbon Dioxide	11.55	0.01	Mol %	ASTM D-1945		
Hydrogen Sulfide	<0.01	0.01	Mol %			
Methane	<0.01	0.01	Mol %	ASTM D-1945		
Ethylene	<0.01	0.01	Mol %	ASTM D-1946		
Ethane	<0.01	0.01	Mol %	ASTM D-1945		
Propylene	<0.01	0.01	Mol %	ASTM D-2163		
Propane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutylene	<0.01	0.01	Mol %	ASTM D-2163		
1-Butene	<0.01	0.01	Mol %	ASTM D-2163		
n-Butane	<0.01	0.01	Mol %	ASTM D-1945		
trans-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
cis-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
Isopentane	<0.01	0.01	Mol %	ASTM D-2163		
n-Pentane	<0.01	0.01	Mol %	ASTM D-2163		
Hexanes	0.08	0.01	Mol %			
Heptanes	0.34	0.01	Mol %			
Octanes	0.33	0.01	Mol %			
Nonanes	0.06	0.01	Mol %			
Decanes	0.01	0.01	Mol %			
Undecanes	0	0	Mol %			
Dodecanes	0	0	Mol %			
Tridecanes	0	0	Mol %			
Tetradecanes Plus	0	0	Mol %			

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L A B O R A T O R Y   T E S T S   R E S U L T S
11/19/93

JOB NUMBER: 935571   CUSTOMER: HALL ENVIRONMENTAL ANALYTICAL   ATTN: **SCOTT HALLENBECK*

CLIENT I.D.........: 210522
DATE SAMPLED.......: 11/04/93
TIME SAMPLED.......: 12:30
WORK DESCRIPTION...: 5-35B

LABORATORY I.D...: 935571-0002
DATE RECEIVED....: 11/09/93
TIME RECEIVED....: 08:23
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Benzene, Toluene, Xylenes in Gas		*1			11/17/93	PKT
Benzene	38	1	ppm v/v			
Toluene	262	1	ppm v/v			
Ethyl Benzene	47	1	ppm v/v			
m+p-Xylenes	558	1	ppm v/v	GC		
ortho-Xylene	32	1	ppm v/v			
Refinery Gas Analysis, Extended		*1			11/17/93	PKT
Hydrogen	<0.01	0.01	Mol %	ASTM D-1945		
Oxygen	3.69	0.01	Mol %	ASTM D-1945		
Nitrogen	85.31	0.01	Mol %	ASTM D-1945		
Carbon Monoxide	<0.01	0.01	Mol %	ASTM D-1946		
Carbon Dioxide	9.85	0.01	Mol %	ASTM D-1945		
Hydrogen Sulfide	<0.01	0.01	Mol %			
Methane	<0.01	0.01	Mol %	ASTM D-1945		
Ethylene	<0.01	0.01	Mol %	ASTM D-1946		
Ethane	<0.01	0.01	Mol %	ASTM D-1945		
Propylene	<0.01	0.01	Mol %	ASTM D-2163		
Propane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutylene	<0.01	0.01	Mol %	ASTM D-2163		
1-Butene	<0.01	0.01	Mol %	ASTM D-2163		
n-Butane	<0.01	0.01	Mol %	ASTM D-1945		
trans-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
cis-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
Isopentane	<0.01	0.01	Mol %	ASTM D-2163		
n-Pentane	<0.01	0.01	Mol %	ASTM D-2163		
Hexanes	0.10	0.01	Mol %			
Heptanes	0.41	0.01	Mol %			
Octanes	0.38	0.01	Mol %			
Nonanes	0.07	0.01	Mol %			
Decanes	0.01	0.01	Mol %			
Undecanes	0.01	0	Mol %			
Dodecanes	0	0	Mol %			
Tridecanes	0	0	Mol %			
Tetradecanes Plus	0	0	Mol %			

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LABORATORY TESTS RESULTS
11/19/93

