Supplementary Investigation
3/90

Deep Ground-water Investigation: Phase 2 SEMCO Twist Drill and Tool Company Facility

Santa Maria, California

Prepared for:
SEMCO Twist Drill and Tool Company

April 1991

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Deep Ground-water Investigation: Phase 2 SEMCO Twist Drill and Tool Company Facility

Santa Maria, California

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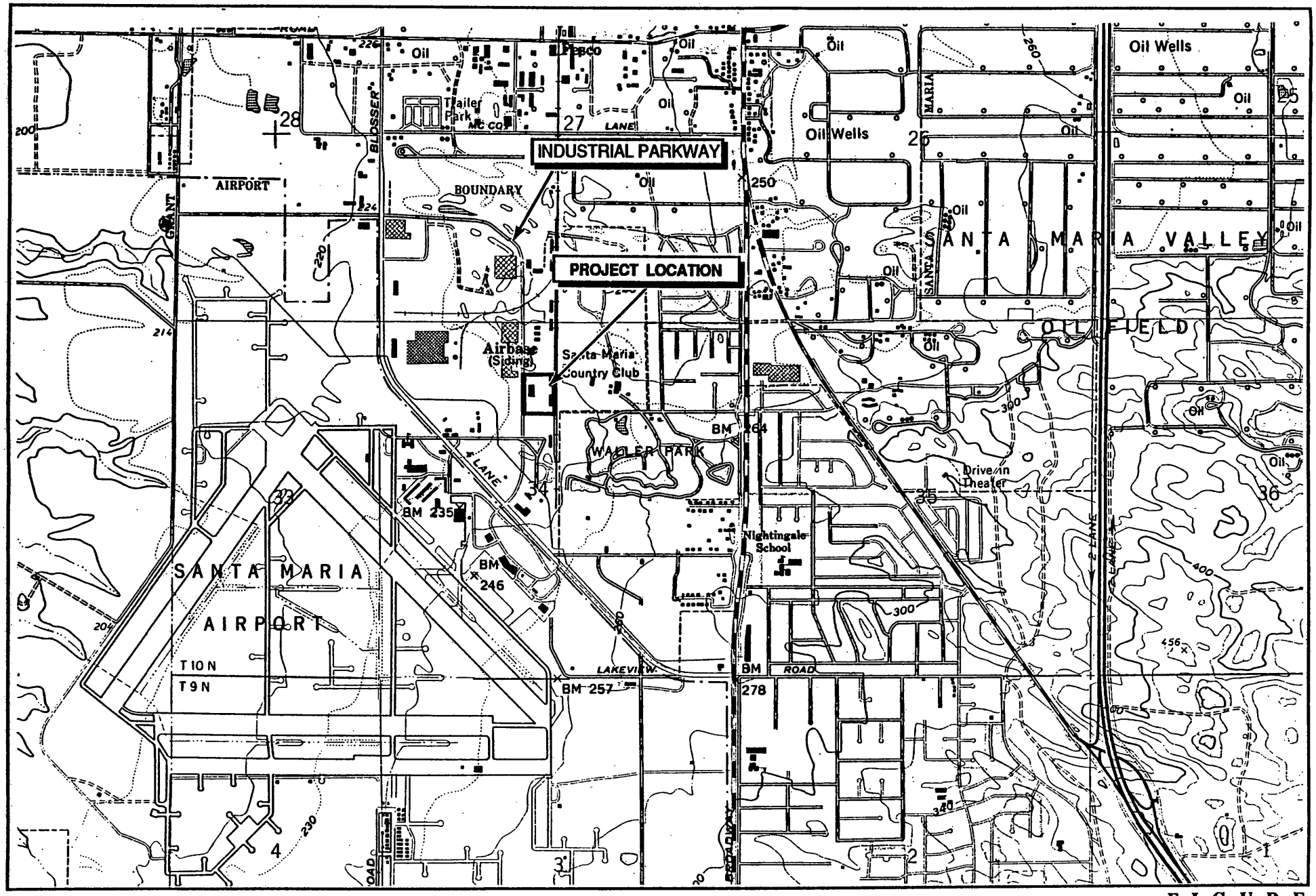
SECTION 1
INTRODUCTION

This report presents the results of an assessment of regional ground-water quality beneath the SEMCO Twist Drill and Tool Company facility (SEMCO) in Santa Maria, California (Figure 1-1) conducted by ERC Environmental and Energy Services Company (ERCE) during March 1991. This investigation was conducted at the request of the California Regional Water Quality Control Board - Central Coast Region (RWQCB) and is intended to further assess the extent of halocarbon contamination previously identified within the regional aquifer system underlying the site. Presented within this report are the pertinent background information concerning the site, the methodologies utilized during the field investigation, and the resultant findings of the study.

As a part of this investigation, two additional ground-water monitor wells were installed into the upper portion of the regional aquifer system, developed, and then sampled to further assess existing conditions in the regional aquifer. Soil samples were obtained during drilling of the monitor wells to further assess the potential migration of contamination through the unsaturated zone between the shallow perched and regional aquifer systems. The work plan utilized during the course of the investigation was accepted by representatives of the RWQCB.

This investigation was conducted pursuant to Point 4b of Cleanup and Abatement Order No. 90-88 (CAO 90-88) issued May 18, 1990 to SEMCO by the RWQCB.



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Location of Project Area

FIGURE 1-1

SECTION 2
BACKGROUND INFORMATION

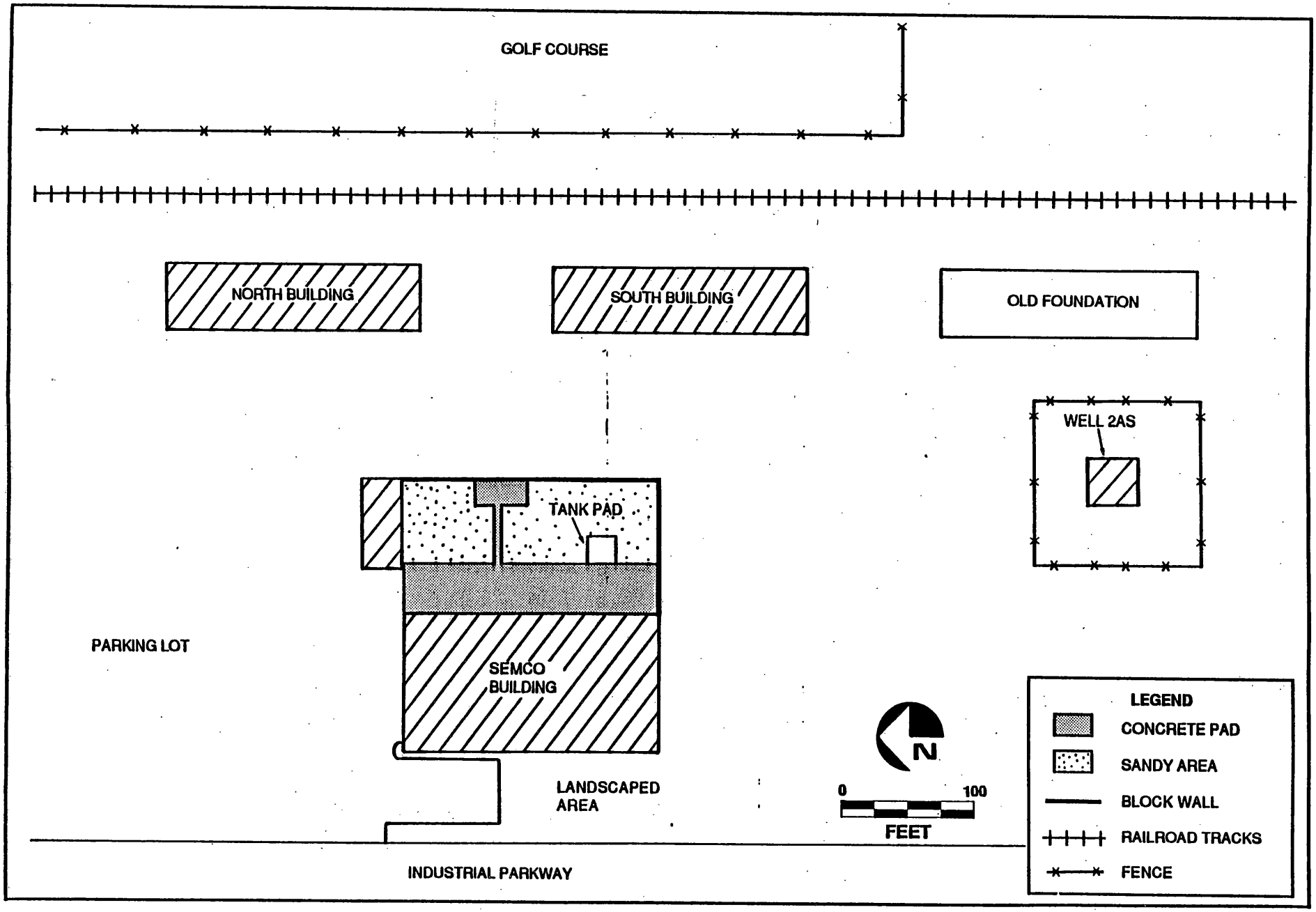
2.1 PROJECT BACKGROUND

In May, 1985, representatives of the County of Santa Barbara Health Department (SBHD) obtained a soil sample adjacent to well 2AS (Figure 2-1) that contained minor levels of trichloroethene (TCE). Their interest in this area was prompted by the previous identification of low levels of TCE in ground-water samples obtained from this well, which is completed in the regional aquifer system and had been used as a municipal water source in the past. Pacific Geosciences conducted a subsurface investigation of the area around the municipal well to assess the potential for contamination; no detectable levels of TCE or trichloroethane (TCA) contamination were identified during their study.

In July, 1987, representatives of the California Regional Water Quality Control Board - Central Coast Region (RWQCB) obtained soil samples approximately 25 feet south of two aboveground storage tanks located at the facility that exhibited elevated levels of TCE and tetrachloroethene (PCE). One of these aboveground tanks currently contains TCA and has contained TCE in the past (WESTEC 1989). The RWQCB required that an additional investigation be conducted in the vicinity of the observed contamination.

WESTEC Services, now ERCE, was retained by SEMCO to conduct a soil boring in the vicinity of the area sampled by the RWQCB. Data from the soil samples obtained from this boring indicated the presence of elevated levels of TCE, and 1,2-dichloroethene (DCE) from 6 to 12 feet below ground surface. Very low levels of DCE and DCA were identified from 15 to 21 feet below ground surface. The maximum levels of TCE, DCE, and DCA detected were 1300 mg/kg, 45 mg/kg, and 0.23 mg/kg respectively.

Following this investigation, the RWQCB conducted a passive soil gas sampling program to further assess the potential for contamination. The soil gas data collected by the RWQCB suggested that elevated levels of TCE and TCA were present throughout the general area of the aboveground tanks. Due to the results of the passive soil gas study, the RWQCB requested further investigation of the area around the aboveground tanks.



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SEMCO Facility Plot Plan

FIGURE 2-1

WESTEC (ERCE) was retained by SEMCO to further investigate the contamination near the aboveground tanks during November, 1988. Ten soil borings and three monitor wells were installed in the general vicinity of the solvent tank. The resulting laboratory analytical data derived from selected soil samples indicated that levels of TCE as high as 7400 mg/kg (WESTEC 1989) exist within the soils north of the solvent tank. Detectable levels of DCE and PCE were also identified in some of the soil samples analyzed. Ground-water samples from the three monitor wells installed on the site indicated the presence of TCE and DCE in the shallow ground-water system. TCE concentrations in ground water ranged from 200 µg/l to 260,000 µg/l while DCE concentrations ranged from 220 µg/l to 7700 µg/l. No other purgeable halocarbons (utilizing EPA Method 601) were identified in the three monitor wells.

In September, 1989, ERCE conducted a soil gas survey over a large portion of the SEMCO facility. Significant levels of TCE and TCA were detected in the shallow soil gas north of the tank pad, where both ground-water and soil contamination had been detected during the previous investigation, and as far as 500 feet to the southeast of the main SEMCO building.

Another subsurface investigation was conducted by ERCE at the SEMCO facility to further assess the extent of soil and ground-water contamination. The results of this investigation indicated that the shallow aquifer system was much less extensive than suggested by the soil gas data and that the shallow aquifer could be described as a perched aquifer. Significant levels of TCE, DCE, and trichloroethane (TCA) were detected in the perched ground-water system. Also, free product was discovered on top of the shallow water-table east of the main SEMCO building and appears to consist of cutting oil.

In February, 1990, ERCE conducted a subsurface investigation to further assess the extent of soil and shallow ground-water contamination at the SEMCO facility. Significant levels of total petroleum hydrocarbon (TPH) were detected in the soil southeast of the main building. The results of this investigation appeared to verify the extent and degree of halocarbon contamination present within the shallow perched aquifer. Additionally, low levels of TCE and DCE contamination were detected as far as approximately 30 feet below the perching layer that exists under the shallow aquifer.

In May,1990, ERCE conducted an investigation of both the shallow and deep aquifer systems underlying the SEMCO facility. Four additional monitor wells were installed to further assess the lateral extent of the perched aquifer. A number of deep borings were

conducted to a depth of 170 feet below ground surface in an attempt to identify the regional aquifer system. However, the regional aquifer was not identified during this investigation due to the limitations of the hollow-stem auger drilling technique and the assessment of potential impacts to the regional aquifer system was inconclusive.

In November and December, 1990, two deep monitor wells were installed within the regional aquifer system, which was encountered at approximately 186 feet below ground surface (ERCE 1990a). Both wells were developed and sampled, then purged and resampled at a later time to verify results. The results of these analyses indicated that the regional aquifer directly below the perched aquifer contained TCE concentrations above the federal and state maximum contaminant level (MCL) of 5 parts per billion.

2.2 REGIONAL GEOLOGY AND HYDROGEOLOGY

2.2.1 Regional Geology

The SEMCO site is situated within the Santa Maria Valley, Santa Barbara County, California. The regional structure surrounding and including the Santa Maria Valley is complex due to the structural influence by tectonic events that have created both the California Coast Ranges and the Transverse Ranges of Southern California.

Unconsolidated sediments within the valley range from Pliocene to Recent in age (Figure 2-2). The Recent, Pleistocene, and Upper Pliocene sediments are chiefly fluvial in origin and comprise channel deposits, alluvium, and terrace deposits in the region near the SEMCO facility. Terrestrial dune sands are also deposited locally (Worts 1951).

2.2.2 Regional Hydrogeology

The Pleistocene Orcutt Formation is the main aquifer supplying ground-water and is the principal water supply for the City of Santa Maria and the surrounding area. Based on recent studies (ERCE 1990a), general depth to ground water is approximately 186 feet below land surface in the region around the SEMCO facility. Recent and Upper Pleistocene deposits are generally above the zone of saturation of the main water body, although water is locally yielded where sediments overly clay or hardpan and a perched water table has formed (Worts 1951). The ground-water basin underlying the SEMCO site

	Geologic age	Formation and symbol on plate 2	Thickness (feet)
Quaternary	Recent	Dune sand (Qs)	0–100+
		Unconformity	
		River-channel deposits (Qrc)	0–25±
		Unconformity	
		Alluvium (Qal)	0–230
		Unconformity	
	Pleistocene	Terrace deposits (Qt)	0–75
		Unconformity	
		Orcutt formation (Qc)	0–225
?	?	Unconformity	
Tertiary	Pliocene (upper)	Paso Robles formation (Tpr)	0–2, 000±
		Local unconformity	
		Careage sand (Tc)	100–650±
		Local unconformity	
	Pliocene (upper) to Miocene (lower)	Unconsolidated Tertiary rocks, undifferentiated (Tu). (Includes Foxen mudstone, Sisquoc formation and Monterey shale.)	0–10, 000+
		Major unconformity	
Jurassic (?)		Franciscan and Knoxville (?) formation (Jfk)	

(After Worts, 1951)

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Stratigraphic Units of the Santa Maria Valley

FIGURE 2-2

is listed as having beneficial uses by the California Regional Water Quality Control Board - Central Coast Region (RWQCB).

SECTION 3
SITE GEOLOGY AND HYDROGEOLOGY

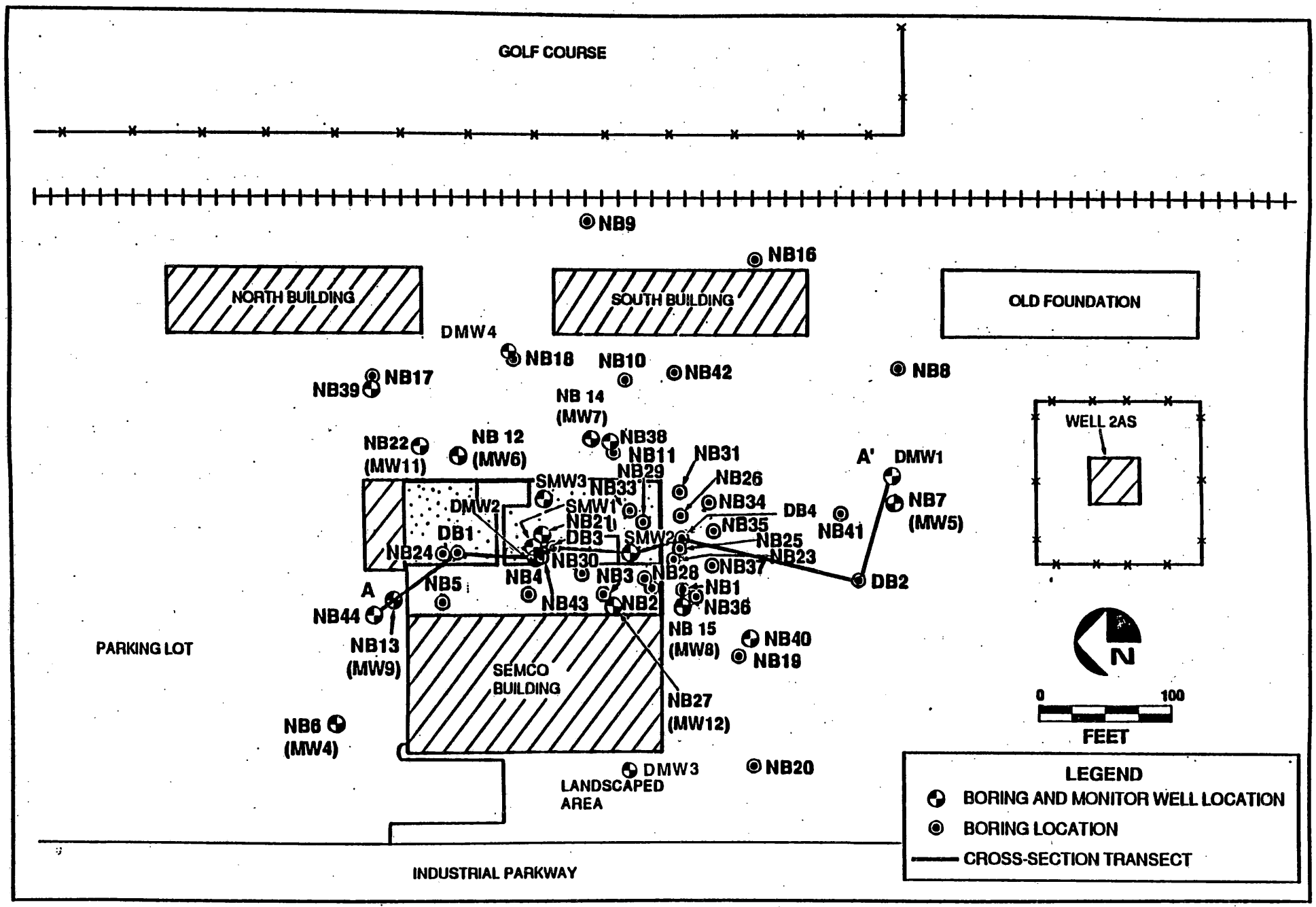
Two deep borings were conducted during the course of field work completed in March 1991. These borings, which were completed to a total maximum depth of approximately 210 feet, were used for the installation of two monitor wells and are depicted as DMW3 and DMW4 on Figure 3-1. The methodologies utilized during boring installation, soil sampling, well installation, well development, and sampling are described in Appendix A. Data obtained during the conduct of the borings can be found in the boring logs located in Appendix B and well construction logs are located in Appendix C. A description of the Unified Soil Classification System (USCS) is presented in Appendix B. The following paragraphs describe the geology and hydrogeology of the site area using these data along with data discussed in WESTEC (1989), and ERCE (1989), (1990a), (1990b), and (1990c).

3.1 SITE GEOLOGY

The site geology has been evaluated by using the lithologic data obtained during this and previous investigations. From these data, it is apparent that the subsurface geology beneath the SEMCO facility is very heterogeneous. However, four general lithologic units can be defined within the upper 210 feet of sediments underlying the SEMCO site. These are described from the uppermost unit (lithologic unit 1) to the lowermost unit (lithologic unit 4) in the paragraphs below. Included for reference is one cross-section (Figure 3-2).

The uppermost lithologic unit (Unit 1) is present from ground surface to approximately 38 feet below ground surface (bgs). Generally, the lithologic character of this unit varies from a clayey, fine- to medium-grained sand and silty, fine- to medium-grained sand, to a well sorted, fine- to medium-grained sand with a light brown to tan color. Visual classifications of these lithologies would be SC, SM, and SP, respectively, according to the USCS classification system. Minor, discontinuous beds of clayey silt and silty clay up to 6 inches thick are also found within this unit.

Lithologic unit 2 appears to have an abrupt upper boundary with unit 1 at approximately 38 feet bgs. The thickness of this unit appears to range from approximately 8 to 20 feet (Figure 3-2). The upper boundary of Unit 2 is generally marked by a nonplastic, clayey silt (ML under the USCS classification system). The lithologic composition of the rest of



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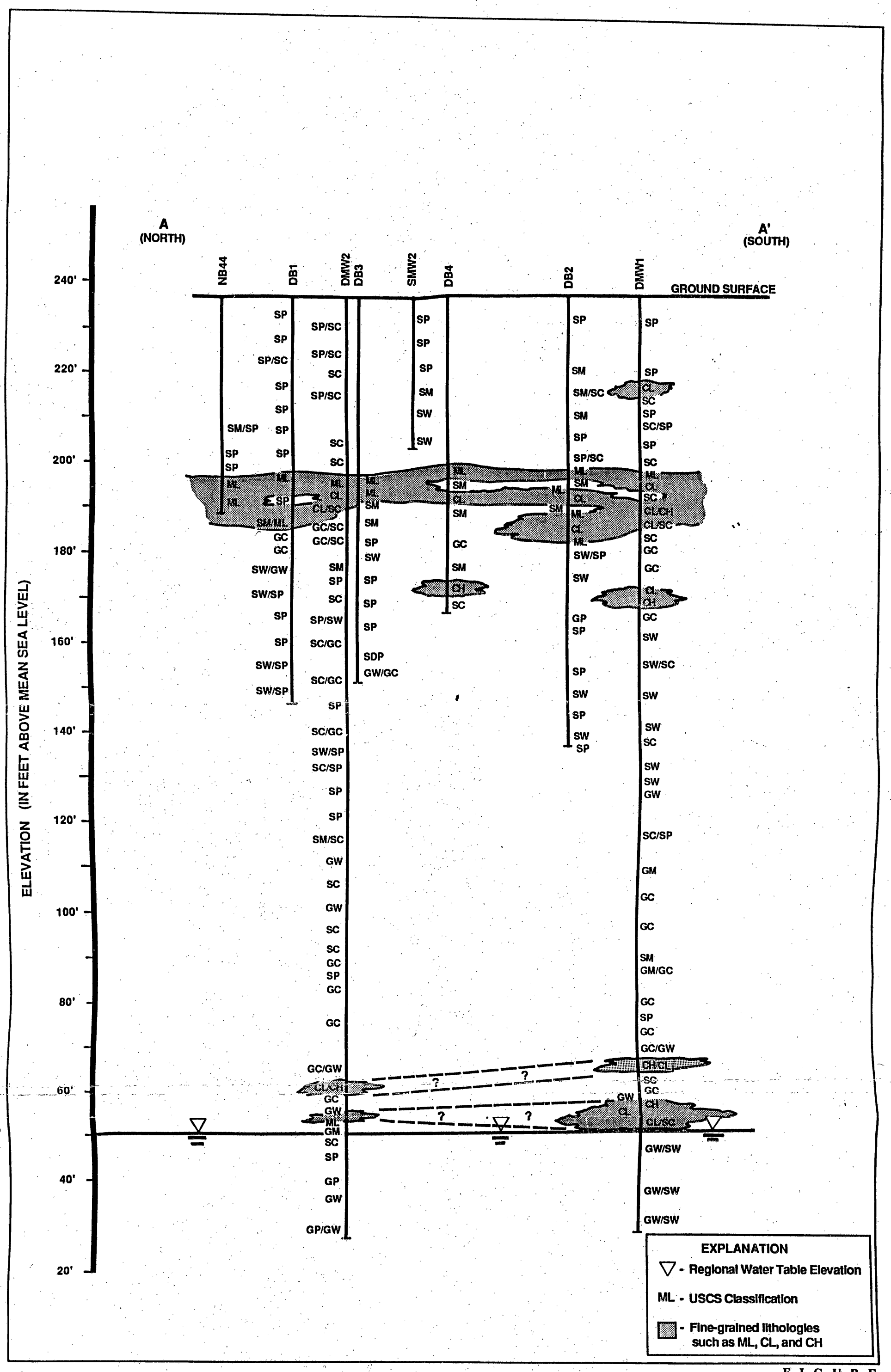
Boring and Cross-Section Location Map

FIGURE 3-1



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Geologic Cross-section A-A'

FIGURE 3-2

this unit is more variable and generally consists of interlayered clay, silty clay, clayey silt, sandy silt, and clayey sand. Minor amounts of clean, fine- to medium-grained sand and clayey gravel were also encountered during drilling within this lithologic unit. Accordingly, the USCS classifications include CH, CL, SM, SC, SP, and GC, respectively.

Lithologic unit 3 extends from approximately 57 feet bgs to roughly 125 feet bgs and dominantly consists of gravelly, poorly to well-sorted, medium- to coarse-grained sand with minor clay and silt. Also present are sandy clay to clay lenses up to 5 feet thick that do not appear to be laterally extensive. Sandy gravel layers constitute a small portion of the lithologies contained within this unit. Cobble clasts up to 6 inches in diameter were encountered throughout this unit. USCS classification of the aforementioned soil types include, SW, SP, GP, GW, SC, and CL to CH, respectively.

The lowermost lithologic encountered (Unit 4) appears to be relatively homogeneous and dominantly consists of poor- to well-sorted sandy gravel (USCS classifications GW and GP) and clayey, sandy gravel (USCS classifications GM to GC). Gravel size ranges from pea gravel (0.5 inches) to cobbles over 6 inches in diameter. It appears that this unit contains less fines within the course-grained lithologies below the regional water table. Also present are lenses of brown to tan, poorly-sorted, silty, fine- to medium-grained sand (USCS classification SM) and silty clay lenses with minor to moderate plasticity. Of potential importance are the clay layers which appear at depths of approximately 170 to 187 feet below ground surface and may laterally continuous (Figure 3-2). However, not enough data are currently available to demonstrate continuity of these deep clay layers. Although the base of this unit was not penetrated, it appears to extend to at least 210 feet below ground surface.

3.2 SITE HYDROGEOLOGY

A total of 20 wells have been installed at the SEMCO facility with 16 completed within and around the shallow perched aquifer and 4 installed within the upper portion of the regional aquifer. A well construction summary of the deep wells is presented in Table 3-1 (Section 3.2.2). Well construction data for the shallow monitor wells present on the SEMCO property can be found in ERCE (1990b). Well installation methodologies are presented in Appendix A.

3.2.1 Shallow Aquifer System

As previously stated (ERCE 1989, 1990c, and 1990b), the shallow aquifer system is defined as a perched aquifer due to its existence as a discontinuous saturated lense with unsaturated conditions existing above and below. The perching zone is located within the upper portion of lithologic unit 2, a fine-grained aquitard material. Therefore, the perched aquifer is present within Unit 1, which is generally a sandy material with a higher relative permeability than the perching layer.

The lateral extent of the shallow perched aquifer is confined to an area on the east side of the main SEMCO building. The lateral extent in four directions has been bracketed by the four previously-installed monitor wells because these wells extend to the perching layer and are dry. Therefore, it appears that the approximate dimensions of the perched aquifer at this time are 300 feet by 180 feet. The depth to water within this aquifer is variable, but generally ranges from approximately 7 to 38 feet below ground surface. The base of the aquifer appears to be approximately 38 feet bgs at the edges of the perched aquifer and may extend to a depth of about 45 feet bgs at the center of the aquifer. This difference is due to the higher pressure head present at the center of the aquifer.

Additional information and data concerning the perched aquifer system can be found in past reports presented by ERCE (1989b, 1990b, and 1990c).

3.2.2 Deep Aquifer System

The top of the regional aquifer was encountered at a depth of approximately 186 to 188 feet below ground surface. Four monitor wells have been installed within the upper portion of the aquifer as shown in Figure 3-1, with two of these wells being installed during this investigation. A well construction summary of the four wells is provided in Table 3-1.

At the time of drilling, it was unknown whether or not the regional ground-water system encountered during the installation of both DMW1 and DMW4 was under confined or unconfined conditions. The first free water in DMW1 and DMW4 appeared at the respective depths of approximately 196 feet and 192 feet below ground surface. However, due to the nature of the drilling procedure and the presence of a substantial clay layer at approximately 181 to 187 feet below ground surface, a screened interval of 20 feet was placed such that the top of the screen was close to the bottom of the clay unit.

During the installation of DMW2 and DMW3, no major confining layers were encountered and the wells were installed into a water table (or unconfined) aquifer with approximately 12 feet of screened interval below the water table and 8 feet extending above.

Table 3-1
DEEP MONITOR WELL CONSTRUCTION SUMMARY
(All Depths in Feet Below Ground Surface)

Monitor Well ID	Total Well Depth	Casing Length	Screen Length	Filter Pack	Bentonite Seal
DMW1	208.0'	0.0-188.0'	20.0'	186.2-208.0'	180.2-186.2'
DMW2	199.0'	0.0-179.0'	20.0'	174.0-199.0'	167.0-174.0'
DMW3	201.0'	0.0-180.0'	20.0'	173.6-200.0'	167.0-173.6'
DMW4	209.4'	0.0-187.0'	20.0'	185.0-209.4'	178.5-185.0'

The two wells were developed according to procedures explained in Appendix A. Static water levels were obtained from each of the wells and converted to water table elevation data utilizing survey data collected during the field work. These data indicate that current static regional water table elevation is approximately 50 feet above mean sea level beneath the SEMCO facility. The water table elevation data are presented in Table 3-2 below.

Table 3-2
REGIONAL WATER TABLE ELEVATION DATA
(All Elevations and Depths in Feet)

Monitor Well ID	Ground Elevation	Casing Elevation	Depth to Water	Water Table Elevation
DMW1	237.9'msl	237.74'msl	186.64'toc	51.10'msl
DMW2	236.4'msl	236.43'msl	185.62'toc	50.81'msl
DMW3	236.38'msl	236.19'msl	185.20'toc	51.08'msl
DMW4	238.44'msl	238.21'msl	187.12'toc	51.09'msl

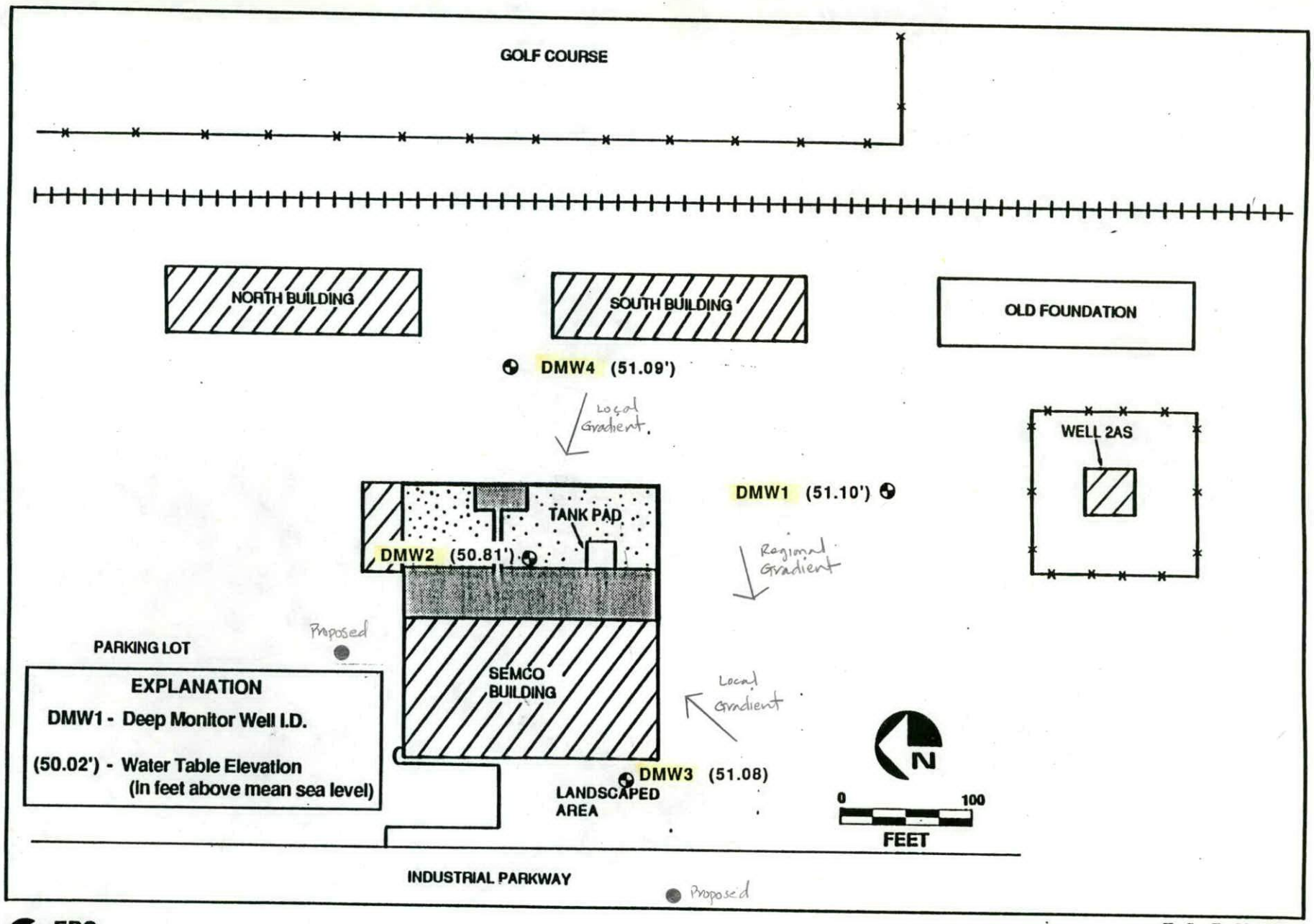
Notes:

1) MSL = above mean sea level.
2) TOC = below top of casing.

The upper portion of the regional aquifer was encountered within a lithologic unit dominated by sandy gravel. This is supported by the ability to pump 5 to 6 gallons per

minute from all four wells installed in the regional aquifer while only incurring minimal drawdown during pumpage, suggesting a high transmissivity aquifer. Although the final water table elevation measured in both DMW1 and DMW4 suggest a confined aquifer, the fact that DMW2 and DMW3 are under water table conditions along with the apparent discontinuous nature of the clay lenses suggest that the upper portion of the regional aquifer may generally be under water table conditions.

Figure 3-3 presents the water table elevations collected from the regional aquifer system prior to development and sampling. It must be noted that these data were collected during a period of ground-water recharge to the regional aquifer and static levels were not observed during the measurement period. From these data it appears that ground-water flow is to the north from DMW2, with ground-water flow converging towards DMW2 from the east, west, and south. These data will be verified prior to the final draft of this report being sent to the RWQCB. It is appears likely that the regional aquifer was being influenced by either recharge or ground-water pumpage at the time of measurement.



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Deep Aquifer Ground-water Elevations

FIGURE 3-8

SECTION 4
ANALYTICAL RESULTS

4.1 DEEP SOIL ANALYTICAL RESULTS

Soil samples were collected at approximately 10 foot intervals from the top of the low permeability layer encountered at approximately 39 feet below ground surface (bgs) until samples could no longer be collected. A total of seven soil samples, collected from depths ranging from approximately 39 to 90 feet (bgs), were recovered during the drilling of DMW3 and DMW4. No other soil samples were recoverable during drilling procedures due to large gravel and cobble clasts present in the subsurface stratigraphy. These large clasts were unable to be cleared from the inner tube of the dual tube reverse circulation drill pipe so that a soil sample could be collected. This problem is discussed further in Appendix A.

The seven soil samples collected were analyzed in the laboratory for purgeable volatile organic compounds utilizing EPA Method 8010/8020. Additionally, four of the soil samples were selected to be analyzed for total organic carbon utilizing EPA Method 9060. All soil samples were analyzed at Analytical Technologies, Inc. (ATI), a California Department of Health Services-certified laboratory. The laboratory analytical reports are presented in Appendix D.

4.1.1 Purgeable Volatile Organic Compound Analytical Results

Seven soil samples were analyzed for purgeable volatile organic compounds utilizing EPA Method 8010/8020. A summary of these analytical results is presented in Table 4-1. No volatile halogenated compounds were identified in the soil samples collected from DMW3. However, trichloroethene (TCE) and cis-1,2-dichloroethene (cis-DCE) were identified in soil samples DMW4-1 and DMW4-2. TCE and cis-DCE were detected in DMW4-1 at the respective levels of 0.25 mg/kg and 0.02 mg/kg. Only the compound TCE, at a level of 0.05 mg/kg, was present above detection in DMW4-2. No other compounds were identified at levels above the detection limit during the volatile halogenated compounds scan.

Toluene was only detected in soil sample DMW3-2 at a level of 0.078 mg/kg using EPA Method 8010/8020. Concentrations of toluene in the remaining soil samples were below

detection (<0.025 mg/kg) in soil samples from DMW3 and DMW4. The detection of toluene in DMW3-2 could be due to cross-contamination of the sampler at ground surface by the exhaust of the dual tube diesel hammer. No other volatile aromatic compounds were identified in the borings for either well installed during this field investigation.

TABLE 4-1
SUMMARY OF EPA METHOD 8010/8020 RESULTS
HALOGENATED AND AROMATIC VOLATILE
ORGANIC COMPOUNDS IN SOIL

SAMPLE	DEPTH	TCE	TCA	cis-DCE	toluene
DMW3-1	39.0'	<0.010	<0.010	<0.010	<0.025
DMW3-2	49.0'	<0.010	<0.010	<0.010	**0.078**
DMW3-3	60.5'	<0.010	<0.010	<0.010	<0.025
DMW3-4	90.0'	<0.010	<0.010	<0.010	<0.025
DMW4-1	39.0'	**0.25**	<0.010	**0.02**	<0.025
DMW4-2	49.0'	**0.05**	<0.010	<0.010	<0.025
DMW4-3	68.5'	<0.010	<0.010	<0.010	<0.025

Notes:

1) All concentrations expressed in mg/kg (ppm).
2) No other analytes detected by the 8010/8020 scan.
3) Sample depths expressed in feet below land surface.
4) TCE = trichloroethene, TCA = 1,1,1-trichloroethane, and cis-DCE = cis-1,2-dichloroethene.

A trip blank was kept on ice with the soil samples throughout the entire sampling process and was analyzed along with the soil samples. No halogenated or aromatic organic compounds were detected during the EPA Method 8010/8020 scan of the trip blank.

4.1.2 Total Organic Carbon Analytical Results

The four soil samples collected from DMW3 were analyzed for total organic carbon (TOC) using EPA Method 9060 for the purpose of establishing background organic carbon levels naturally occurring in the soils underlying the site. These soil samples showed no indication of being contaminated during field screening and, with the exception of sample DMW3-2 containing 0.078 mg/kg toluene, do not contain detectable levels of volatile

organic compounds. Therefore, the results presented should be reasonably representative of the naturally-occurring levels of organic carbon present in the soil. The results of the total organic carbon analysis are presented in Table 4-2.

TABLE 4-2
SUMMARY OF EPA METHOD 9060 RESULTS
TOTAL ORGANIC CARBON IN SOIL

SAMPLE	DEPTH	SOIL TYPE	TOC
DMW3-1	39.0'	silty clay	339
DMW3-2	49.0'	clayey, silty gravel	324
DMW3-3	60.5'	sandy, clayey gravel	208
DMW3-4	90.0'	sandy, silty gravel	357

Notes:

1) All concentrations expressed in mg/kg (ppm).
2) Sample depths expressed in feet below land surface.
4) TOC = Total Organic Carbon

TOC concentrations in the soils analyzed ranged from 208 mg/kg to 357 mg/kg or approximately 0.02 % to 0.036 % by weight. There does not appear to be any observable relationship between the TOC content and soil types present underlying the site.

4.2 DEEP GROUND-WATER ANALYTICAL RESULTS

Two ground-water samples were collected from monitor wells DMW3 and DMW4 in March 1991. Both samples were analyzed using EPA method 8010/8020 for volatile halogenated and aromatic organic compounds at ATI. A summary of the analytical results is presented in Table 4-2. The laboratory analytical reports are presented in Appendix D. Levels of 21 µg/l trichloroethene (TCE), and 1.4 µg/l cis-1,2-dichloroethene (cis-DCE) were present within the ground-water sample collected from DMW3. Well DMW3 is located almost due west of the contaminated perched aquifer and DMW2, which contained TCE, TCA, toluene, cis-DCE above the limits of detection. No other volatile organic compounds were identified by the EPA Method 8010/8020 scan in this well.

Ground-water sample DMW4-3-91, collected from DMW4, contained no detectable levels of volatile halogenated organic compounds. However, 6.5 µg/l toluene was identified from the volatile aromatic organic compound scan. No other compounds were identified in this well by the volatile organics analyses.

TABLE 4-3
SUMMARY OF EPA METHOD 8010/8020 RESULTS
HALOGENATED AND AROMATIC VOLATILE
ORGANIC COMPOUNDS IN DEEP GROUND WATER

Analyte	Sample Identification			
	DMW3-3-91	DMW3-3-91D	DMW4-3-91	Trip Blank
cis-1,2-dichloroethene	**1.4**	**1.4**	<0.20	<0.20
toluene	<1	<1	**6.5**	<0.50
1,1,1-trichloroethane	<0.4	<0.4	<0.20	<0.20
trichloroethene	**21**	**22**	<0.20	<0.20

Notes:

1) All concentrations expressed in µg/l (ppb).
2) No other analytes detected in the 8010/8020 scan.

For quality assurance and quality control (QA/QC) purposes, one ground-water sample split (or duplicate) was collected from DMW3. This sample, labelled DMW3-3-91D, was utilized to test the consistency of the laboratory analyses of the ground-water samples. As can be observed in Table 4-2, the results of the analysis of DMW3-3-91 and DMW3-3-91D are almost identical, suggesting a high degree of reproducibility of laboratory results. Additionally, a trip blank was placed in the cooler used to cool and transport the ground-water samples to the analytical laboratory. No halogenated or aromatic organic compounds were detected during the EPA Method 8010/8020 scan of the trip blank.

SECTION 5
DISCUSSION

5.1 ASSESSMENT OF DEEP SOIL CONTAMINATION

Although the collection of soil samples was not the major purpose of this and the previous investigation, attempts were made to collect split spoon samples through the inner tube of the dual tube drilling system (ERCE 1990a). However, due to the presence of cobbles within the formational materials and the winnowing effect of the reverse air circulation, gravel and cobbles tended to be concentrated in the bottom portion of the drilling casing. Because of this, recovery was poor and only a total of eleven soil samples were recovered for laboratory analysis during the installation of the four monitor wells. The analytical results of soil samples collected during the drilling of DMW1 and DMW3 suggest that no chlorinated solvent contamination is present within these areas, but that minor chlorinated solvent contamination appears to exist within the perching layer in the vicinity of DMW4.

Thus far, laboratory analysis of soil samples collected from between the perching layer and the regional water table have not verified the downward migration of chlorinated solvents to the regional water table.

5.2 ASSESSMENT OF REGIONAL AQUIFER CONTAMINATION

The analytical data derived from the ground-water samples collected from the four deep monitor wells during this and previous investigations (ERCE 1990a) suggest that the upper portion of the regional aquifer system directly beneath and west of the perched aquifer has been impacted by volatile organic contaminants. Table 5-1 presents the most recent ground-water analytical results acquired on the four monitor wells that penetrate the regional aquifer underlying the SEMCO property. Analytical data from DMW1 and DMW2 are verification sampling data from ground-water samples collected in December 1990 and were previously presented to the RWQCB in a letter dated January 9, 1991. The analytical data for DMW3 and DMW4 are the data presented in Section 4 of this report

These data indicate that the ground-water in the vicinity of monitor wells DMW2 and DMW3 contained TCE at the respective concentrations of approximately 24 and 21 µg/l at the time of sampling. The TCE levels identified in these two wells are approximately four

times the 5 µg/l federal and state defined maximum contaminant level (MCL) of TCE for drinking water.

TABLE 5-1
SUMMARY OF EPA METHOD 8010/8020 RESULTS
HALOGENATED AND AROMATIC VOLATILE
ORGANIC COMPOUNDS IN DEEP GROUND WATER

Analyte	Sample Identification			
	DMW1-12-90V	DMW2-12-90V	DMW3-3-91	DMW4-3-91
cis-1,2-dichloroethene	<0.20	1.2 ~~2.1~~	**1.4**	<0.20
toluene	<0.50 ~~1.3~~	1.3 ~~<2.50~~	<1	**6.5**
1,1,1-trichloroethane	<0.20	3.0 ~~<1.00~~	<0.20	<0.20
trichloroethene	<0.20	13 ~~24~~	**21**	<0.20

Notes:
1) All concentrations expressed in µg/l (ppb).

Cis-DCE, a breakdown product of TCE, was identified at levels of 2.1 µg/l and 1.4 µg/l in wells DMW2 and DMW3, respectively. These levels are below the 6 µg/l federal and state MCL for cis-DCE. Although the concentration of 1.3 µg/l toluene identified in DMW1 may be suspect, the presence of toluene at concentrations of 6.5 µg/l in DMW4 suggests sources of ground-water contamination other than that of the perched aquifer underlying the SEMCO site may have had an impact on the quality of the regional ground-water system. However, at this time, the source of these contaminants has not been established.

5.3 ASSESSMENT OF REGIONAL GROUND-WATER FLOW DIRECTIONS

The additional wells installed at the site have not yet allowed for a clearer picture of the regional ground-water flow direction. The data gathered during the sampling of wells DMW3 and DMW4 suggest ground-water flow from the areas near DMW1, DMW3, and DMW4 converge in the vicinity of DMW2 and flow north from there. However, this most recent water level data may be influenced by recharge to the regional ground-water system, and therefore, does not represent the flow directions that are present during the dry season. Other factors may also be influencing the regional water table elevations. Ground-water

flow directions need to be reconfirmed and analyzed in an effort to assess potential sources of regional aquifer contamination.

SECTION 6
CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The following conclusions can be made concerning the deep regional aquifer system underlying the project site.

- The regional water table underlying the SEMCO site is encountered at a depth of approximately 185 feet below ground surface. The hydrogeologic character of the upper portion of this unit appears to be a relatively high permeability, sand and gravel aquifer containing discrete lenses of low permeability materials. The regional aquifer appears to locally exist under confined conditions, but in general exists under water table conditions.

- The horizontal direction of regional ground-water flow in the vicinity of the SEMCO facility is unclear at this time based on the ground-water elevation data obtained from the four wells installed in the upper portion of this aquifer. Potential effects of ground-water recharge to the regional water table may have altered the water table surface temporarily. These data should be verified as soon as possible since the regional ground-water flow directions, seasonal and otherwise, have implications in terms of additional monitor well placement.

- Data from this and the previous study indicate that the upper portion of the regional ground-water system beneath the main SEMCO building has been impacted by TCE and cis-DCE. These data also suggest that the portion of the aquifer between the main building and Well 2AS, as well as the portion of the aquifer to the east of the main building, has not been impacted by either of these two compounds. Given the data collected thus far, the eastern and southern margin of the contaminant plume have been adequately assessed. However, the northern and western margins of the plume have thus far not been adequately assessed. Additional wells will be needed along the northern and western margin to adequately evaluate the extent of TCE contamination in the regional aquifer.

6.2 RECOMMENDATIONS

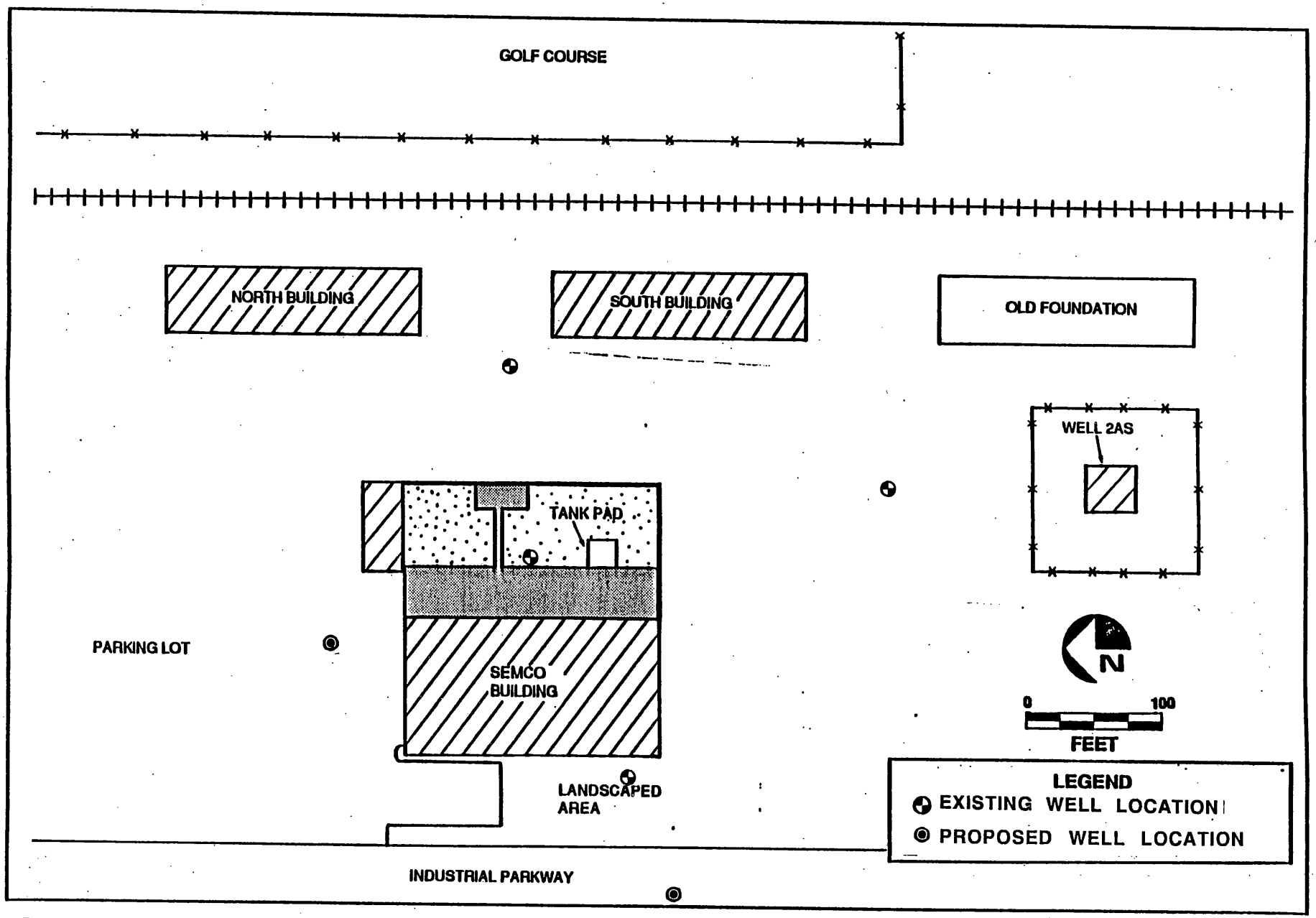
ERCE recommends that two more deep wells will be installed within the deeper aquifer following completion of verification measurement of water levels in each deep monitor well. These wells are intended to further assess the extent of TCE and cis-DCE ground-water contaminant present in the uppermost portion of the deeper aquifer system. One well will be situated north north-west of DMW2 as shown in Figure 6-1. A second well will be placed in the street in front of the main SEMCO building west of DMW3. These locations may change dependent on the results of the verification water level measurements. Both wells will be installed utilizing either dual tube casing hammer with reverse air circulation or casing hammer with air rotary. Due to the cobbles encountered at depth and the problems caused by these cobbles when attempting to collect soil samples, soil samples will be collected at 10 foot intervals only when permissible during this phase of work. Ground-water samples will be collected following well development and will be analyzed for purgeable volatile organic compounds (EPA Methods 601/602). The details of the proposed work follow.

6.2.1 Proposed Work Plan and Time Schedule

Borehole Installation

The two monitor wells will be installed utilizing a drilling rig equipped for air rotary drilling with casing hammer or dual-tube casing hammer with reverse air circulation. These drilling methods has been selected since they will allow consistent penetration to depths of 200 feet and will prevent cross-contamination due to the presence of the removable casing, which is driven into the ground during borehole advancement.

Prior to commencement of drilling activities, the drilling rig and all equipment used in drilling will be thoroughly steam cleaned. Well borings will have a diameter of 10 inches or greater. If the "air rotary with casing hammer" method is utilized, the borings will be advanced using an 8.5-inch diameter tricone bit inside of a 9.5-inch I.D. and 10.5-inch O.D. hardened steel casing. The casing, driven by its own weight, generally follows the



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Proposed Locations of Additional Deep Monitor Wells

FIGURE 6-1

drill bit down the boring as the bit is advanced. However, if the casing lags behind the bit by 5 feet or more, the casing hammer is used to drive the casing down to the bit.

If the "dual-tube casing hammer with reverse air circulation" method is utilized, the borings will be advanced by driving a dual-wall drilling pipe with an I.D. of 6 inches and an O.D. of 10 inches. The annulus between the two pipes will be utilized for the reverse circulation process, with air and cuttings being carried by the air stream up the inner pipe to the surface.

Because drive casing is used in the well boring construction, potential cross-contamination during construction is minimized if not eliminated. Generally, no fluids are needed during drilling due to the presence of the drive casing and reasonable effort will be made to avoid their addition during drilling. However, water may be required to be injected into the system if a problem is encountered such as plugging of the air rotary bit if plastic clays encountered.

Due to the nature of these two drilling methods, geologic materials and water are transported to the ground surface almost as rapidly as they are encountered, allowing for accurate assessment of variations in geologic materials. Lithologic samples will be collected at the drilling discharge every five to ten feet and when lithologic changes have been encountered. Split-spoon samples will be collected every ten feet from approximately 38 feet below ground surface to as deep as allowable by the cobbles. Lithologic observations, along with blow counts and sampling intervals, will be placed into a boring log by an ERCE hydrogeologist.

Well Construction

If "air rotary with casing hammer" method was utilized to install the borehole, the bit will be retrieved to allow installation of the well materials and the drive casing will be used as a tremie for annular materials. With the dual-tube method, no bit needs to be retrieved for the inner tube to be utilized as a tremie pipe. As well materials are emplaced, the casing will be removed at approximately 2-foot intervals until the well screen and filter pack have been emplaced.

Each monitor well will be constructed of 5-inch diameter, flush-threaded Schedule 40 PVC casing and slotted casing with 0.020-inch factory slotting if "air rotary with casing

hammer" is used. If the dual-tube drilling method is utilized, 4-inch steel casing and screen with 0.020-inch factory slotting will be used for well construction. The casing material will be steam cleaned prior to installation to ensure that all possible contaminants have been removed. Clean, #3 silica sand will be placed within the annular space from the total depth of the well to at least 3 feet above the screened interval. The annular space above the filter pack will be sealed with approximately 5 feet of pure sodium bentonite pellets. A bentonite grout will be emplaced on top of the bentonite pellets by utilizing a 1.5-inch diameter tremie pipe to pressure grout around the annulus if "air rotary with casing hammer" is used. The top of the well will be enclosed in a water-tight traffic box cemented flush with ground surface.

The total depth of each well will be approximately 200 to 210 feet below ground surface. If unconfined conditions are encountered during drilling, the screen interval will be 10 feet long with approximately 10 feet of screen above and 10 feet below the water table. If confined conditions are encountered, there will be 10 feet of screen installed below the base of the confining layer.

Well Development and Ground-water Sampling

Well development will be conducted after a period of 24-hours following construction. A 3-3/4-inch diameter, Grundfos stainless-steel submersible pump or equivalent will be utilized for the well development procedure. The submersible pump and associated equipment will be decontaminated by steam cleaning prior to lowering it down the well. The submersible pump will also be washed in an Alconox and water solution, rinsed in potable water, rinsed in isopropyl alcohol, rinsed in potable water, and rinsed in deionized water.

Prior to lowering the pump into the water, an ERCE hydrogeologist will measure the elevation of the water in the well and calculate the volume of the well. If possible , at least three well volumes will be removed from each well during the development procedure. Additionally, pH, specific conductivity, and temperature data will be collected and recorded during the well development procedure to demonstrate the restoration of the natural formation waters. A log will be kept of all data collected during the well development process.

The two wells will be sampled following well development. Each ground-water sample will be collected utilizing a Teflon, bottom-discharging bailer that has been properly decontaminated. The decontamination process will consist of an Alconox and potable water wash, a potable water rinse, an isopropyl alcohol rinse, another potable water rinse, and a final rinse of deionized water. One equipment rinsate sample will be collected after decontamination to verify that the bailer is contaminant-free prior to collecting a ground-water sample.

Each sample collected will be immediately transferred to two 40-ml, glass VOA vials, properly labelled, entered into a ground-water sampling log, then placed on ice to await shipment to the analytical laboratory. All samples will be analyzed at Analytical Technologies, Inc. (ATI), a CDOHS certified laboratory, for purgeable volatile organic compounds utilizing EPA Methods 601/602.

Reporting

A report will be prepared detailing project methodologies, and describing the results of the investigation. The report will be signed by an engineering geologist licensed to practice in the State of California.

Time Schedule

ERCE anticipates that a report will be submitted to the RWQCB 60 days following verbal approval of this work plan by the RWQCB.

SECTION 7
LIMITATIONS

The data presented in this report are intended for the use in the course of a subsurface investigation. The data cited herein should not be used for any other than this intended purpose. Furthermore, ERCE's conclusions are based solely on these data.

Changes in the condition of the project site may occur with time due to either natural processes or the activities of man. This site investigation was carried out using the degree of care and skill ordinarily exercised under similar circumstances by qualified professionals; no further warranty is made.

SECTION 8
REFERENCES

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ERCE. 1990b. Shallow and Deep Ground-water Investigation - SEMCO Twist Drill and Tool Company Facility, Santa Maria, California, July.

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APPENDIX A

FIELD METHODOLOGIES

APPENDIX A

Boring and Soil Sampling Methodologies

The borings utilized to construct the two wells were conducted to a maximum depth of 210 feet below ground surface utilizing dual-tube reverse-circulation drilling. This drilling method uses flush-threaded double-wall drill pipe and high-pressure air to provide a relatively continuous return of formation samples. No drilling additives are used during drilling and the compressed air is filtered prior to being forced down the annulus of the two drill pipes. The drill pipe is advanced by means of a diesel driven pile driver; none of the drill pipe rotates during drilling. Impact from the hammer is applied to the outer pipe only and no annular space is present between the outer pipe and formations as drilling proceeds. In this manner, the borehole is drilled and temporarily cased at the same time, eliminating the potential for cross-contamination. While the casing is being removed during well construction, a positive head of grout is kept within the inner pipe, thereby controlling potential formational collapse and maintaining a continuous grout seal up to ground surface.

One problem encountered during the use of the dual-tube drilling method at the SEMCO facility was the continual concentration of gravel and cobble clasts in the lower portion of the inner drill pipe. While this did not inhibit the installation of monitor wells within the regional aquifer, this problem did inhibit the collection of discrete, split-spoon samples with depth. Despite the fact that upward velocities of up to 70 feet/second can be reached, this velocity does not appear to apply enough force to continuously remove large gravel clasts from the drill pipe. Because of this problem, much of the new lithologic data is based upon cuttings collected at the surface.

The dual-tube drilling pipe utilized during drilling operations had an O.D. of 10 inches and I.D. of 6 inches, the annulus between the two pipes was utilized for the reverse circulation process. The drilling pipe was decontaminated using a steam cleaner prior to each use. Soil samples were obtained at 10-foot intervals using an 18-inch sampler equipped with three, 6-inch removable brass liners that was lowered through the inner pipe. An 140-pound automatic drop hammer with a 30-inch drop height was employed to drive the sampler. The sampler was driven for a full 18 inches whenever possible. A total of four soil samples were recovered from the two borings.

The sampler and brass liners were cleaned thoroughly prior to each use. Cleaning was accomplished by washing with a solution of Alconox and water, rinsing with potable water, rinsing with isopropyl alcohol, rinsing with potable water, and a final rinsing with deionized water.

Following soil sample acquisition, the three brass liners were immediately removed from the sampler. During this process, the contents were initially screened for volatile organic compounds using a HNU. If possible, the lowermost liner was retained as the laboratory sample. The ends of this liner were immediately covered with Teflon film, sealed with plastic caps, and wrapped with tape. The sample was then labelled, entered into a sampling log and chain-of-custody form, and placed in a cooler on ice to await analysis at the analytical laboratory. All soil samples collected underwent laboratory analysis for volatile halogenated and aromatic organic compounds using EPA Method 8010/8020 at Analytical Technologies, Inc., a CDOHS certified lab.

The lithologic and screening data were entered into a log by an ERCE hydrogeologist. The boring logs include lithologic descriptions of the samples, location of sampling intervals, blow counts, and HNU data obtained during the sampling event.

After each boring was completed, the hole was utilized for the construction of a monitor well. Cuttings from each boring were placed within a DOT-approved 55-gallon drum and disposal is the responsibility of the client.

Monitor Well Construction

Both monitor wells were installed through the 6 inch I.D. inner pipe. Following the completion of boring activities, all casing materials were steam-cleaned prior to emplacement through the inner pipe. Individual lengths of casing and screen were constructed of 4-inch flush-threaded low carbon steel and stainless steel, respectively. A flush-threaded kinart adapter was utilized to connect the two material types and minimize the potential for electrochemical reactions. The screen length installed into each well was 20-feet in length and had a slot size of 0.020-inch. Filter pack, consisting of clean, No. 3 Lonestar sand, was installed within the annular space from total depth to at least 1.5 feet above the top of the screened interval utilizing the inner drill pipe as a tremie pipe. The annular space above the filter pace was sealed with approximately 5 feet of 0.25-inch diameter pure sodium bentonite pellets, again using the inner pipe of the dual-tube system

as a tremie pipe. The rest of the borehole was grouted to the surface with a sodium bentonite grout which was emplaced by keeping a positive head within the drilling pipe as the pipe was being pulled out of the ground. This was done to avoid potential collapse of the hole and ensure a continuous seal up to the surface. The top of the well was enclosed in a water-tight traffic box cemented flush with ground surface.

Monitor Well Development and Sampling

At least 24 hours following the installation of each well, an ERCE hydrogeologist determined the total well depth and static water level within each well. Standing water depth and total well volume were calculated. Each well was then developed utilizing a submersible pump with galvanized-steel drop-pipe. All materials were steam-cleaned prior to being placed within the wells. At least four well volumes of water were removed during the well development process. Additionally, while pumping from the well, the pump was raised and lowered over the saturated screened section to ensure effective well development. Specific conductivity, pH, and temperature of the ground water were monitored during the well development process to demonstrate that the natural water quality of the aquifer had been restored. Development water was placed within DOT-approved 55-gallon drums and disposal is the responsibility of the client.

Approximately 1-hour following development, each well was sampled using a Teflon, bottom-discharging bailer with Teflon coated bailer wire. The bailer and bailer wire were decontaminated using an Alconox and water washing solution, a potable water rinse, an isopropyl alcohol rinse, another potable water rinse, and a final de-ionized water rinse. Ground-water samples were immediately transferred to clean, 40-ml glass VOA vials preserved with HCl. The samples were then labelled, entered into a sampling log and chain-of-custody form, and maintained at 4° C for transport to the analytical laboratory. Both ground-water samples were taken to ATI for laboratory analysis.

APPENDIX B

BORING LOGS

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS More Than Half of Material is Larger Than No. 200 Sieve Size	GRAVELS More Than Half of Coarse Fraction is Larger Than No. 4 Sieve	CLEAN GRAVELS (Less Than 6% Fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVEL With Fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS More Than Half of Coarse Fraction is Smaller Than No. 4 Sieve	CLEAN SANDS (Less Than 6% Fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS With Fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS More Than Half of Material is Smaller Than No. 200 Sieve Size	SILTS AND CLAYS Liquid Limit is Less Than 50%		ML	Inorganic silts, rock flour, fine sandy silts or clays, and clayey silts with non- or slightly-plastic fines.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, sandy clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS Liquid Limit is Greater Than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts, clayey silt.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

GRAIN SIZES

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

200 40 10 4 3/4" 3" 12"

U.S. STANDARD SERIES SIEVE — CLEAR SQUARE SIEVE OPENINGS

RELATIVE DENSITY		CONSISTENCY	
SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT*	CLAYS AND PLASTIC SILTS	BLOWS/FOOT*
VERY LOOSE	0 - 4	VERY SOFT	0 - 2
LOOSE	4 - 10	SOFT	2 - 4
MEDIUM DENSE	10 - 30	FIRM	4 - 8
DENSE	30 - 60	STIFF	8 - 16
VERY DENSE	OVER 50	VERY STIFF	16 - 32
		HARD	OVER 32

*NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT SPOON (ASTM D-1586).

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

ERCE

Unified Soil Classification System

FIGURE

ERCE

FIELD LOG OF BORING

BORING NUMBER DMW3

SHEET 1 OF 6

PROJECT NAME	PROJECT NUMBER	ELEVATION AND DATUM	LOCATION
SEMCO	30273.001		2936 Industrial Pky

DRILLING COMPANY	DRILLER	DATE AND TIME STARTED	DATE AND TIME COMPLETED
Layne Environmental	Steve	3-7-91 @ 1130	3-7-91 @ 1730

DRILLING EQUIPMENT	DRILLING METHOD	COMPLETION DEPTH	TOTAL NO. OF SAMPLES
Drill Systems	Dual Wall	201 ft	4

SIZE AND TYPE OF BIT	HOLE DIAMETER	NO. OF SAMPLES	BULK	SS	DRIVE	PITCHER
10-in Crowd-in Bit	10-in		—	4	—	—

DRILLING FLUID	DRILLING ANGLE	WATER LEVEL	FIRST	AFTER ____ HOURS
None	∅			

SAMPLE HAMMER TYPE	DRIVING WT.	DROP	HYDROGEOLOGIST / DATE	CHECKED BY / DATE
Automatic	140-lb	30-in	CED/SLD	

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
	2				Clean fine-to medium-grained	SP	0	100	0	
	4				sand, pale brown, well-sorted, loose, moist to damp.					
	6				Same as above with thin					
	8				clayey layers (SC).					
	10									First link 1137
					Same as at 2 feet	SP	0	95	5	
	12									
	14				Clayey, silty, fine-grained sand, brown, moderately sorted, moist,	SC/SM	0	50	50	
	16				moderately loose.					
	18									2nd link 1142
					Same as at 10-ft	SP	0	95	5	
	20									
	22									
	24				Alternating, clayey fine-to medium-grained sands and fine-to medium-grained sand, moist, loose.	SC/SP	0	50	50	
	26									
	28									
					medium-to coarse-grained sand	SP	0	100	0	3rd link 1150

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FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW3

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
					Medium-to coarse-grained sand.	SP	0	100	0	
	32				Pale brown, well-sorted, loose, moist.					
	34									
	36									
						SP	0	95	5	
	38		100	17 30 32	Silty clay w/minor sand, mottled	CL/CH	0	10	90	DMW3-1
	40				brown, low to moderate plasticity,					1205
CL/CH					moderately firm - some rust					Hnu = Tr ppm
	42				colored mottles.					H.S. = 0 ppm
	44									
	46									
					Clayey sand	SC	0	80	20	
	48		100	7 20 30	Clayey, silty pebble to cobble	GC	50	10	40	DMW3-2
	50				gravel, brown, poorly sorted					1225
					damp to wet, minor sand.					Hnu = 0 ppm
	52				matrix is a cl					H.S. = 0 ppm
	54									
	56									
	58									
	60		100	10 20 24	Sandy, clayey, silty gravel, brown,	GM	50	30/20	20/30	DMW3-3
	62				poorly sorted, moist, gravel size					1235
					from pea to cobble - some clay/silt					Hnu = 0 ppm
	64				derived from claystone clasts.					H.S. = 0 ppm
ML						ML	25	25	50	
CL	66				sandy clay, minor plasticity	CL/CH	5	10	85	
	68				Fat clay - highly plastic	CH				
CH			0	4 6	No Recovery					1305

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FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW3

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
CH	72				Clay - highly to moderately plastic	CH				Dual tube moved up 10' to clear cuttings.
	74									
	76				clayey gravel, → 1-inch gravel with coarse-grain sand, silt and clay - clay balls indicating interbedded clay + gravel	GC				
	78									
	80		0	7 10 29	No Recovery	GW	65	35	0	1400 No Sample
	82				medium-grained sandy gravel (pea to cobbles), minor silt, red brown, damp	GW	55	40	5	
	84									
	86				Gravelly sand, pale red brown, damp, loose, coarse-grained sand and pea gravel - mod well-sorted	SP	30	70	0	
	88									
	90	X	✓	9 41 50	sandy gravel, brown, moderately sorted, dry, minor silt, loose	GM	70	20	10	DMW3-4 1410 Hnu = 0 ppm No Headspace.
	92									
	94									
	96									
	98									
	100		0	16 35 50	No Recovery					
	102				Sandy gravel w/ large cobbles, sand is fine-grained, tan, dry	GW	55	45	0	
	104									
	106									
	108									

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FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW3

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
					Sandy, silty gravel, red brown, damp, poorly sorted, loose	GM	50	25	25	15 silt, 10 clay
	112									
	114				Sand, moist, well sorted, coarse grained	SP	0	95	5	
CH	116				Plastic clay w/ minor silt and sand	CH	0	20	80	
	118				Clayey silty sand	SC	0	50	25/25	
	120				Silty, clayey coarse-grained sand, red brown, moist, poorly sorted non-plastic	SM	0	80	10/10	
	122									
	124				Clayey sand (coarse-grained sand) dark red brown to brown	SC	0	80	20	
	126				Clayey sand w/ gravel, brown, moist, poorly sorted (gravel 1-in on up.	SC	20	60	20	
	128									
	130				Gravelly medium-to coarse-grain sand, brown, moist, poorly sorted with clay and silt, gravel size from 1-inch on up.	SM	25	50	25	
	132									
	134									
	136				sandy gravel, tan brown, minor silt and clay, moist, poorly sorted	GW/GM	50	45/40	5/10	
5-in + dia rocks	138									
	140				Clayey gravel with sand (red brn) silty, fine-to medium-grained sand. ~~moist~~	GC SM	60	15	25	
	142									
	144									
	146				Clayey, gravelly fine-to medium-grained sand, moist to damp, poorly sorted, brownish red.	SC	20	65	15	
	148									

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW3

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
					medium-grain sand, red brown,	SP	0	95	5	
	152				well-sorted, well rounded, minor silt					
	154									
	156				clayey, medium- to coarse-grain sand, dark red-brown, moist	SC	0	85	15	
	158				poorly sorted, loose to med dense silty gravelly sand to sandy grav.	GM/SM	40	40	20	
	160				moderately poorly sorted, brown, moist, loose.					
	162				clayey, silty 1 to 5-in gravel,	GM	60	5	35/15	
	164				matrix CL to ML, moderately dense. Pale brown color.	GC	60	5	35/20	
					moist to damp.					
CL/ML	166				silty clay to clayey silt, pale brn,	CL/ML			100	
	168				moist to damp, non to minor plasticity moderately soft					
	170				silty, clayey fine-grain sand,	SM	0	70	30	
	172				red-brown, moist, w/minor clay, moderately well-sorted.					
	174				Gravelly clayey coarse-grained sand, poorly sorted, moist,	SC	30	40	30	
	176				brown.					
					clayey coarse-grained sand, mod sorting, moist, brown,	SC	0	85	15	
CH	178				silty clay, red brown, plastic,	CH				
	180				moist, soft.					
GM					Silty, clayey sandy gravel.	GM	65	10	25	
ML/CL	182				clayey silt to silty clay, non- to slightly plastic, brown,	ML/CL			100	
	184				damp, soft					
	186				Coarse-grained sand with minor silts and clay.	SM		80	20	
	188				Gravelly silty sand to sandy silty	GM/SM	45	45	10	

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW 3

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
					Gravelly, silty coarse-grained sand, wet, moderately sorted, loose	SM	30	60	10	
	192									
	194									
	196									
	198									
	200									
	202				Total Depth = 201 ft					
	204									
	206									
	208									
	210									
	212									

ERCE

FIELD LOG OF BORING

BORING NUMBER DMW4

SHEET 1 OF 6

PROJECT NAME	PROJECT NUMBER	ELEVATION AND DATUM	LOCATION
SEMCO	30273.001		2936 Industrial Pkg

DRILLING COMPANY	DRILLER	DATE AND TIME STARTED	DATE AND TIME COMPLETED
Layne Environmental	Steve	3-8-91 / 1300	3-9-91 / 0910

DRILLING EQUIPMENT	DRILLING METHOD	COMPLETION DEPTH,	TOTAL NO. OF SAMPLES
Drill Systems	Dual Wall	209.4	3

SIZE AND TYPE OF BIT	HOLE DIAMETER	NO. OF SAMPLES	BULK	SS	DRIVE	PITCHER
10-in Crowd-in Bit	10-in		—	3	—	—

DRILLING FLUID	DRILLING ANGLE	WATER LEVEL	FIRST	AFTER 12 HOURS
None	∅		184 (steam)	187 ft

SAMPLE HAMMER	HYDROGEOLOGIST / DATE	CHECKED BY / DATE
TYPE Automatic DRIVING WT. 140-lb DROP 30-in	CED/SLD / 3-9-91	

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
	2									
	4									
	6									
	8									
	10				Silty, medium- to coarse-grained sand, orange-brown, moist, well-sorted with minor 2-in gravel, loose.	SP/SM	1	84	15	
	12									
	14									
	16				Interbedded clays (1 to 4-in thick)	CL				
	18									
	20					SP/SM		85	15	
	22				Clean, coarse-grained sand, light brown, moist to damp, well-sorted, loose	SP		95	5	
	24									
	26									
	28				Same as at 22 ft	SP		95	5	

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW4

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
	32				Medium- to coarse-grained sand, light brown, well-sorted, loose	SP		95	5	
	34									
	36									
38.5 CH	38	X	/		Clay, red-brown, moist, firm, highly plastic	CH			100	1342
	40									DMW4-1
										HNU = 1.5 ppm
	42									H.S. = 7 ppm
SM	44				silty, fine-grained sand, yellowbrn, moist to dry, well sorted, loose.	SM		60	40	
CH/CL						CH/CL			100	
SM	46					SM		60	40	
SP					fine- to medium-grained sand,	SP				
SM	48			6 9 12	red-brown, moist to dry, well-	SM				1358
CL		X	/		sorted, loose	CL				DMW4-2
	50									HNU = 3 ppm
	52				Silty clayey fine-grained sand to sandy silt in upper 6-inches					H.S. = 42 ppm
?	54				silty clay					
	56				Gravelly clayey sand - 1 to 6" cobble	SC	30	40	30	
	58		0	3 21 30	No Recovery					
										1405
	60				silty, gravelly medium- to	SM	30	45	25	Cobble in shoe -
	62				coarse-grained sand, dry to moist, orange brown, poorly					only a minor amount of sample -
	64				sorted					HNU = 4 ppm.
	66									
										DMW4-3 @ 1425
	68		/	2 6 34	silty fine- to medium-grained sand, pale brown, loose, well sorted	SM	0	85	15	HNU = 2 ppm
		X								H.S. = 0 ppm.

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW4

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
						SM	0	85	15	
	72				Same as at 68-ft					
	74									
	76				silty sandy gravel, orange brn moist, moderately sorted, loose gravel from 1 to 6-inches?		40	35	25	
	78		0/6	6 11 10						1450 No sample taken - all silt and loose gravel. 90% gravel, 10% silt
	80									
	82				Medium-to coarse-grained sand with minor silt, orange brn, damp loose.	SP	0	95	5	
	84									
	86									
	88				Sandy gravel, light brown, damp, loose, gravel 1-in to 6in. poorly-sorted, - minor silt.	GW	60	35	5	
	90									
	92									
	94									
	96									
	98		0	5 11 27	No Recovery					
	100				Sandy gravel, light brown, loose, moist, gravel from 0.5-in to 2-in+, poorly sorted	GW	60	35	5	
	102									
	104				medium-to coarse-grained sand, wellsorted, brown, moist, loose.	SP	0	100	0	
	106									
	108				Coarse-grained sand w/gravel, brown, loose poorly sorted	SW	5	95	0	

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW4

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
	112				same as at 108'	SW	5	95	0	
	114				clayey, sandy gravel, dark orange brown, poorly sorted, moist. gravel from 1/4-in to 1/2-in	GC	60	25	15	
	116									
	118									
	120									
	122				silty fine-to medium-grained sand, light brown, well-sorted moist, loose.	SM		80	20	
	124									
	126				126-127ft-gravel layer					
	128				silty, clayey fine-to medium-grained sand, light brown, well-to moderately-sorted, moist to damp, loose	SM/SC		75	15	
	130									
	132				clayey fine-to coarse-grained sand, orange brown, moist. moderately-sorted.	SC		80	20	
	134					GC	50	25	25	
	136				alternating silty sands w/gravel	SM	10	70	20	
	138				and ~~gravelly~~ silty gravels w/ sand.	GM	50	20	30	
						SM	10	70	20	
	140									
	142									
	144									
	146				clayey sandy gravel, poorly sorted, Red brown, moist to damp.	GC	50	25	25	
	148									

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW 4

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
	152									
	154									
	156									
	158									
	160									3-9-91 @ 0655
					Clayey, sandy gravel, red brown, moist, poorly sorted, 1"-4.5"	GC	50	25	25	Resume Drilling
	162									
	164									
	166									
	168				Clayey sandy gravel, red-brown, moist dense, poorly-sorted, gravel ranging from 1/2 to 3-inches	GC	60	25	15	
	170									
	172									
	174				Clayey sandy gravel, red brown, moist, poorly-sorted w/ clay balls.	GC	50	10	40	
	176									
	178				Medium-to coarse-grained sand, red brown, moist, well sorted, loose	SP	0	95	5	
	180									
	182				silty, sandy clay, dark brown, moist to wet, highly plastic, moderately soft	CH		20	80	
CH	184									Steam comming out of cyclone
	186				sandy, silty clay, red brown, moist, moderately plastic, stiff.	CL		30	70	from 188' on down
CL	188					SP	10	80	10	
SP										

ERC Environmental and Energy Services Co.

FIELD LOG OF BORING (CONTINUED)

BORING NUMBER DMW4

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF GR	SA	FI	COMMENTS
					medium-to coarse-grained sand	SP	10	85	5	
					w/ gravel and silt, saturated.					
	192					SW	10	85	5	
	194				Gravelly sand (fine-to coarse-					
					grained sand with silt, moderately					
	196				to poorly sorted.					
					Sandy Gravel, poorly sorted.	GW	60	40		
	198									
CL					silty sandy clay, brown, minor plastic	CL		20	80	
	200									
					Sandy Gravel, 1" to 6" diameter	GW	70	30		
	202				sand is coarse-grained,					
					saturated, loose,					
	204									
	206					GW	60	40		
	208									
	210				BGH at 209.4'					0910
	212									

APPENDIX C

WELL COMPLETION RECORDS

ERCE

WELL COMPLETION RECORD

JOB NO. 30273.001 WELL NO. DMW3 HYDROGEOLOGIST CED and SLD

CLIENT SEMCO DRILLER Layne Environmental

WELL LOCATION 2936 Industrial Pky DATE/TIME 3/8/91 @ 0840

Well Head Elevation _____

Ground Surface Elev. _____

Well Head Completion Method

Traffic Box - flush mount

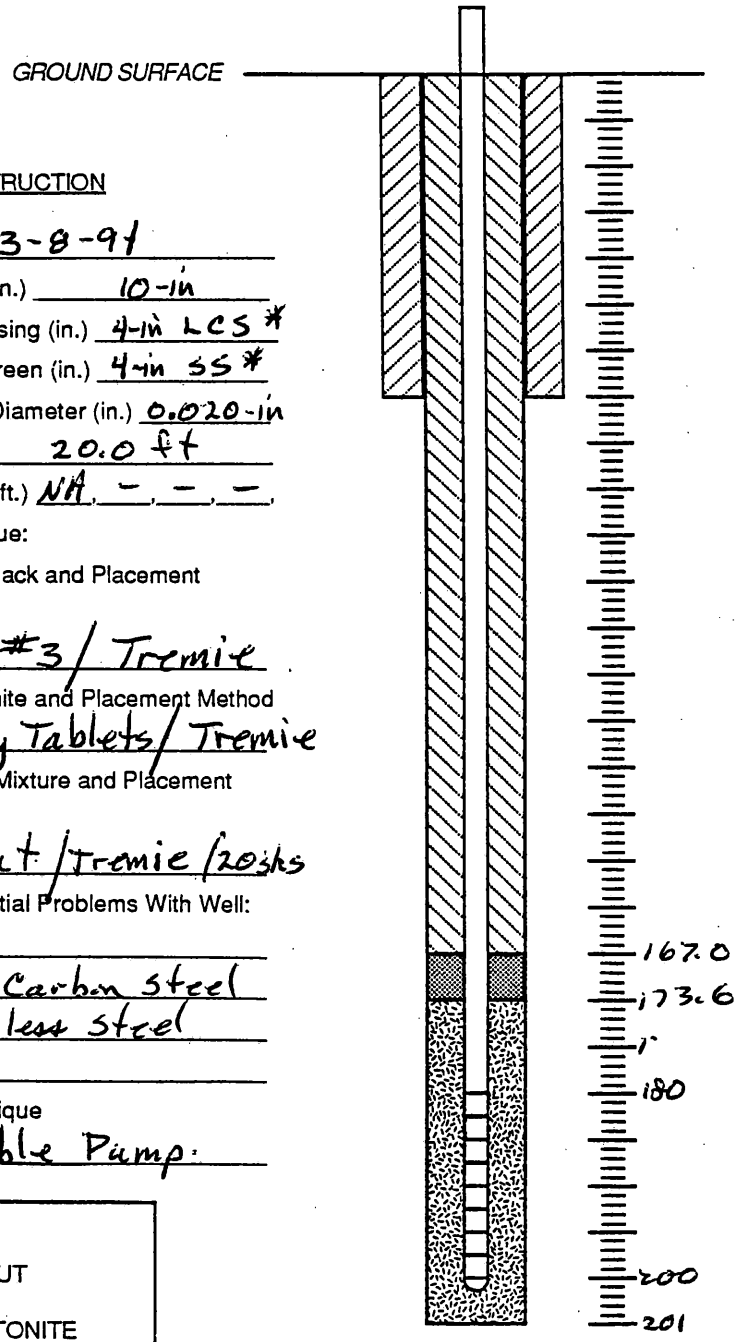
Drilling Method/Rig Type

Dual Tube / Drill Systems

Surface Casing: Type NA

Diameter —

Length —



DETAILS OF CONSTRUCTION

Date Completed 3-8-91

Borehole Diameter (in.) 10-in

Type and Size of Casing (in.) 4-in LCS *

Type and Size of Screen (in.) 4-in SS *

Screen Perforation Diameter (in.) 0.020-in

Screen Length (ft.) 20.0 ft

Centralizer Depths (ft.) NA, —, —, —,

Completion Technique:

1) Type of Filter Pack and Placement Method

Lonestar #3 / Tremie

2) Type of Bentonite and Placement Method

1/4-in Volclay Tablets / Tremie

3) Type of Grout Mixture and Placement Method

Volclay Grout / Tremie / 20 sks

Description of Potential Problems With Well:

Notes:

* LCS ≡ Low Carbon Steel

** SS ≡ Stainless Steel

Development Technique

Submersible Pump.

MATERIALS

Cement (sks.) 3 sks

Filter Pack Material (ft.^{3}) 9 sks

Casing Material (ft.) 200-ft

Bentonite (ft.^{3}) 3 buckets

Top of Bentonite Seal 167.0 ft.

Top of Filter Pack 173.6 ft.

Top of Screen 180.0 ft.

Bottom of Screen 200.0 ft.

Bottom of Hole 201.0 ft.

GROUT

BENTONITE

FILTER PACK

NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

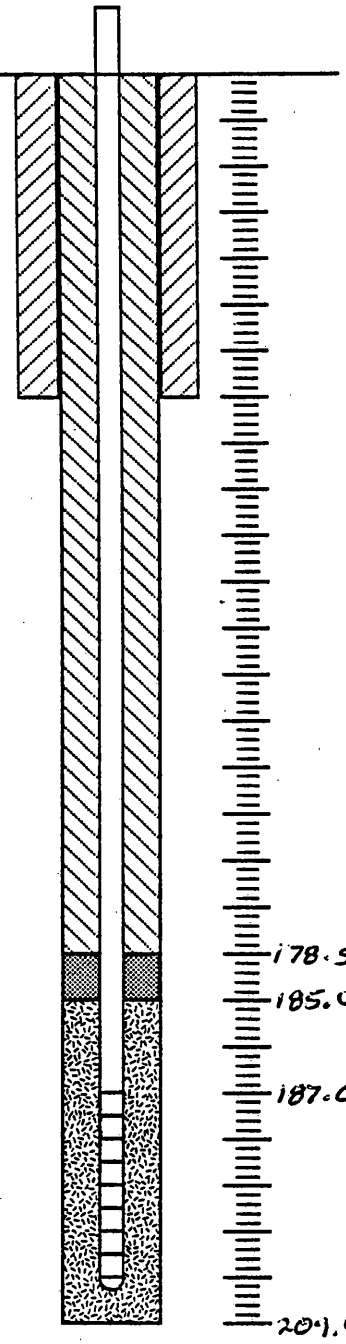
ERCE

WELL COMPLETION RECORD

JOB NO. 30273.001 WELL NO. DMW4 HYDROGEOLOGIST CED and SLD

CLIENT SEMCO DRILLER Layne Environmental

WELL LOCATION 2936 Industrial Pky DATE/TIME 3/9/91 @ 0915



Well Head Elevation _____

Ground Surface Elev. _____

Well Head Completion Method

Traffic Box

Drilling Method/Rig Type

DualWall / Drill Systems

Surface Casing: Type NA

Diameter –

Length –

DETAILS OF CONSTRUCTION

Date Completed 3-9-91

Borehole Diameter (in.) 10-in

Type and Size of Casing (in.) 4-in LCS*

Type and Size of Screen (in.) 4-in SS**

Screen Perforation Diameter (in.) 0.020-in

Screen Length (ft.) 20 ft

Centralizer Depths (ft.) NA, –, –, –,

Completion Technique:

1) Type of Filter Pack and Placement Method

Lonestar #3 / Tremie

2) Type of Bentonite and Placement Method

1/4-in Volclay Tablets / Tremie

3) Type of Grout Mixture and Placement Method

Volclay Grout / Tremie (23 bgs)

Description of Potential Problems With Well:

Notes

* LCS = Low Carbon Steel

** SS = Stainless Steel

Development Technique

Submersible Pump.

MATERIALS

~~Cement~~ (sks.) 3 sks

Filter Pack Material (ft.^{3}) 9 sks

Casing Material (ft.) 210

Bentonite (ft.^{3}) 4 buckets

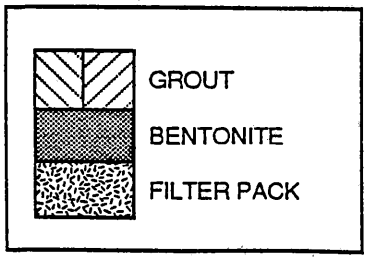
Top of Bentonite Seal 178.5 ft.

Top of Filter Pack 185.0 ft.

Top of Screen 187.0 ft.

Bottom of Screen 207.0 ft.

Bottom of Hole 209.4' ft.



NOTE: ALL DEPTHS ARE REFERENCED TO GROUND SURFACE

APPENDIX D

LABORATORY ANALYTICAL RESULTS

AnalyticalTechnologies, Inc. Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

ATI I.D.: 103132

April 03, 1991

ERC ENVIRONMENTAL
5510 MOREHOUSE DR.
SAN DIEGO, CA 92121

Project Name: SEMCO
Project # : 30273.003

Attention: CHRISTOPHER E. DIERCKS

Analytical Technologies, Inc. has received the following sample(s):

Date Received	Quantity	Matrix
March 12, 1991	7	SOIL

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed.

TIMOTHY J. FITZPATRICK
SENIOR PROJECT MANAGER

for: RICHARD M. AMANO
LABORATORY MANAGER

AnalyticalTechnologies,Inc.

SAMPLE CROSS REFERENCE

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

Report Date: April 03, 1991
ATI I.D. : 103132

ATI #	Client Description	Matrix	Date Collected
1	DMW3-1	SOIL	07-MAR-91
2	DMW3-2	SOIL	07-MAR-91
3	DMW3-3	SOIL	07-MAR-91
4	DMW3-4	SOIL	07-MAR-91
5	DMW4-1	SOIL	08-MAR-91
6	DMW4-2	SOIL	08-MAR-91
7	DMW4-3	SOIL	08-MAR-91

---TOTALS---

Matrix	# Samples
SOIL	7

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in twenty-one (21) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies,Inc.

ANALYTICAL SCHEDULE

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D.: 103132

Analysis	Technique/Description
EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)	GC/PHOTO IONIZATION/ELEC.COND. DETECTOR
EPA 9060 (TOTAL ORGANIC CARBON)	TOTAL ORGANIC CARBON ANALYZER

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D.: 103132

Sample #	Client ID	Matrix	Date Sampled	Date Received
1	DMW3-1	SOIL	07-MAR-91	12-MAR-91
2	DMW3-2	SOIL	07-MAR-91	12-MAR-91
3	DMW3-3	SOIL	07-MAR-91	12-MAR-91
4	DMW3-4	SOIL	07-MAR-91	12-MAR-91

Parameter	Units	1	2	3	4
TOTAL ORGANIC CARBON	MG/KG	339	324	208	357

AnalyticalTechnologies,Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

DUP/MS

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103132

Parameters	REF I.D.	Units	Sample Result	Dup Result	RPD	Spiked Sample	Spike Conc	% Rec
TOTAL ORGANIC CARBON	103132-03	MG/KG	208	186	11	826	844	73

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Sample Result - Duplicate Result)*100/Average Result

AnalyticalTechnologies,Inc.

GENERAL CHEMISTRY - QUALITY CONTROL

BLANK SPIKE

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103132

Parameters	Blank Spike ID#	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
TOTAL ORGANIC CARBON	11454	MG/KG	<5.0	575	543	106

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Sample Result - Duplicate Result)*100/Average Result

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Client : ERC ENVIRONMENTAL
ATI I.D. : 103132
Project # : 30273.003
Project Name: SEMCO

Sample #	Client ID	Matrix	Date Sampled	Date Extracted	Date Analyzed	Dil. Factor
1	DMW3-1	SOIL	07-MAR-91	13-MAR-91	19-MAR-91	1.00
2	DMW3-2	SOIL	07-MAR-91	13-MAR-91	20-MAR-91	1.00
3	DMW3-3	SOIL	07-MAR-91	13-MAR-91	20-MAR-91	1.00

Parameter	Units	1	2	3
BENZENE	MG/KG	<0.025	0.035	<0.025
BROMODICHLOROMETHANE	MG/KG	<0.01	<0.01	<0.01
BROMOFORM	MG/KG	<0.01	<0.01	<0.01
BROMOMETHANE	MG/KG	<0.01	<0.01	<0.01
CARBON TETRACHLORIDE	MG/KG	<0.01	<0.01	<0.01
CHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
CHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
CHLOROFORM	MG/KG	<0.01	<0.01	<0.01
CHLOROMETHANE	MG/KG	<0.01	<0.01	<0.01
DIBROMOCHLOROMETHANE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
1,3-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
1,4-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
DICHLORODIFLUOROMETHANE	MG/KG	<0.01	<0.01	<0.01
1,1-DICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,1-DICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
CIS-1,2-DICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
TRANS-1,2-DICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROPROPANE	MG/KG	<0.01	<0.01	<0.01
CIS-1,3-DICHLOROPROPENE	MG/KG	<0.01	<0.01	<0.01
TRANS-1,3-DICHLOROPROPENE	MG/KG	<0.01	<0.01	<0.01
ETHYLBENZENE	MG/KG	<0.025	<0.025	<0.025
METHYLENE CHLORIDE	MG/KG	<0.1	<0.1	<0.1
1,1,2,2-TETRACHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
TETRACHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
TOLUENE	MG/KG	<0.025	0.078	<0.025
1,1,1-TRICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,1,2-TRICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
TRICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
TRICHLOROFLUOROMETHANE	MG/KG	<0.1	<0.1	<0.1
VINYL CHLORIDE	MG/KG	<0.01	<0.01	<0.01
XYLENES (TOTAL)	MG/KG	<0.05	<0.05	<0.05
SURROGATES				
BROMOFLUOROBENZENE (ELCD)	%	96	95	88
BROMOFLUOROBENZENE (PID)	%	104	110	108

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO
ATI I.D. : 103132

Sample #	Client ID	Matrix	Date Sampled	Date Extracted	Date Analyzed	Dil. Factor
4	DMW3-4	SOIL	07-MAR-91	13-MAR-91	20-MAR-91	1.00
5	DMW4-1	SOIL	08-MAR-91	13-MAR-91	20-MAR-91	1.00
6	DMW4-2	SOIL	08-MAR-91	20-MAR-91	20-MAR-91	1.00

Parameter	Units	4	5	6
BENZENE	MG/KG	<0.025	<0.025	<0.025
BROMODICHLOROMETHANE	MG/KG	<0.01	<0.01	<0.01
BROMOFORM	MG/KG	<0.01	<0.01	<0.01
BROMOMETHANE	MG/KG	<0.01	<0.01	<0.01
CARBON TETRACHLORIDE	MG/KG	<0.01	<0.01	<0.01
CHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
CHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
CHLOROFORM	MG/KG	<0.01	<0.01	<0.01
CHLOROMETHANE	MG/KG	<0.01	<0.02	<0.01
DIBROMOCHLOROMETHANE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
1,3-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
1,4-DICHLOROBENZENE	MG/KG	<0.025	<0.025	<0.025
DICHLORODIFLUOROMETHANE	MG/KG	<0.01	<0.01	<0.01
1,1-DICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,1-DICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
CIS-1,2-DICHLOROETHENE	MG/KG	<0.01	0.02	<0.01
TRANS-1,2-DICHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
1,2-DICHLOROPROPANE	MG/KG	<0.01	<0.01	<0.01
CIS-1,3-DICHLOROPROPENE	MG/KG	<0.01	<0.01	<0.01
TRANS-1,3-DICHLOROPROPENE	MG/KG	<0.01	<0.01	<0.01
ETHYLBENZENE	MG/KG	<0.025	<0.025	<0.025
METHYLENE CHLORIDE	MG/KG	<0.1	<0.1	<0.1
1,1,2,2-TETRACHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
TETRACHLOROETHENE	MG/KG	<0.01	<0.01	<0.01
TOLUENE	MG/KG	<0.025	<0.025	<0.025
1,1,1-TRICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
1,1,2-TRICHLOROETHANE	MG/KG	<0.01	<0.01	<0.01
TRICHLOROETHENE	MG/KG	<0.01	0.25	0.05
TRICHLOROFLUOROMETHANE	MG/KG	<0.1	<0.1	<0.1
VINYL CHLORIDE	MG/KG	<0.01	<0.01	<0.01
XYLENES (TOTAL)	MG/KG	<0.05	<0.05	<0.05
SURROGATES				
BROMOFLUOROBENZENE (ELCD)	%	89	88	92
BROMOFLUOROBENZENE (PID)	%	103	97	108

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Client : ERC ENVIRONMENTAL ATI I.D. : 103132
Project # : 30273.003
Project Name: SEMCO

Sample #	Client ID	Matrix	Date Sampled	Date Extracted	Date Analyzed	Dil. Factor
7	DMW4-3	SOIL	08-MAR-91	13-MAR-91	20-MAR-91	1.00

Parameter	Units	7
BENZENE	MG/KG	<0.025
BROMODICHLOROMETHANE	MG/KG	<0.01
BROMOFORM	MG/KG	<0.01
BROMOMETHANE	MG/KG	<0.01
CARBON TETRACHLORIDE	MG/KG	<0.01
CHLOROBENZENE	MG/KG	<0.025
CHLOROETHANE	MG/KG	<0.01
CHLOROFORM	MG/KG	<0.01
CHLOROMETHANE	MG/KG	<0.01
DIBROMOCHLOROMETHANE	MG/KG	<0.01
1,2-DICHLOROBENZENE	MG/KG	<0.025
1,3-DICHLOROBENZENE	MG/KG	<0.025
1,4-DICHLOROBENZENE	MG/KG	<0.025
DICHLORODIFLUOROMETHANE	MG/KG	<0.01
1,1-DICHLOROETHANE	MG/KG	<0.01
1,2-DICHLOROETHANE	MG/KG	<0.01
1,1-DICHLOROETHENE	MG/KG	<0.01
CIS-1,2-DICHLOROETHENE	MG/KG	<0.01
TRANS-1,2-DICHLOROETHENE	MG/KG	<0.01
1,2-DICHLOROPROPANE	MG/KG	<0.01
CIS-1,3-DICHLOROPROPENE	MG/KG	<0.01
TRANS-1,3-DICHLOROPROPENE	MG/KG	<0.01
ETHYLBENZENE	MG/KG	<0.025
METHYLENE CHLORIDE	MG/KG	<0.1
1,1,2,2-TETRACHLOROETHANE	MG/KG	<0.01
TETRACHLOROETHENE	MG/KG	<0.01
TOLUENE	MG/KG	<0.025
1,1,1-TRICHLOROETHANE	MG/KG	<0.01
1,1,2-TRICHLOROETHANE	MG/KG	<0.01
TRICHLOROETHENE	MG/KG	<0.01
TRICHLOROFLUOROMETHANE	MG/KG	<0.1
VINYL CHLORIDE	MG/KG	<0.01
XYLENES (TOTAL)	MG/KG	<0.05
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	96
BROMOFLUOROBENZENE (PID)	%	120

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

REAGENT BLANK

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Blank I.D. : 11125
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103132
Date Extracted: 20-MAR-91
Date Analyzed : 20-MAR-91
Dil. Factor : 1.00

Parameters	Units	Results
BENZENE	MG/KG	<0.025
BROMODICHLOROMETHANE	MG/KG	<0.01
BROMOFORM	MG/KG	<0.01
BROMOMETHANE	MG/KG	<0.01
CARBON TETRACHLORIDE	MG/KG	<0.01
CHLOROBENZENE	MG/KG	<0.025
CHLOROETHANE	MG/KG	<0.01
CHLOROFORM	MG/KG	<0.01
CHLOROMETHANE	MG/KG	<0.01
DIBROMOCHLOROMETHANE	MG/KG	<0.01
1,2-DICHLOROBENZENE	MG/KG	<0.025
1,3-DICHLOROBENZENE	MG/KG	<0.025
1,4-DICHLOROBENZENE	MG/KG	<0.025
DICHLORODIFLUOROMETHANE	MG/KG	<0.01
1,1-DICHLOROETHANE	MG/KG	<0.01
1,2-DICHLOROETHANE	MG/KG	<0.01
1,1-DICHLOROETHENE	MG/KG	<0.01
CIS-1,2-DICHLOROETHENE	MG/KG	<0.01
TRANS-1,2-DICHLOROETHENE	MG/KG	<0.01
1,2-DICHLOROPROPANE	MG/KG	<0.01
CIS-1,3-DICHLOROPROPENE	MG/KG	<0.01
TRANS-1,3-DICHLOROPROPENE	MG/KG	<0.01
ETHYLBENZENE	MG/KG	<0.025
METHYLENE CHLORIDE	MG/KG	<0.1
1,1,2,2-TETRACHLOROETHANE	MG/KG	<0.01
TETRACHLOROETHENE	MG/KG	<0.01
TOLUENE	MG/KG	<0.025
1,1,1-TRICHLOROETHANE	MG/KG	<0.01
1,1,2-TRICHLOROETHANE	MG/KG	<0.01
TRICHLOROETHENE	MG/KG	<0.01
TRICHLOROFLUOROMETHANE	MG/KG	<0.1
VINYL CHLORIDE	MG/KG	<0.01
XYLENES (TOTAL)	MG/KG	<0.05
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	103
BROMOFLUOROBENZENE (PID)	%	95

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

REAGENT BLANK

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Blank I.D. : 11125
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103132
Date Extracted: 20-MAR-91
Date Analyzed : 20-MAR-91
Dil. Factor : 1.00

Parameters	Units	Results
BENZENE	MG/KG	<0.025
BROMODICHLOROMETHANE	MG/KG	<0.01
BROMOFORM	MG/KG	<0.01
BROMOMETHANE	MG/KG	<0.01
CARBON TETRACHLORIDE	MG/KG	<0.01
CHLOROBENZENE	MG/KG	<0.025
CHLOROETHANE	MG/KG	<0.01
CHLOROFORM	MG/KG	<0.01
CHLOROMETHANE	MG/KG	<0.01
DIBROMOCHLOROMETHANE	MG/KG	<0.01
1,2-DICHLOROBENZENE	MG/KG	<0.025
1,3-DICHLOROBENZENE	MG/KG	<0.025
1,4-DICHLOROBENZENE	MG/KG	<0.025
DICHLORODIFLUOROMETHANE	MG/KG	<0.01
1,1-DICHLOROETHANE	MG/KG	<0.01
1,2-DICHLOROETHANE	MG/KG	<0.01
1,1-DICHLOROETHENE	MG/KG	<0.01
CIS-1,2-DICHLOROETHENE	MG/KG	<0.01
TRANS-1,2-DICHLOROETHENE	MG/KG	<0.01
1,2-DICHLOROPROPANE	MG/KG	<0.01
CIS-1,3-DICHLOROPROPENE	MG/KG	<0.01
TRANS-1,3-DICHLOROPROPENE	MG/KG	<0.01
ETHYLBENZENE	MG/KG	<0.025
METHYLENE CHLORIDE	MG/KG	<0.1
1,1,2,2-TETRACHLOROETHANE	MG/KG	<0.01
TETRACHLOROETHENE	MG/KG	<0.01
TOLUENE	MG/KG	<0.025
1,1,1-TRICHLOROETHANE	MG/KG	<0.01
1,1,2-TRICHLOROETHANE	MG/KG	<0.01
TRICHLOROETHENE	MG/KG	<0.01
TRICHLOROFLUOROMETHANE	MG/KG	<0.1
VINYL CHLORIDE	MG/KG	<0.01
XYLENES (TOTAL)	MG/KG	<0.05
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	103
BROMOFLUOROBENZENE (PID)	%	95

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
MSMSD # : 11735
Client : ERC ENVIRONMENTAL

Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103132
Date Extracted: 13-MAR-91
Date Analyzed : 19-MAR-91
Sample Matrix : SOIL
REF I.D. : 103132-07

Parameters	Units	Sample Result	Conc Spike	Spiked Sample	% Rec	Dup Spike	Dup % Rec	RPD
BENZENE	MG/KG	<0.025	0.50	0.54	108	0.53	105	2
CHLOROBENZENE	MG/KG	<0.025	0.20	0.21	105	0.22	110	5
CHLOROFORM	MG/KG	<0.010	0.20	0.20	100	0.20	100	0
1,1-DICHLOROETHENE	MG/KG	<0.010	0.20	0.22	110	0.17	85	26
TETRACHLOROETHENE	MG/KG	<0.010	0.20	0.21	105	0.21	105	0
TOLUENE	MG/KG	<0.025	0.50	0.53	106	0.55	110	4
TRICHLOROETHENE	MG/KG	<0.010	0.20	0.21	105	0.21	105	0

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Spiked Sample Result - Duplicate Spike Result)*100/Average Result

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

BLANK SPIKE

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Blank Spike #: 10896
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name : SEMCO

ATI I.D. : 103132
Date Extracted: 13-MAR-91
Date Analyzed : 16-MAR-91
Sample Matrix : SOIL

Parameters	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
BENZENE	MG/KG	<0.025	0.48	0.50	96
CHLOROBENZENE	MG/KG	<0.025	0.20	0.20	100
CHLOROFORM	MG/KG	<0.010	0.19	0.20	95
1,1-DICHLOROETHENE	MG/KG	<0.010	0.20	0.20	100
TETRACHLOROETHENE	MG/KG	<0.010	0.19	0.20	95
TOLUENE	MG/KG	<0.025	0.49	0.50	98
TRICHLOROETHENE	MG/KG	<0.010	0.20	0.20	100

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Spiked Sample - Blank Result)*100/Average Result

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

BLANK SPIKE

Test : EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)
Blank Spike #: 11245
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name : SEMCO

ATI I.D. : 103132
Date Extracted: 20-MAR-91
Date Analyzed : 25-MAR-91
Sample Matrix : SOIL

Parameters	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
BENZENE	MG/KG	<0.025	0.57	0.50	114
CHLOROBENZENE	MG/KG	<0.025	0.22	0.20	110
CHLOROFORM	MG/KG	<0.010	0.20	0.20	100
1,1-DICHLOROETHENE	MG/KG	<0.010	0.23	0.20	115
TETRACHLOROETHENE	MG/KG	<0.010	0.22	0.20	110
TOLUENE	MG/KG	<0.025	0.55	0.50	110
TRICHLOROETHENE	MG/KG	<0.010	0.21	0.20	105

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative % Difference) = (Spiked Sample - Blank Result)*100/Average Result

Analytical Technologies, Inc.
5550 Morehouse Drive • San Diego, CA 92121-1709

Chain of Custody

DATE 3/8/91 PAGE 1 OF 1

PROJECT MANAGER: Chris Dierchs
COMPANY: ERCE
ADDRESS: 5510 Morehouse Dr. San Diego CA. 92121

BILL TO: Same as above
COMPANY:
ADDRESS:

Christopher E. Dierchs (619) 458-9044 ext 361
SAMPLERS: (Signature) PHONE NUMBER

Recommended Quantity and Preservative (Provide triple volume on QC Samples)

	SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons 418.1 (1L (H_2SO_4)/100g)	Oil and Grease 413.2 (1L (H_2SO_4)/100g)	Gasoline (MOD 8015/DOHS) (4 oz (HCl)/50g)	Diesel (MOD 8015/DOHS) (4 oz (HCl)/50g)	Gasoline/BTXE (MOD 8015/8020) (4 oz (HCl)/50g)	Pet.Distillates (C6-C25,MOD 8015) (4 oz (HCl)/50g)	BTXE (8020) (2X40ml (HCl)/50g)	Chlorinated Hydrocarbons (8010) (2X40ml (HCl)/50g)	Aromatic Hydrocarbons (8020) (2X40ml (HCl)/50g)	Chlorinated/Aromatic Hydrocarbons (8010/8020) (2X40ml (HCl)/50g)	Organic Pb (500ml/50g)	Pesticides/PCB (8080) (1L/50g)	Base/NEU/Acid Cmpds GC/MS (8270) (1L/100g)	Volatile Cmpds GC/MS (8240) (2X40ml (HCl)/100g)	Polynuclear Aromatic (8310) (1L/100g)	CCR Metals (500ml/100g)	Priority Pollutant Metals (500ml/100g)	Total Organic Carbon	Number of Containers
01	DMW3-1 3/7/91	3/7/91	1205	Soil											X								X		1
02	DMW3-2	3/7/91	1225	"											X								X		1
03	DMW3-3	3/7/91	1235	"											X								X		1
04	DMW3-4	3/7/91	1410	"											X								X		1
05	DMW4-1	3/8/91	1342	"											X										1
06	DMW4-2	3/8/91	1358	"											X										1
07	DMW4-3	3/8/91	1425	"											X										1

PROJECT INFORMATION	
PROJECT NUMBER:	30273.003
PROJECT NAME:	SEMCO
PURCHASE ORDER NUMBER:	
VIA:	Handcarry
TAT:	☐ 24HR ☐ 48 HRS ☐ 1 WK ☒ 2 WKS

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	7
CHAIN OF CUSTODY SEALS Y/N/NA	N
INTACT? Y/N/NA	NA
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	1373132

SAMPLE DISPOSAL INSTRUCTIONS
☒ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

Comments:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Christopher E. Dierchs Time: 830	Signature: Time:	Signature: Time:
Printed Name: Christopher E. Dierchs Date:	Printed Name: Date:	Printed Name: Date:
Company: ERCE	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Michael Hallorn Time: 0830
Printed Name: Date:	Printed Name: Date:	Printed Name: Michael Hallorn Date: 3/12/91
Company:	Company:	Analytical Technologies, Inc.

ATI LABORATORIES: San Diego (619) 458-9141 • Phoenix (602) 438-1530 • Seattle (206) 228-8335 DISTRIBUTION: White, Canary - ANALYTICAL TECHNOLOGIES, INC. • Pink - ORIGINATOR

AnalyticalTechnologies, Inc. Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

ATI I.D.: 103328

March 29, 1991

ERC ENVIRONMENTAL
5510 MOREHOUSE DR.
SAN DIEGO, CA 92121

Project Name: SEMCO
Project # : 30273.003

Attention: CHRISTOPHER E. DIERCKS

Analytical Technologies, Inc. has received the following sample(s):

Date Received	Quantity	Matrix
March 23, 1991	4	WATER

The sample(s) were analyzed with EPA methodology or equivalent methods as specified in the enclosed analytical schedule. The symbol for "less than" indicates a value below the reportable detection limit. Please see the attached sheet for the sample cross reference table.

The results of these analyses and the quality control data are enclosed.

TJ Fitzpatrick
TIMOTHY J. FITZPATRICK
SENIOR PROJECT MANAGER

RICHARD M. AMANO
LABORATORY MANAGER

AnalyticalTechnologies,Inc.

SAMPLE CROSS REFERENCE

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

Report Date: March 29, 1991
ATI I.D. : 103328

ATI #	Client Description	Matrix	Date Collected
1	DMW3-3-91	WATER	22-MAR-91
2	DMW3-3-91D	WATER	22-MAR-91
3	DMW4-3-91	WATER	22-MAR-91
4	TRIP BLANK	WATER	22-MAR-91

---TOTALS---

Matrix	# Samples
WATER	4

ATI STANDARD DISPOSAL PRACTICE

The sample(s) from this project will be disposed of in twenty-one (21) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies,Inc.

ANALYTICAL SCHEDULE

Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D.: 103328

Analysis	Technique/Description
EPA 8010/8020 (HALOGENATED/AROMATIC VOLATILES)	GC/ELCD/PID

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Client : ERC ENVIRONMENTAL ATI I.D. : 103328
Project # : 30273.003
Project Name: SEMCO

Sample #	Client ID	Matrix	Date Sampled	Date Extracted	Date Analyzed	Dil. Factor
1	DMW3-3-91	WATER	22-MAR-91	N/A	26-MAR-91	2.00
2	DMW3-3-91D	WATER	22-MAR-91	N/A	26-MAR-91	2.00
3	DMW4-3-91	WATER	22-MAR-91	N/A	26-MAR-91	1.00

Parameter	Units	1	2	3
BENZENE	UG/L	<1	<1	<0.5
BROMODICHLOROMETHANE	UG/L	<0.4	<0.4	<0.2
BROMOFORM	UG/L	<0.4	<0.4	<0.2
BROMOMETHANE	UG/L	<0.4	<0.4	<0.2
CARBON TETRACHLORIDE	UG/L	<0.4	<0.4	<0.2
CHLOROBENZENE	UG/L	<1	<1	<0.5
CHLOROETHANE	UG/L	<0.4	<0.4	<0.2
CHLOROFORM	UG/L	<0.4	<0.4	<0.2
CHLOROMETHANE	UG/L	<0.4	<0.4	<0.2
DIBROMOCHLOROMETHANE	UG/L	<0.4	<0.4	<0.2
1,2-DICHLOROBENZENE	UG/L	<1	<1	<0.5
1,3-DICHLOROBENZENE	UG/L	<1	<1	<0.5
1,4-DICHLOROBENZENE	UG/L	<1	<1	<0.5
DICHLORODIFLUOROMETHANE	UG/L	<0.4	<0.4	<0.2
1,1-DICHLOROETHANE	UG/L	<0.4	<0.4	<0.2
1,2-DICHLOROETHANE	UG/L	<0.4	<0.4	<0.2
1,1-DICHLOROETHENE	UG/L	<0.4	<0.4	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	1.4	1.4	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<0.4	<0.4	<0.2
1,2-DICHLOROPROPANE	UG/L	<0.4	<0.4	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.4	<0.4	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.4	<0.4	<0.2
ETHYLBENZENE	UG/L	<1	<1	<0.5
METHYLENE CHLORIDE	UG/L	<4	<4	<2
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.4	<0.4	<0.2
TETRACHLOROETHENE	UG/L	<0.4	<0.4	<0.2
TOLUENE	UG/L	<1	<1	6.5
1,1,1-TRICHLOROETHANE	UG/L	<0.4	<0.4	<0.2
1,1,2-TRICHLOROETHANE	UG/L	<0.4	<0.4	<0.2
TRICHLOROETHENE	UG/L	21	22	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<4	<4	<2
VINYL CHLORIDE	UG/L	<0.4	<0.4	<0.2
XYLENES (TOTAL)	UG/L	<2	<2	<1
SURROGATES				
BROMOFLUOROBENZENE (ELCD)	%	94	82	102
BROMOFLUOROBENZENE (PID)	%	109	94	120

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Client : ERC ENVIRONMENTAL
ATI I.D. : 103328
Project # : 30273.003
Project Name: SEMCO

Sample #	Client ID	Matrix	Date Sampled	Date Extracted	Date Analyzed	Dil. Factor
4	TRIP BLANK	WATER	22-MAR-91	N/A	25-MAR-91	1.00

Parameter	Units	4
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.2
BROMOMETHANE	UG/L	<0.2
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.2
CHLOROFORM	UG/L	<0.2
CHLOROMETHANE	UG/L	<0.2
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
DICHLORODIFLUOROMETHANE	UG/L	<0.2
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE	UG/L	<0.2
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<0.2
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYLENE CHLORIDE	UG/L	<2
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<0.2
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<2
VINYL CHLORIDE	UG/L	<0.2
XYLENES (TOTAL)	UG/L	<1
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	106
BROMOFLUOROBENZENE (PID)	%	121

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GAS CHROMATOGRAPHY - QUALITY CONTROL

REAGENT BLANK

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Blank I.D. : 11157
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103328
Date Extracted: N/A
Date Analyzed : 26-MAR-91
Dil. Factor : 1.00

Parameters	Units	Results
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.2
BROMOMETHANE	UG/L	<0.2
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.2
CHLOROFORM	UG/L	<0.2
CHLOROMETHANE	UG/L	<0.2
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
DICHLORODIFLUOROMETHANE	UG/L	<0.2
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE	UG/L	<0.2
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<0.2
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
METHYLENE CHLORIDE	UG/L	<2
ETHYLBENZENE	UG/L	<0.5
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
1,1,1-TRICHLOROETHANE	UG/L	<0.2
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TOLUENE	UG/L	<0.5
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<2
VINYL CHLORIDE	UG/L	<0.2
XYLENES (TOTAL)	UG/L	<1
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	98
BROMOFLUOROBENZENE (PID)	%	112

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GAS CHROMATOGRAPHY - QUALITY CONTROL

REAGENT BLANK

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Blank I.D. : 11170
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103328
Date Extracted: N/A
Date Analyzed : 25-MAR-91
Dil. Factor : 1.00

Parameters	Units	Results
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.2
BROMOMETHANE	UG/L	<0.2
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.2
CHLOROFORM	UG/L	<0.2
CHLOROMETHANE	UG/L	<0.2
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
DICHLORODIFLUOROMETHANE	UG/L	<0.2
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE	UG/L	<0.2
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<0.2
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYLENE CHLORIDE	UG/L	<2
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<0.2
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<2
VINYL CHLORIDE	UG/L	<0.2
XYLENES (TOTAL)	UG/L	<1
SURROGATES		
BROMOFLUOROBENZENE (ELCD)	%	75
BROMOFLUOROBENZENE (PID)	%	106

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GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

Test : EPA 8010/8020 (VOLATILE ORGANICS)
MSMSD # : 12338
Client : ERC ENVIRONMENTAL

Project # : 30273.003
Project Name: SEMCO

ATI I.D. : 103328
Date Extracted: N/A
Date Analyzed : 27-MAR-91
Sample Matrix : WATER
REF I.D. : 103330-16

Parameters	Units	Sample Result	Conc Spike	Spiked Sample	% Rec	Dup Spike	Dup % Rec	RPD
BENZENE	UG/L	<0.50	2.00	2.0	100	2.1	105	5
CHLOROBENZENE	UG/L	<0.50	2.00	1.8	90	1.9	95	5
CHLOROFORM	UG/L	<0.20	2.00	2.0	100	2.1	105	5
1,1-DICHLOROETHENE	UG/L	<0.20	2.00	2.1	105	2.1	105	0
TETRACHLOROETHENE	UG/L	<0.20	2.00	2.1	105	2.2	110	0
TOLUENE	UG/L	<0.50	2.00	2.1	105	2.1	105	0
TRICHLOROETHENE	UG/L	<0.20	2.00	2.2	110	2.3	115	4

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative Percent Difference) = (Sample Result - Duplicate Result)*100/Average Result

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GAS CHROMATOGRAPHY - QUALITY CONTROL

BLANK SPIKE

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Blank Spike #: 11283
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name : SEMCO

ATI I.D. : 103328
Date Extracted: N/A
Date Analyzed : 26-MAR-91
Sample Matrix : WATER

Parameters	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
BENZENE	UG/L	<0.50	2.0	2.0	100
CHLOROBENZENE	UG/L	<0.50	2.0	2.0	100
CHLOROFORM	UG/L	<0.20	1.9	2.0	95
1,1-DICHLOROETHENE	UG/L	<0.20	2.0	2.0	100
TETRACHLOROETHENE	UG/L	<0.20	2.1	2.0	105
TOLUENE	UG/L	<0.50	2.0	2.0	100
TRICHLOROETHENE	UG/L	<0.20	2.3	2.0	115

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative Percent Difference) = (Sample Result - Duplicate Result)*100/Average Result

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

BLANK SPIKE

Test : EPA 8010/8020 (VOLATILE ORGANICS)
Blank Spike #: 11308
Client : ERC ENVIRONMENTAL
Project # : 30273.003
Project Name : SEMCO

ATI I.D. : 103328
Date Extracted: N/A
Date Analyzed : 25-MAR-91
Sample Matrix : WATER

Parameters	Units	Blank Result	Spiked Sample	Spike Conc.	% Rec
BENZENE	UG/L	<0.50	2.00	2.0	100
CHLOROBENZENE	UG/L	<0.50	2.00	2.0	100
CHLOROFORM	UG/L	<0.20	1.8	2.0	90
1,1-DICHLOROETHENE	UG/L	<0.20	1.8	2.0	90
TETRACHLOROETHENE	UG/L	<0.20	2.1	2.0	105
TOLUENE	UG/L	<0.50	2.0	2.0	100
TRICHLOROETHENE	UG/L	<0.20	2.2	2.0	110

% Recovery = (Spike Sample Result - Sample Result)*100/Spike Concentration
RPD (Relative Percent Difference) = (Sample Result - Duplicate Result)*100/Average Result

Analytical Technologies, Inc.
5550 Morehouse Drive • San Diego, CA 92121-1709

Chain of Custody

DATE 3-23-91 PAGE 1 OF 1

PROJECT MANAGER: Chris Dierks
COMPANY: ERCE
ADDRESS: 5510 Morehous Drive San Diego Ca 92121

BILL TO: Same as Above
COMPANY:
ADDRESS:

Suzanne Dalo — SAMPLERS: (Signature)
(619) 458-9044 — PHONE NUMBER

Recommended Quantity and Preservative (Provide triple volume on QC Samples)

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons 418.1 (1L (H_2SO_4)/100g)	Oil and Grease 413.2 (1L (H_2SO_4)/100g)	Gasoline (MOD 8015/DOHS) (4 oz (HCl)/50g)	Diesel (MOD 8015/DOHS) (4 oz (HCl)/50g)	Gasoline/BTXE (MOD 8015/8020) (4 oz (HCl)/50g)	(C6-C25,MOD 8015) (4 oz (HCl)/50g)	BTXE (8020) (2X40ml (HCl)/50g)	Chlorinated Hydrocarbons (8010) (2X40ml (HCl)/50g)	Aromatic Hydrocarbons (8020) (2X40ml (HCl)/50g)	Chlorinated/Aromatic Hydrocarbons (8010/8020) (2X40ml (HCl)/50g)	Organic Pb (500ml/50g)	Pesticides/PCB (8080) (1L/50g)	Base/NEU/Acid Cmpds GC/MS (8270) (1L/100g)	Volatile Cmpds GC/MS (8240) (2X40ml (HCl)/100g)	Polynuclear Aromatic (8310) (1L/100g)	CCR Metals (500ml/100g)	Priority Pollutant Metals (500ml/100g)	Number of Containers
DMW3-3-91	3-22-91	1:45	H_2O	01										X								2
DMW3-3-91D	3-22-91	1:50	H_2O	02										X								2
DMW4-3-91	3-22-91	2:26	H_2O	03										X								2
Trip Blank	~~3-22-91~~			04										X								2

PROJECT INFORMATION	
PROJECT NUMBER:	30273.003
PROJECT NAME:	SEMCO
PURCHASE ORDER NUMBER:	
VIA:	ERCE
TAT:	☐ 24HR ☐ 48 HRS ☒ 1 WK ☐ 2 WKS

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	8
CHAIN OF CUSTODY SEALS Y/N/NA	Y/N/A
INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	103328

SAMPLE DISPOSAL INSTRUCTIONS
☐ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)
Comments:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Suzanne Dalo Time:	Signature: Time:	Signature: Time:
Printed Name: Suzanne Dalo Date: 3-23-91	Printed Name: Date:	Printed Name: Date:
Company: ERCE	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Majid Hejazi Time: 6.37 p.m.
Printed Name: Date:	Printed Name: Date:	Printed Name: Majid Hejazi Date: 3-23-91
Company:	Company:	Analytical Technologies, Inc.

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