JOB NUMBER: 935571 CUSTOMER: HALL ENVIRONMENTAL ANALYTICAL ATTN: **SCOTT HALLENBECK*

CLIENT I.D.........: 210522
DATE SAMPLED.......: 11/04/93
TIME SAMPLED.......: 16:10
WORK DESCRIPTION...: 5-34B

LABORATORY I.D...: 935571-0003
DATE RECEIVED....: 11/09/93
TIME RECEIVED....: 08:23
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Benzene, Toluene, Xylenes in Gas		*1			11/17/93	PKT
Benzene	192	1	ppm v/v			
Toluene	969	1	ppm v/v			
Ethyl Benzene	96	1	ppm v/v			
m+p-Xylenes	435	1	ppm v/v	GC		
ortho-Xylene	117	1	ppm v/v			
Refinery Gas Analysis, Extended		*1			11/17/93	PKT
Hydrogen	<0.01	0.01	Mol %	ASTM D-1945		
Oxygen	1.56	0.01	Mol %	ASTM D-1945		
Nitrogen	81.39	0.01	Mol %	ASTM D-1945		
Carbon Monoxide	<0.01	0.01	Mol %	ASTM D-1946		
Carbon Dioxide	14.44	0.01	Mol %	ASTM D-1945		
Hydrogen Sulfide	<0.01	0.01	Mol %			
Methane	<0.01	0.01	Mol %	ASTM D-1945		
Ethylene	<0.01	0.01	Mol %	ASTM D-1946		
Ethane	<0.01	0.01	Mol %	ASTM D-1945		
Propylene	<0.01	0.01	Mol %	ASTM D-2163		
Propane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutylene	<0.01	0.01	Mol %	ASTM D-2163		
1-Butene	<0.01	0.01	Mol %	ASTM D-2163		
n-Butane	<0.01	0.01	Mol %	ASTM D-1945		
trans-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
cis-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
Isopentane	<0.01	0.01	Mol %	ASTM D-2163		
n-Pentane	<0.01	0.01	Mol %	ASTM D-2163		
Hexanes	0.42	0.01	Mol %			
Heptanes	0.55	0.01	Mol %			
Octanes	0.89	0.01	Mol %			
Nonanes	0.12	0.01	Mol %			
Decanes	0.02	0.01	Mol %			
Undecanes	0	0	Mol %			
Dodecanes	0	0	Mol %			
Tridecanes	0	0	Mol %			
Tetradecanes Plus	0	0	Mol %			

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LABORATORY TESTS RESULTS
11/19/93

JOB NUMBER: 935571 CUSTOMER: HALL ENVIRONMENTAL ANALYTICAL ATTN: **SCOTT HALLENBECK*

CLIENT I.D.........: 210522
DATE SAMPLED.......: 11/05/93
TIME SAMPLED.......: 09:50
WORK DESCRIPTION...: 5-4B

LABORATORY I.D...: 935571-0004
DATE RECEIVED....: 11/09/93
TIME RECEIVED....: 08:23
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Benzene, Toluene, Xylenes in Gas		*1			11/17/93	PKT
Benzene	<1	1	ppm v/v			
Toluene	31	1	ppm v/v			
Ethyl Benzene	6	1	ppm v/v			
m+p-Xylenes	67	1	ppm v/v	GC		
ortho-Xylene	9	1	ppm v/v			
Refinery Gas Analysis, Extended		*1			11/17/93	PKT
Hydrogen	<0.01	0.01	Mol %	ASTM D-1945		
Oxygen	15.31	0.01	Mol %	ASTM D-1945		
Nitrogen	78.92	0.01	Mol %	ASTM D-1945		
Carbon Monoxide	<0.01	0.01	Mol %	ASTM D-1946		
Carbon Dioxide	5.72	0.01	Mol %	ASTM D-1945		
Hydrogen Sulfide	<0.01	0.01	Mol %			
Methane	<0.01	0.01	Mol %	ASTM D-1945		
Ethylene	<0.01	0.01	Mol %	ASTM D-1946		
Ethane	<0.01	0.01	Mol %	ASTM D-1945		
Propylene	<0.01	0.01	Mol %	ASTM D-2163		
Propane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutylene	<0.01	0.01	Mol %	ASTM D-2163		
1-Butene	<0.01	0.01	Mol %	ASTM D-2163		
n-Butane	<0.01	0.01	Mol %	ASTM D-1945		
trans-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
cis-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
Isopentane	<0.01	0.01	Mol %	ASTM D-2163		
n-Pentane	<0.01	0.01	Mol %	ASTM D-2163		
Hexanes	<0.01	0.01	Mol %			
Heptanes	0.01	0.01	Mol %			
Octanes	0.03	0.01	Mol %			
Nonanes	0.01	0.01	Mol %			
Decanes	<0.01	0.01	Mol %			
Undecanes	0	0	Mol %			
Dodecanes	0	0	Mol %			
Tridecanes	0	0	Mol %			
Tetradecanes Plus	0	0	Mol %			

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LABORATORY TESTS RESULTS
11/19/93

JOB NUMBER: 935571 CUSTOMER: HALL ENVIRONMENTAL ANALYTICAL ATTN: **SCOTT HALLENBECK*

CLIENT I.D.........: 210522
DATE SAMPLED.......: 11/05/93
TIME SAMPLED.......: 12:15
WORK DESCRIPTION...: 5-5B

LABORATORY I.D...: 935571-0005
DATE RECEIVED....: 11/09/93
TIME RECEIVED....: 08:23
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Benzene, Toluene, Xylenes in Gas		*1			11/17/93	PKT
Benzene	<1	1	ppm v/v			
Toluene	2	1	ppm v/v			
Ethyl Benzene	<1	1	ppm v/v			
m+p-Xylenes	6	1	ppm v/v	GC		
ortho-Xylene	<1	1	ppm v/v			
Refinery Gas Analysis, Extended		*1			11/17/93	PKT
Hydrogen	<0.01	0.01	Mol %	ASTM D-1945		
Oxygen	12.70	0.01	Mol %	ASTM D-1945		
Nitrogen	82.47	0.01	Mol %	ASTM D-1945		
Carbon Monoxide	<0.01	0.01	Mol %	ASTM D-1946		
Carbon Dioxide	4.83	0.01	Mol %	ASTM D-1945		
Hydrogen Sulfide	<0.01	0.01	Mol %			
Methane	<0.01	0.01	Mol %	ASTM D-1945		
Ethylene	<0.01	0.01	Mol %	ASTM D-1946		
Ethane	<0.01	0.01	Mol %	ASTM D-1945		
Propylene	<0.01	0.01	Mol %	ASTM D-2163		
Propane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutane	<0.01	0.01	Mol %	ASTM D-1945		
Isobutylene	<0.01	0.01	Mol %	ASTM D-2163		
1-Butene	<0.01	0.01	Mol %	ASTM D-2163		
n-Butane	<0.01	0.01	Mol %	ASTM D-1945		
trans-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
cis-2-Butene	<0.01	0.01	Mol %	ASTM D-2163		
Isopentane	<0.01	0.01	Mol %	ASTM D-2163		
n-Pentane	<0.01	0.01	Mol %	ASTM D-2163		
Hexanes	<0.01	0.01	Mol %			
Heptanes	<0.01	0.01	Mol %			
Octanes	<0.01	0.01	Mol %			
Nonanes	<0.01	0.01	Mol %			
Decanes	<0.01	0.01	Mol %			
Undecanes	0	0	Mol %			
Dodecanes	0	0	Mol %			
Tridecanes	0	0	Mol %			
Tetradecanes Plus	0	0	Mol %			

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CHAIN-OF-CUSTODY RECORD

HALL ENVIRONMENTAL ANALYSIS LABORATORY
2403 San Mateo NE, Suite P-13
Albuquerque, New Mexico 87110
505.880.1803

Client: Daniel B. Stephens & Assoc.

Address: 6020 Academy NE Suite 100
Albuquerque, NM 87109

Phone #: 505 822 9400

Fax #: 505 822 8877

Project Name: Enron - Thoreau

Project #: 2105 2.2

Project Manager: Bob Marley

Sampler: Bob Marley

Samples Cold? ☐ Yes ☐ No (crossed out)

Date	Time	Matrix	Sample I.D. No.	Number/Volume	Preservative HgCl2	Preservative HCl	Preservative Other	HEAL No.	BTEX (Method 602/8020)	BTEX + MTBE (602/8020)	TPH Method 8015 MOD (Gas/Diesel)	BTEX + ~~MTBE~~ + TPH (Gasoline Only)	BTEX + MTBE + TPH (Gas + Diesel)	TPH (Method 418.1)	601/602 Volatiles	EDB (Method 504.1)	EDC	610 (PNA or PAH)	extended refinery Gasses			Air Bubbles or Headspace (Y or N)
11/3/93	1440	Air	5-35B	1L / 1600cc								X							X			Y
11/4/93	1230	Air	5-35B	1L								X							X			↓
11/4/93	1610	Air	5-34B	1L								X							X			↓
11/5/93	0950	Air	5-4B	1L								X							X			↓
11/5/93	1215	Air	5-5B	1L								X							X			↓

Date	Time	Relinquished By: (Signature)	Received By: (Signature)
11/5/93	1745	Bob Marley	[signature]
11/5/93	1745	[signature]	[signature] 11-8-93/1030

Remarks: