GROUNDWATER TECHNOLOGY, INC.

4057 Port Chicago Highway, Concord, CA 94520 (415) 671-2387

FAX: (415) 685-9148

LETTER OF TRANSMITTAL

TO:	Alameda County Health Agency, Department of Environmental Health	DATE: April 2, 1993
ADDRESS:	80 Swan Way, Room 200 Oakland, CA 94621	
ATTENTION:	Mr. Scott Seery	
PROJECT NUMBER:	Not Available	
PROJECT ADDRESS:	4904 South Front St., Livermore, CA	
SUBJECT:	Per your request in the December 29, 1992 letter to Mr. Brett Hunter, Chevron U.S.A., Inc., Groundwater Technology is forwarding copies of two reports pertaining to Chevron Service Station No. 9-1924. The reports referenced above are the Recovery System Report, dated December 12, 1985 and the Project Update Report, dated April 16, 1986.	

If you have any questions or comments, please contact our Concord office at (510-671-2387).

Sincerely,
GROUNDWATER TECHNOLOGY, INC.

S.C. Hurley, IV
Associate Geologist

cc: Brett Hunter, Chevron U.S.A., Inc.

GROUNDWATER
TECHNOLOGY
Consulting Groundwater Geologists
A Division of Oil Recovery Systems, Inc.
5047 CLAYTON ROAD • CONCORD, CA 94521 • (415) 671-2387

RECOVERY SYSTEM REPORT
CHEVRON U.S.A., INC.
LIVERMORE, CALIFORNIA

December 12, 1985

Prepared for:

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INTRODUCTION

In January of 1985, Groundwater Technology was contracted by Chevron U.S.A., Inc. to immediately proceed with an abatement program for a known gasoline spill at the Chevron Service Station in Livermore, California. The station is located on the northern corner of First Street and South Front Road adjacent to Highway 580. The location of the site relative to the general vicinity is shown on Figure 1, Site Location Map. The site and its location to adjacent roads is shown on Figure 2, Site Plan.

The abatement program was necessitated by the inadvertent loss of between 2,000 to 3,000 gallons of gasoline from a hole in one of the subsurface fuel storage tanks. The leak reportedly occurred in January 1985.

BACKGROUND

At the time of Groundwater Technology's initial involvement, a total of 17 monitoring wells had been installed by others at the study site. The preliminary drill logs provided to Groundwater Technology are included in Appendix I. Groundwater monitoring conducted by Groundwater Technology on January 16, 1985 produced data indicating a southwesterly groundwater gradient direction it was also determined that five wells located to the southwest of the tank location were impacted by free floating product with a maximum thickness of 0.83 feet. The free product plume appeared to extend up to, but not beyond, the drainage culvert which runs along the west side of the site. As shown on the site plan, the culvert travels underground towards the south beneath the Mobil Service Station across the street from the Chevron Station.

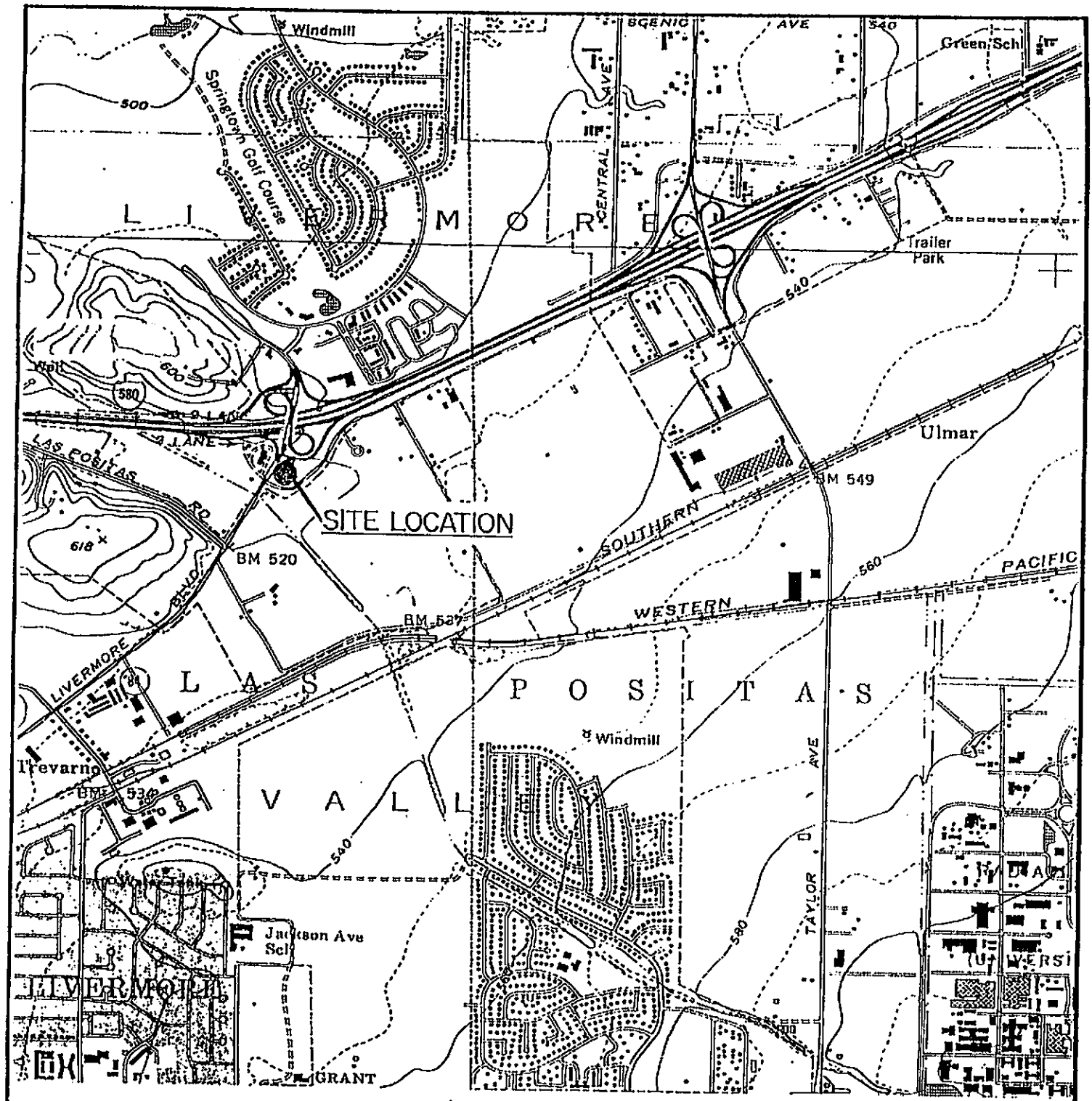

FIGURE 1

SITE LOCATION MAP

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0 MILES 1/2

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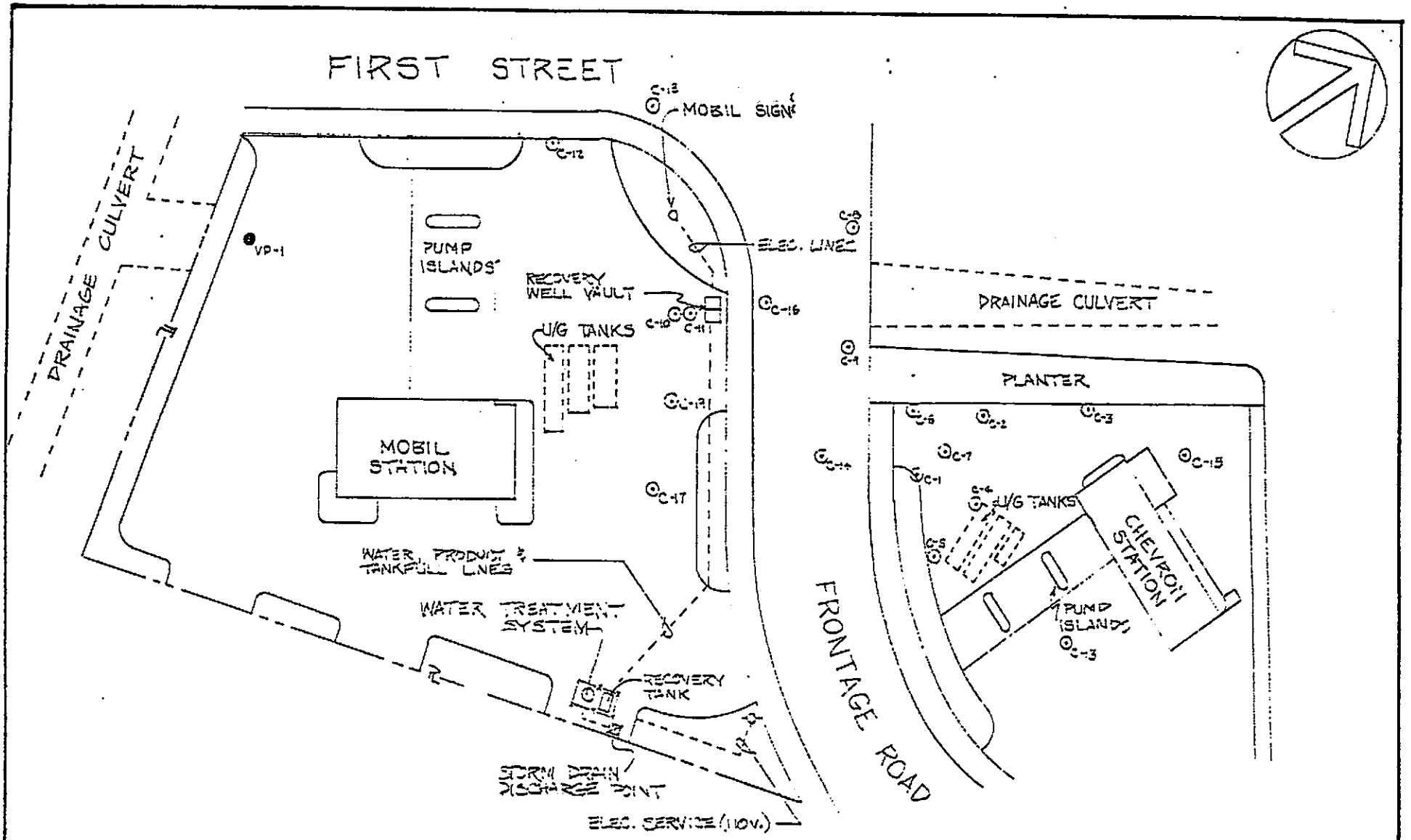

FIGURE 2

SITE PLAN

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It was postulated that the product may be intersecting and migrating within the backfill of this drainage culvert. Under this assumption and considering the southwesterly groundwater gradient direction, a recovery well was installed adjacent to the drainage culvert on the north corner of the Mobil Station property. The well location and the immediate installation of the recovery system was requested by Chevron to provide recovery of the free product and reduce the potential for further migration.

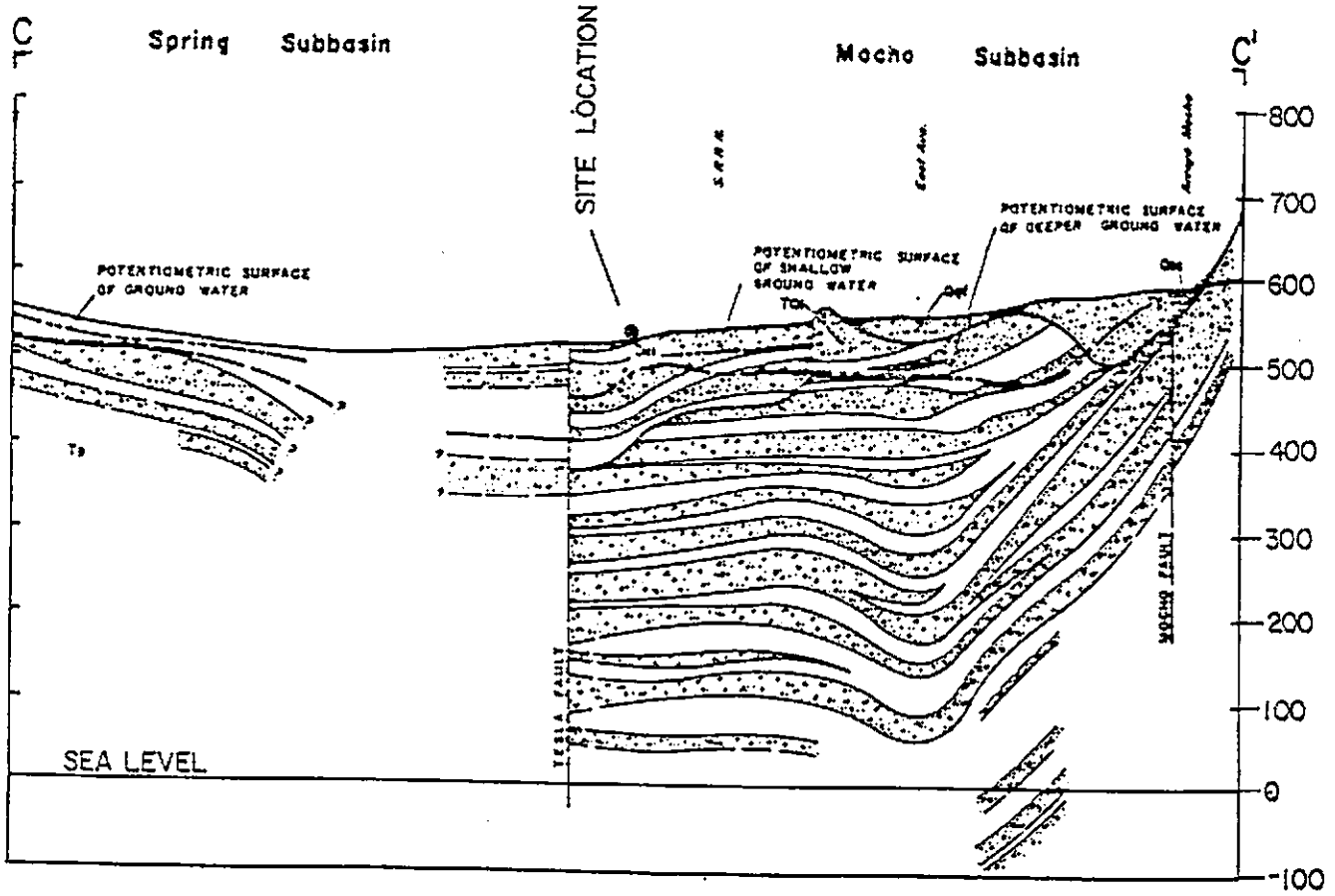
SETTING

The Chevron site is located in the north central portion of the Livermore Valley on the eastern outskirts of the San Francisco Bay Area. The site lies at an elevation of approximately 520 feet above mean sea level. Slope gradients across the property are approximately 2 percent, with the direction of slope being southerly towards the Arroyo Las Positas, the principal stream in the study area.

SOILS AND LOCAL GEOLOGY

The Livermore Valley is approximately 13 miles long in an east-west direction and 4 miles wide. The Chevron site lies in the north central portion of the valley and is in the Mocho groundwater subbasin II as defined by the California Department of Water Resources (DWR). The Mocho subbasin is bounded on the east by the Tesla fault and the west by the Macho Fault. Although the Tesla fault is located less that 1/4 mile east of the site, DWR data indicated that the fault does not effect movement in the shallow groundwater system (See cross section C-C' Figure 3).

Taken from "Evaluation of Groundwater Resources: Livermore and Sunol Valleys" Department of Water Resources, Bulletin No. 118-2 June 1974



CROSS SECTION C-C'

FIGURE 3

HORIZONTAL SCALE
1/2 0 1/2 1
MILES

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Unconsolidated alluvial deposits of upper Pleistocene and recent age, underlie the site to a depth of about 28 feet. These soils consist of silty clays, sands and gravels which in turn overlie the Tassajara Formation sediments. The Tassajara, as shown on Figure 4, Geologic Map, also forms the hills to the west of the site. The variability in soil types (clay to gravels) encountered in the stratigraphic sequence is likely the result of fluvial deposition from the nearby stream. Below approximately 28 feet, a very dense, gray sand (sandstone) is encountered (Monitoring Wells C-16 and C-17). This contact is interpreted to represent the interface between the valley alluvium and rock types from the Tassajara formation which outcrops to the west of the site. Exposures of the Pliocene Tassajara Formation are described as beds of sandstone, tuffaceous sandstone, shale, and limestone by DWR. The rocks of this formation are prevalent throughout the northern part of Livermore Valley.

HYDROGEOLOGY

Groundwater is present at the site at a depth of approximately 13 feet below the ground surface. Monitoring data indicates the shallow water table aquifer flow direction is southwesterly under a gradient of approximately 0.7 percent.

Groundwater in the Livermore area is utilized extensively. The valley alluvium is the primary supplier of the groundwater to wells. However, most of the wells in the area use groundwater in confined zones considerably deeper than the unconfined near-surface waters tapped at the study site. The locations of wells within a 1/2 mile radius of the property are plotted on Figure 5, Well Location Map. The well location points at the project site represent the existing monitoring wells.

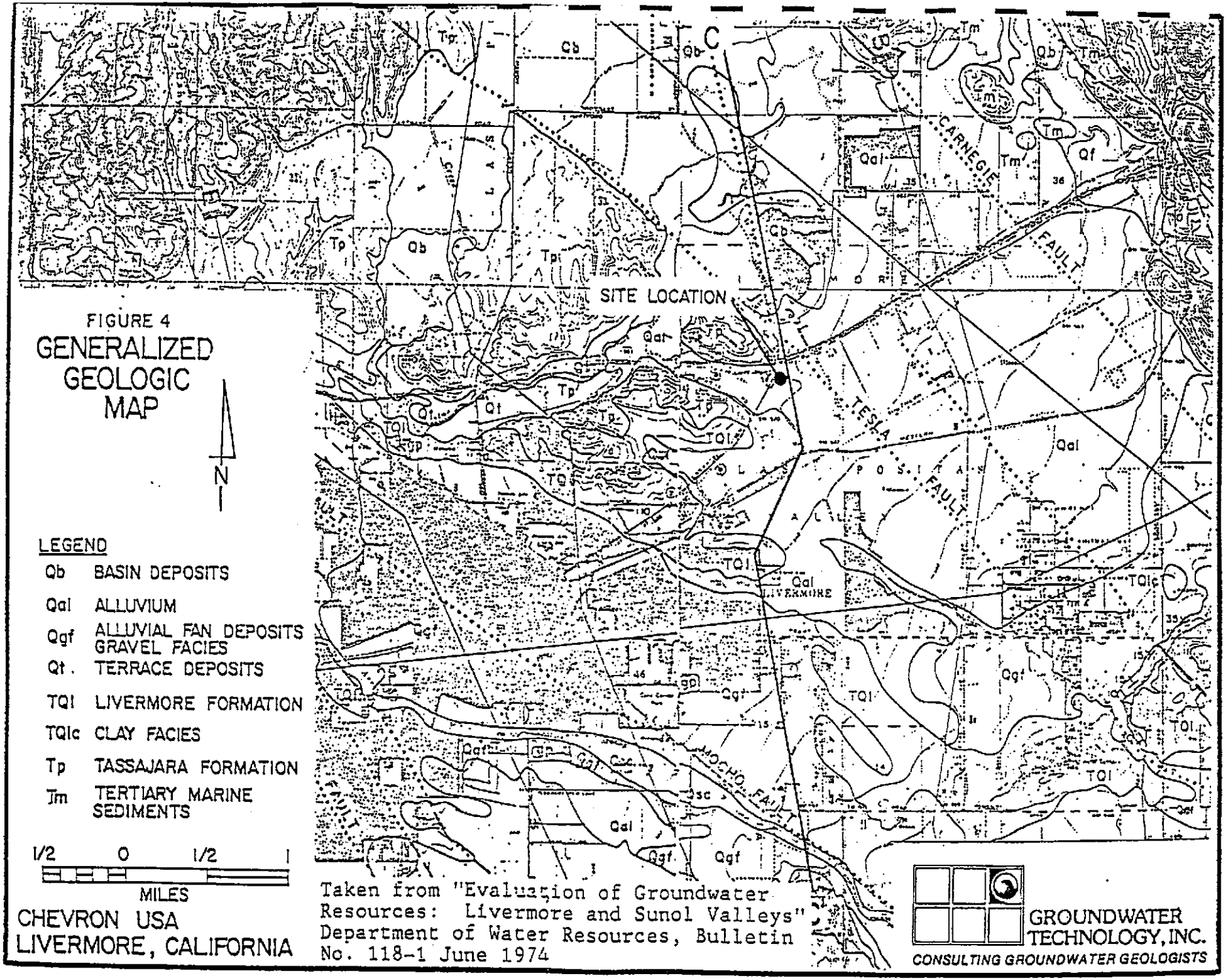

FIGURE 4

GENERALIZED GEOLOGIC MAP

LEGEND

Qb	BASIN DEPOSITS
Qal	ALLUVIUM
Qgf	ALLUVIAL FAN DEPOSITS GRAVEL FACIES
Qt	TERRACE DEPOSITS
TQl	LIVERMORE FORMATION
TQlc	CLAY FACIES
Tp	TASSAJARA FORMATION
Tm	TERTIARY MARINE SEDIMENTS

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Taken from "Evaluation of Groundwater Resources: Livermore and Sunol Valleys" Department of Water Resources, Bulletin No. 118-1 June 1974

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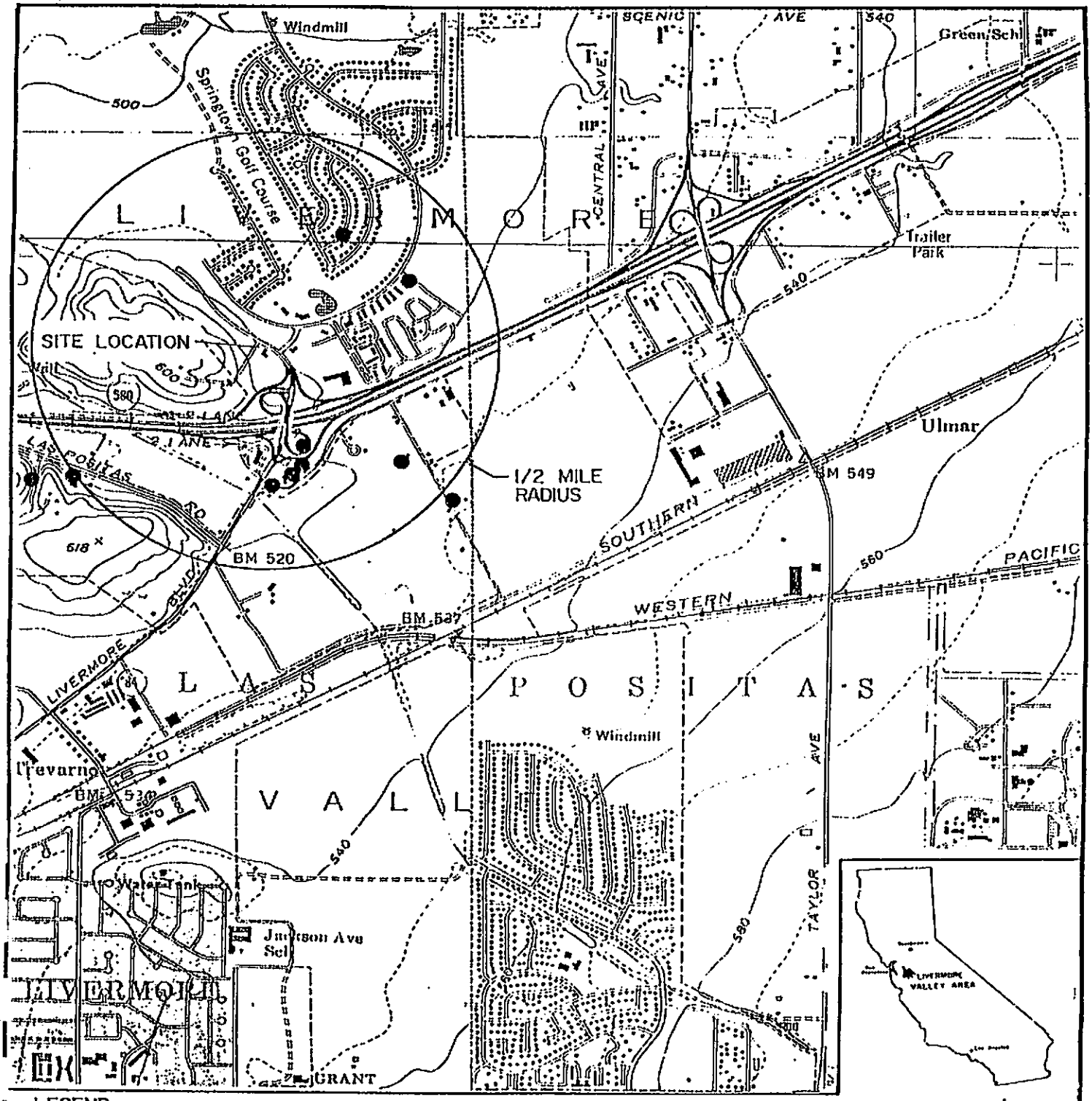

FIGURE 5

WELL LOCATION MAP

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Poor quality groundwater, principally sodium bicarbonate-chloride in composition, occurs within the alluvium in the studied portion of the Livermore Valley. This water apparently is a result of infiltration of surface runoff from the marine sedimentary rocks to the east. Because of the naturally occurring high chloride concentrations, the use of groundwater is restricted from this upper zone and water wells generally utilize deeper water bearing zones.

Underlying the permeable valley-fill materials are the sediments of the Tassajara Formation. Because of the fine grained nature of these sediments, groundwater yields are relatively low, usually sufficient only for domestic or livestock purposes.

RECOVERY SYSTEM

RECOVERY WELL

On January 16, 1985 Groundwater Technology initiated the drilling and installation of the recovery well. An LDH 709 drill rig with 24-inch diameter augers was used to drill the borehole. A solid conductor casing was advanced to a depth of 32.5 feet during the drilling. The borehole intersected the pea gravel backfill of the drainage culvert at about 7 feet. The attached boring log for RW-1 provides a description of the soils encountered during drilling of the recovery well (See Appendix I). A 12-inch PVC, .020-inch well screen and casing was installed to the bottom of the borehole. The screen interval extends from 32.5 to 10 feet below ground surface. The top of the blank casing is 1.5 feet below the ground surface. The gravel pack consisted of 1/4 inch pea gravel

which was in turn overlain by an annular seal consisting of bentonite and cement. The wellhead is contained below grade within a concrete vault with a traffic rated cover as shown on Figure 6, Recovery Well Construction.

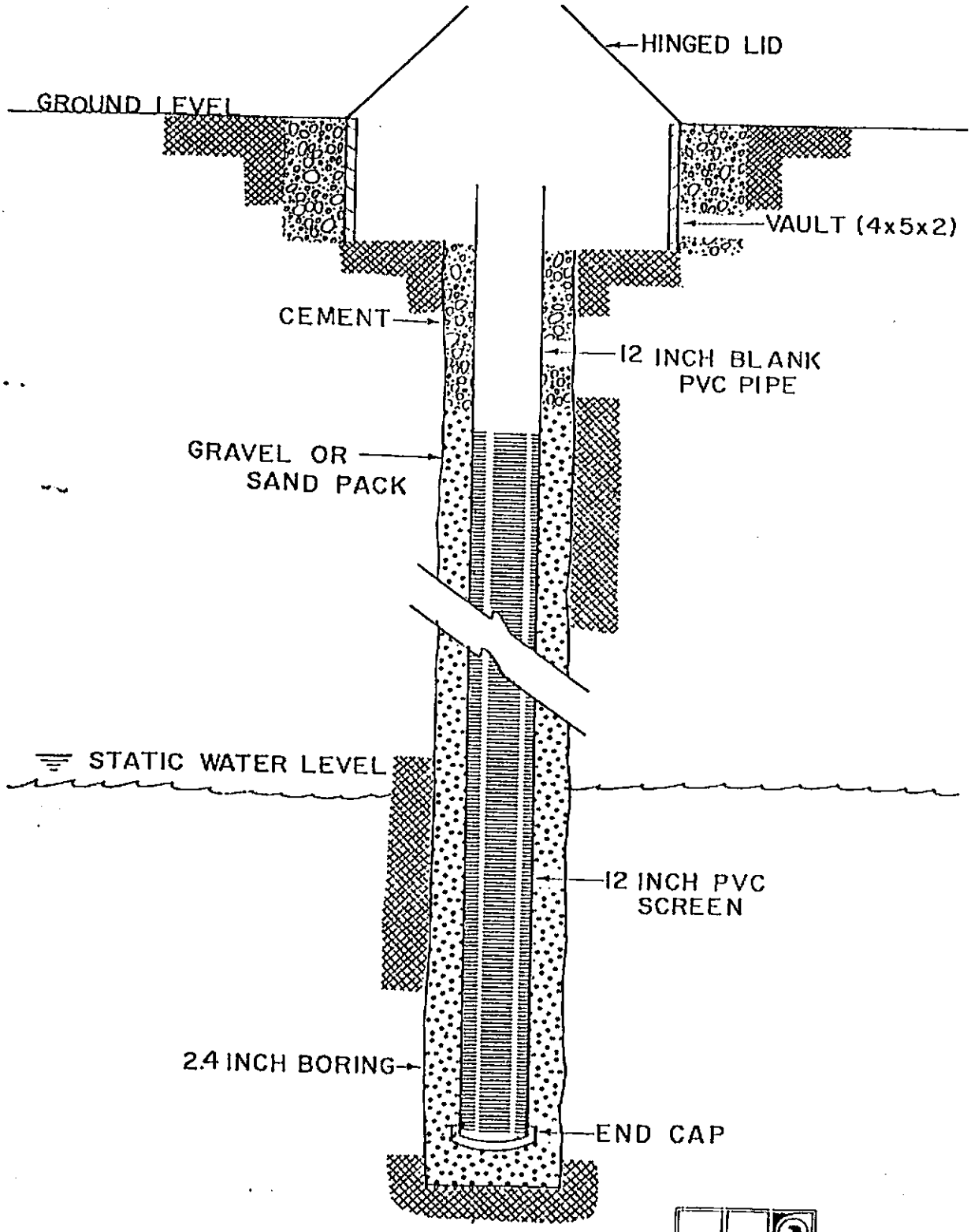
RECOVERY EQUIPMENT

The recovery well was equipped with a double pump recovery system consisting of a Grundfos water table depression pump (WTDP) and an Oil Recovery Systems Probe Scavenger Unit for product recovery. The Grundfos WTDP with teflon seals was installed as per specifications determined from a preliminary pump test. A float sensor probe electronically connected to the WTDP is set at the depth necessary to sustain the required drawdown within the recovery well. The Probe Scavenger Unit was installed in the well to collect the accumulated free product. A conductivity/float probe within the unit automatically starts the product pump when the product thickness within the recovery well is greater than 0.20 feet. The recovery well equipment vault layout is graphically depicted on Figure 7, Recovery Well Vault Layout.

The recovered free product is pumped through underground piping directly into a 500 gallon Underwriters Laboratories (U.L.) listed above ground storage tank for flammable liquids. The recovery tank is located in a fenced recovery compound located in the northeast corner of the Mobil Service Station property. A tankfill sensor connected to the product recovery pump automatically shuts down the pump when the recovery tank is full. All components of the recovery equipment are suitable for the applications described with respect to the potentially explosive working environment.

FIGURE 6

RECOVERY WELL CONSTRUCTION



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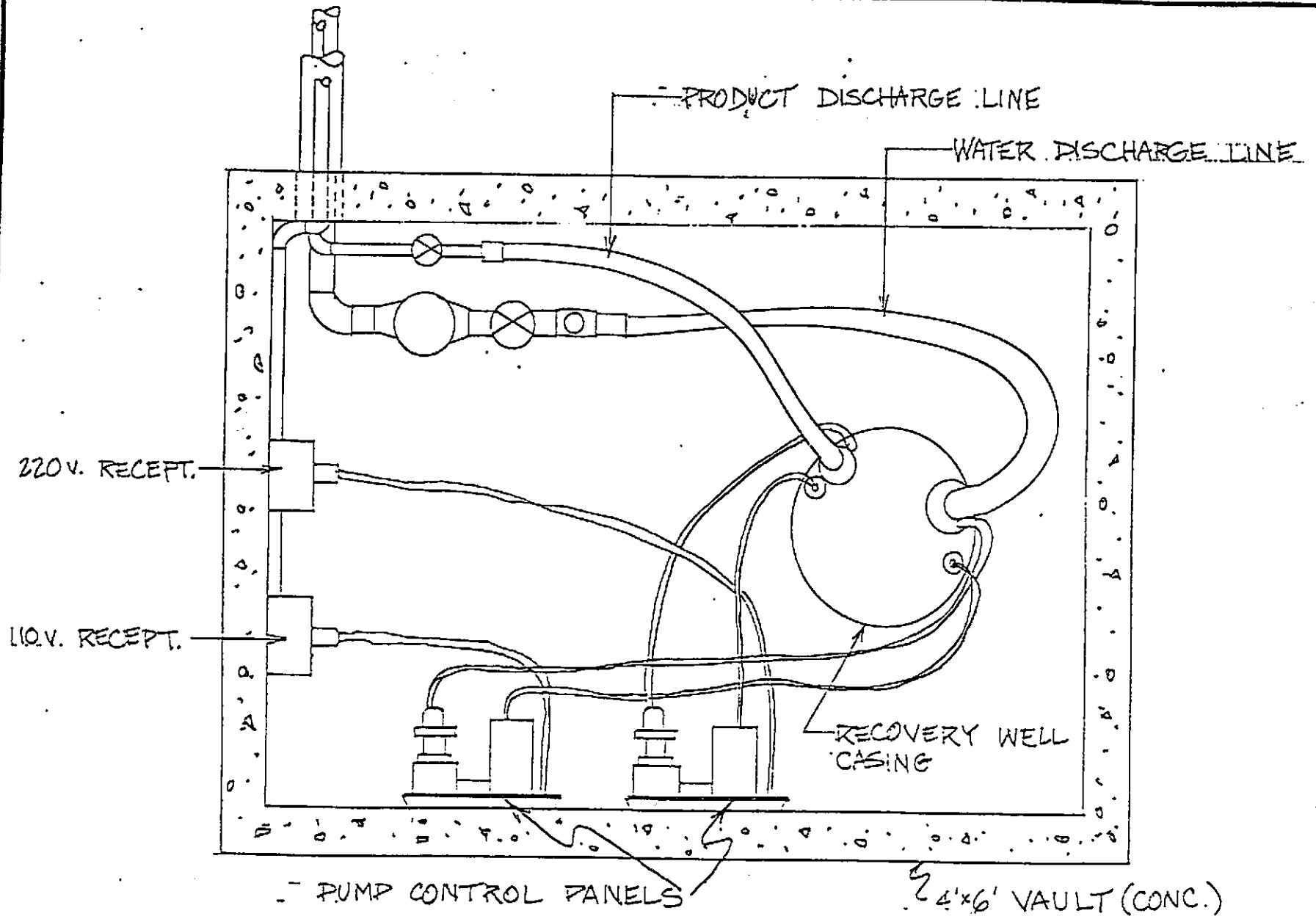

FIGURE 7

RECOVERY WELL VAULT LAYOUT

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WATER TREATMENT UNIT

A water treatment unit is located within the same fenced compound as the product recovery tank. To expedite the recovery system start-up, the pumped groundwater was initially treated with activated carbon to reduce the concentrations of dissolved hydrocarbon components. A water sample collected from the recovery well was analyzed for volatile hydrocarbons and selected inorganic parameters to provide data for the water treatment unit design (See Appendix II). Preliminary data indicated that the system had to treat dissolved volatile hydrocarbon concentrations of about 30 ppm total at flow rates less than 5 gallons per minute. A 400 gallon carbon tank capable of handling flow rates of up to 20 gpm was used to treat the pumped water until April 24, 1985. After obtaining air discharge permits from the Bay Area Air Quality Management District, the water treatment was converted to an Oil Recovery Systems, Inc. air stripping unit designed for the site specific conditions. Figure 8, Air Stripper Schematic shows the typical construction details of an air stripping unit.

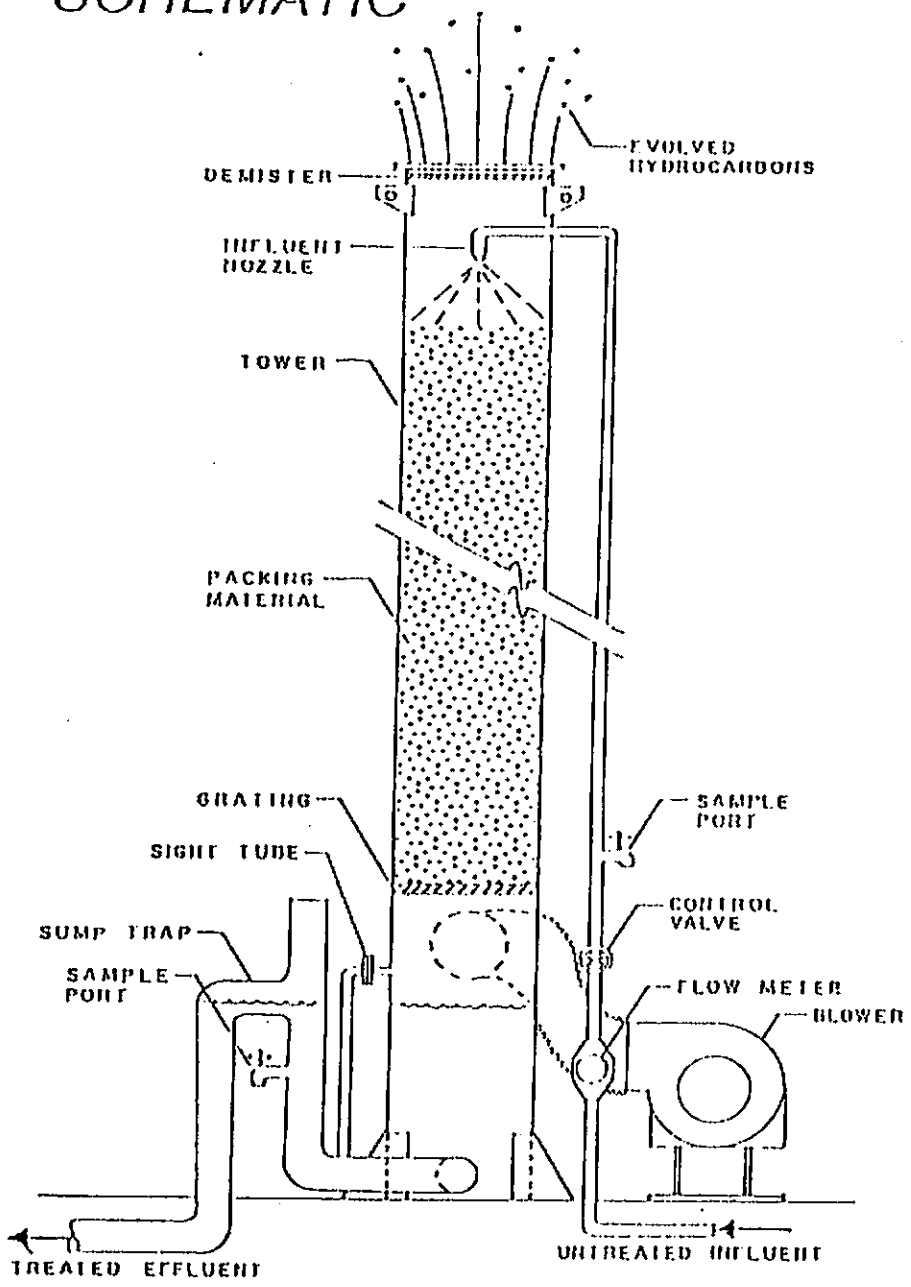
RECOVERY SYSTEM MONITORING/SAMPLING

WATER TREATMENT UNIT

As per the requirements outlined in a proposal made to Mr. Robert Samaniego of the California Regional Water Quality Control Board (CRWQCB), water samples were collected from the initial carbon tank water treatment unit for analysis on a weekly basis. Analyses for dissolved volatile hydrocarbon components were conducted by the GC/FID Static Headspace Method. Permission to discharge the treated water to the storm drainage system at total hydrocarbon concentrations of less than 100 parts per billion

FIGURE 8

AIR STRIPPER SCHEMATIC



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hydrocarbon concentrations of less than 100 parts per billion (ppb) was obtained from Mr. Samaniego. Analyses conducted on the treatment unit influent and effluent water through April 17, 1985 revealed discharge (effluent) concentrations of below 100 ppb. The influent and effluent concentrations ranged from 14 to 81 parts per million (ppm) and non detected to 87 ppb, respectively. The laboratory test results and method detection limits can be found in Appendix III.

On April 24, 1985 the treatment of pumped water was converted from the carbon tank unit to the air stripping unit. As per requirements outlined in a proposal made to Mr. Samaniego, CRWQCB, the influent and effluent water at the air stripper was sampled weekly during the first month and monthly thereafter. The purpose of the sampling program was to monitor the air stripper discharge (effluent) so that it remained below the 100 ppb limit for total dissolved volatile hydrocarbons as required by CRWQCB. Analyses of the air stripper discharge remained below the set limit for all samplings except on September 30, 1985. The higher concentration for this sampling was the result of reduced air stripper efficiently brought on by precipitation of carbonates in the influent spray nozzle and discharge line (effluent). These problems were immediately corrected. The concentrations of benzene, ethyl benzene and toluene have remained below method detection limits since the first sampling which was conducted the day of the unit start-up. The laboratory test results and method detection limits can be found in Appendix IV.

RECOVERY EQUIPMENT

The equipment associated with the product recovery and water treatment units were monitored/maintained on a weekly schedule. The product recovery monitoring was conducted by

the use of a meter in the product line. Meter accuracy was checked by measuring the accumulated product volume in the recovery tank. As shown on Figure 9, Total Gasoline Recovered, the rate of product recovery was the greatest during the first two months of the system operation with a steady decline in product recovery since. The total free product recovered through November 1985 is approximately 292 gallons. In addition a meter monitoring the flow of pumped groundwater through the water treatment unit indicates that approximately 550,000 gallons of contaminated water has been treated. Figure 10, Total Groundwater Pumped/Treated, graphically depicts the total flow of pumped groundwater through the treatment system.

GROUNDWATER MONITORING

A total of 17 groundwater monitoring wells were installed by others at the site prior to Groundwater Technology's involvement with the project. The additional monitoring wells, C-18 and C-19, were installed by Groundwater Technology on March 29, 1985 to further define possible pathways of product migration. The monitoring well installation was conducted in accordance with Groundwater Technology's Standard Operating Procedure SOP 13 (See Appendix V). The drilling logs, shown in Appendix I, provides information on the well construction and soil types encountered. To enable replacement of the underground fuel storage tanks at the Chevron Service Station, monitoring well C-4 was abandoned on March 20, 1985. Both the monitoring well installation and abandonment were permitted by the Alameda County Flood Control and Water Conservation District, Zone 7.

The groundwater monitoring program was conducted to determine the following: (1) location of free product, (2)

FIGURE 9

TOTAL GASOLINE RECOVERED

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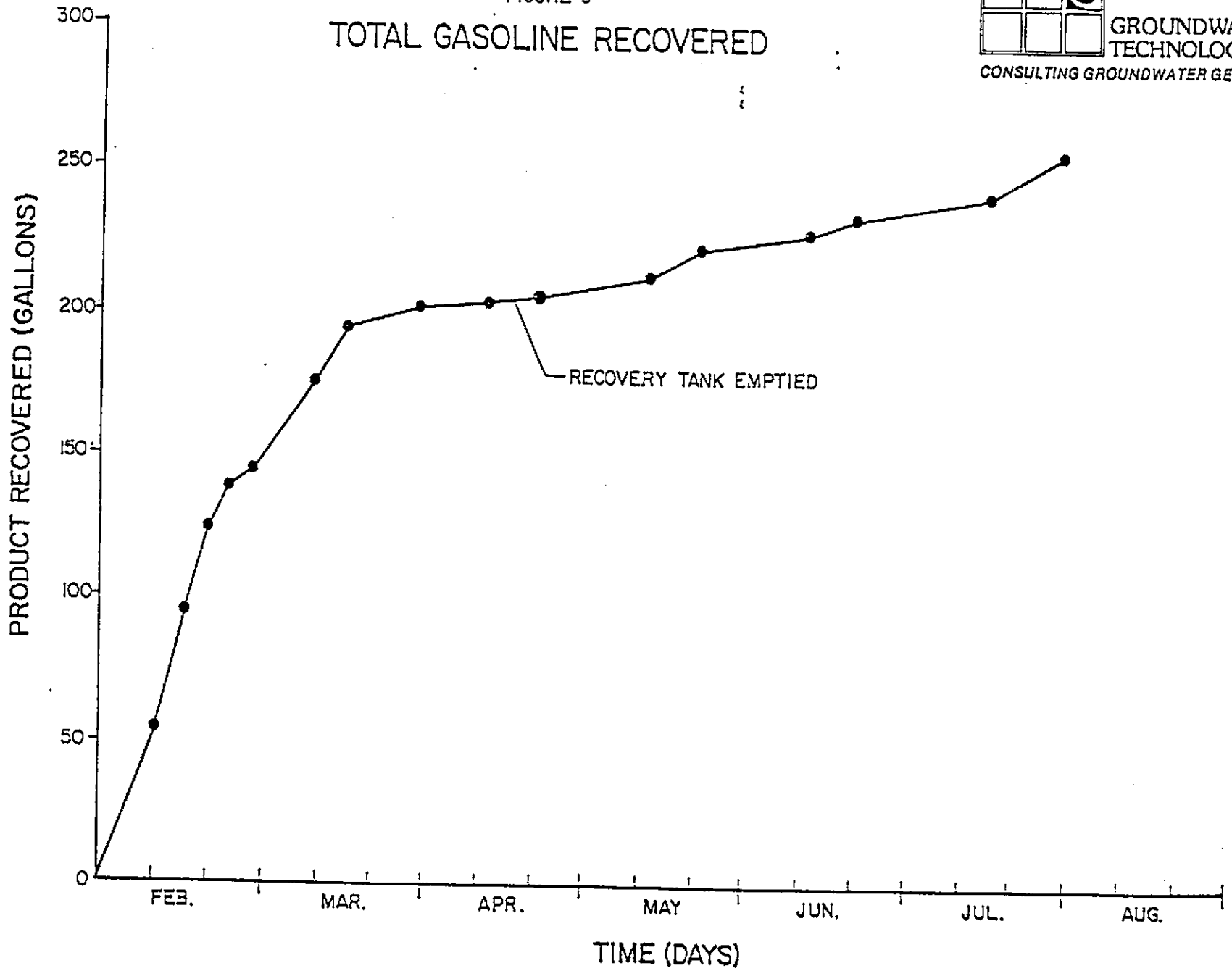

CHEVRON RECOVERY PROJECT
LIVERMORE, CALIF.

FIGURE 10

TOTAL GROUNDWATER PUMPED/TREATED

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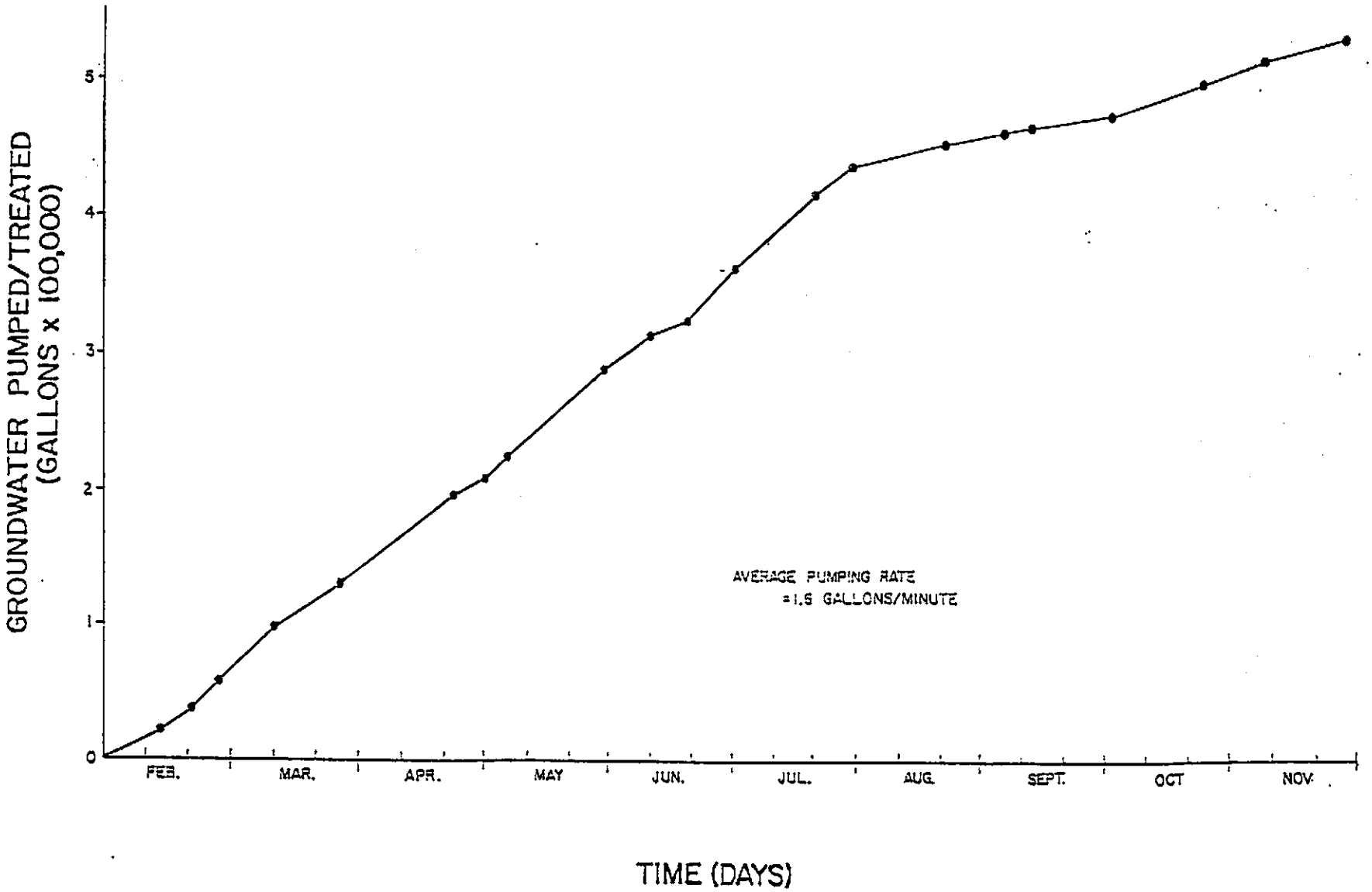


CHEVRON USA
LIVERMORE, CALIF.

groundwater flow direction and, (3) effectiveness of the recovery system. The groundwater monitoring was conducted in accordance with Groundwater Technology's Standard Operating Procedure SOP 8 (See Appendix V). The tabulated groundwater monitoring data is shown in Appendix VI. The monitoring data indicated that on January 16, 1985, a total of 5 wells were impacted by free product to a maximum thickness of .83 feet. Since the recovery system start-up, the thickness of the free product plume has gradually diminished over time to the most recent monitoring which indicates a product thickness of 0.03 feet in well C-9. The product thickness maps, shown in Appendix VI, depict the reduction in the free product plume over time.

A southwesterly groundwater flow direction in the shallow water table aquifer was determined from the well monitoring data and surveyed elevations of the wellheads. This flow direction could account for the southwesterly elongation of the free product plume in the down gradient direction from the tank pit area. The groundwater flows under a gradient of less than 1 percent. The groundwater gradient maps graphically depict the flow direction and the influence of pumping groundwater from the recovery well (See Appendix VI).

Analyses of water samples collected from six wells at the site were performed to provide a preliminary assessment of the extent of dissolved hydrocarbon contamination. The sampling procedures are outlined in Groundwater Technology's Standard Operating Procedures SOP 9, SOP 10 and SOP 11 (See Appendix V). Analyses of samples collected from monitoring wells C-11 and C-16 on January 16, 1985 revealed total dissolved hydrocarbon concentrations of 0.12 and 5.0 ppm, respectively (See Appendix VI). Groundwater samples were collected from wells C-3, C-5, C-8 and C-12 on February 19, 1985 for similar analyses. The

wells closest to the tank pit, C-3 and C-5 contained the higher concentrations of 10.7 and 20.5 ppm, respectively of total dissolved hydrocarbons. The wells C-8 (.04 ppm) and C-12 (trace), the furthest down gradient well, had relatively low total dissolved hydrocarbon concentrations (See Appendix VI).

VAPOR MONITORING

In order to investigate the possibility that free product may have migrated within the backfill of the drainage culvert beyond the location of the recovery well, a vapor monitoring point, consisting of a 1-inch diameter hole, was drilled through the floor of the culvert on March 26, 1985. The vapor point, VP-1, is shown on the Site Plan (See Figure 2). The vapor monitoring point provided a means of monitoring hydrocarbon vapor concentrations contained within the pore spaces of the soil materials beneath the culvert. A HNU Photoionizer Detector was used to measure the total (volatile) hydrocarbon concentrations in parts per million (ppm). The initial field testing and subsequent monitorings, through April 1985, indicated no detectable concentrations of hydrocarbon vapors (1 ppm detection limit). Based on the results of the monitoring, it was concluded that free product was not present and further monitoring was not necessary. Therefore, the vapor point was abandoned and sealed with cement grout on May 8, 1985.

pt is far, far from down-gradient. Why not closer to source? How deep was this well?

SUMMARY

In summary, Groundwater Technology was contracted to implement a recovery/abatement program in response to a known loss of between 2,000 and 3,000 gallons of gasoline from an underground fuel storage tank at the Chevron Service Station. A double pump recovery system was installed to collect the retrievable free product. A water treatment unit was constructed to process the pumped groundwater prior to discharge. The water treatment unit has treated about 550,000 gallons of contaminated groundwater from which a total of approximately 292 gallons of free product has been recovered to date. A steady decrease in the size of the free product plume has been shown by data collected from the groundwater monitoring program.

IN Oct 1985, influent sample w/ 4,470 ppb benzene, why stop P+T?

CONCLUSIONS

The recovery operation at the Livermore project site is proceeding successfully in terms of recovering free product and treating the dissolved hydrocarbon components in the groundwater. At this time the rate of product recovery and the extent of the free product plume has diminished to insignificant levels. The difference in the estimated quantity of product lost and the actual quantity of free product recovered may be attributed to one or a combination of the following factors: A significant amount of free product could be adsorbed onto the subsurface soils; the dissolved hydrocarbons in groundwater will account for a small quantity of free product, the volume of product loss could be less than originally estimated. Groundwater monitoring and sampling of down gradient wells indicates the migration of contamination to be limited. Thus Groundwater Technology believes the recovery operations at the site have been effective and at this time the subsurface contamination does not pose a threat to public health and safety.

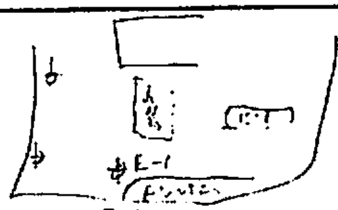
LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. [illegible] DATE [illegible]
CLIENT [illegible]
LOCATION [illegible]
LOGGED BY [illegible] DRILLER [illegible]

BORING No. E-1
Sheet ___ of ___

Field location of boring:



Ground Elev. Datum

Drilling method [illegible]
Hole dia. [illegible]

Casing Installation data 20 ft. 3" PVC lower 12' slotted
2 [illegible] Sand to 6, ben/concrete [illegible]
[illegible] to surface

Water level	13.5±	13		
Time	[illegible]	1 pm		
Date		12/21		

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								AC
					2		CL	CL - Olive (5Y 4/3) to black (5Y 2.5/1) gravelly, silty CLAY FILL, fine to crs gravel - damp, no odor
					4			[illegible]
	2.60 (2.)	6 / 10 / 14 18" drive	S1Pen rec 95%	1	6			
					8			SC-CL [illegible] clayey fine SAND to fine sandy CLAY, contains root holes, [illegible] faint [illegible]
	1.55	6 / 11 / 13 18" drive	MOD rec [illegible]	2	10			
					12			- [illegible]
	NT	4 / 7 / 9 18" drive	S1Pen rec 100%	3	14		SC	SC - Yellow [illegible] (10YR 5/6) [illegible] root holes, [illegible] [illegible] @ 13.5 [illegible]
					16			
					18		CL	CL - Light gray (10YR 7/2) silty CLAY [illegible] root holes, [illegible] damp, no odor
	[illegible]	6 / 8 / 12 18" drive	S1Pen rec	4	20			
					22			- [illegible] 21.5 [illegible] no odor [illegible]
					24			
					26			
					28			

DRAFT

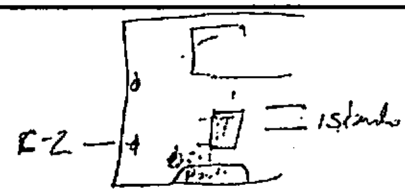
PRELIMINARY

LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 437.55.0' DATE 12/21/84
CLIENT G.E.
LOCATION Livermore
LOGGED BY [illegible] DRILLER HEW
BORING No. C-2
Sheet 1 of 1

Field location of boring:



Ground Elev. Datum

Drilling method Hollowstem
Hole dia. 8"

Casing installation data Cased w/ 25' 3" PVC lower 15 slot Sand to 8 bent. to 7 conc 7400 vault

Water level	15'	17± - could be held by augers
Time	155	
Date	12/21	

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								AC
					2		FILL	CL - Dark yellowish brown (10YR 3/4) slightly fine sandy silty CLAY - damp FILL
	2.5	5/8/12 18" drive	St Pen rec 100%	1	6			- clr black (5Y 2.5/1) minor 5% < fine sand dissem, no odor - damp
					8		CL	CL - Yellowish brown (10YR 5/4) dissem fine sandy silty CLAY some root holes or burrows, limonite mottles (fluctuating water table?) - damp
	NT	6/15/17 18" drive	MOD rec 50%	2	10			
	3.10	5/7/11 18" drive	St Pen rec 100%	3				- contains rare fine gravel and 10% dissem fine sand no odor - damp very stiff
							SC	SC - Clayey fine SAND wet no sample inter same as in C-1
	NT	12/18/16 18" drive	St Pen rec 100%	4			CL	CL - Light gray (10YR 7/2) silty CLAY, contains dissem fine sand (5% <) appears strongly oxidized and leached very stiff - damp
					24			
	2.0	5/8 12" drive	St Pen/SS	5	26			- clr change to dark gray brown (10YR 4/2) - damp
					28			TD 26.5 prove 5+ feet clay end in clay aquitard
					30			

NOTE - odor from hole of "fresh" gas assume same as water

1/8" pond or. north

DRAFT

PRELIMINARY

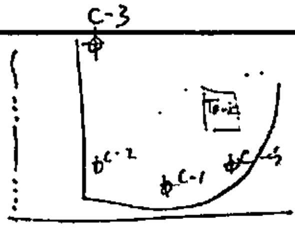
LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438-55.01 DATE 12/21/84
CLIENT GR
LOCATION Livermore
LOGGED BY CMP DRILLER HEW

BORING No. C-3
Sheet 1 of 1

Field location of boring:



Ground Elev. Datum

Drilling method Hollow stem
Hole dia. 8"

Casing installation data 20 ft 3" PVC lower 12 slotted sand to 6 bent. 6-5 concrete 5-0 vault

Water level	14'±			
Time	400			
Date	12/21			

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								AC
							CL	CL - Black (5Y.2.5/1) fine sandy slightly gravelly silty CLAY, FILL - damp to moist
					2			
					4			
	1.0	5/4/7 18"	SS rec 80%	1	6			- as above, no odor
					8			
	3.8	6/6/12 18"	SS rec	2	10		CL	CL - Brown (10YR.5/3) slightly fine sandy silty CLAY, sand 5%±, very stiff no odor - root holes none and infilled - damp; some root holes open
					12			
					14			
							SC	SC - Brown (10YR.5/3) clayey fine SAND, very faint odor, stiff, wet root holes - wet - decrease odor 16 to 16.5
	2.5	6/9/11 18"	MOD rec 100%	3	16			
					18		CL	CL - Brown (10YR.5/3) and grey (10YR.7/2) silty CLAY contains disseminated fine sand - 10% and fine gravel - 5% in clay matrix, no odor damp
	4.25	6/7/12 18"	SS rec	4	20			- very stiff - damp all color light grey (10YR.7/
								TD @ 21.5 in stiff clay aquitard as in C-1, C-2, C-5

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PRELIMINARY

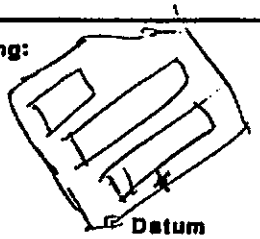
LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438-55.1 DATE 1-3-85
CLIENT GR Chevron
LOCATION LIVERMORE
LOGGED BY GM DRILLER XD

BORING No. C-4
Sheet 1 of

Field location of boring:



Ground Elev.

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT 23-9, BLANK TO SURF. SAND TO 8, BC TO SURF

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								Water level / Time / Date
					0			Asphalt
					2		CL	CLAY Black (5Y 2.5/1), 5% sand, 5% fine to medium gravel, damp, slight prod odor
					4		SW	SAND Greish brown (2.5Y 5/2) 0-5% clay, 5% fine gravel, 90% fine to med sand, damp strong prod wet odor
					6			
					8	X		8.5-9.5: saturated w/ gas
		1/2/4	STP 100%		10	X	CL	CLAY Olive (5Y 5/3), 0-5% fine sand, 5% silt, 90% fines, white caliche mottle - moist, very strong gas odor
					12			~12.5-14': saturated w/ black gas (old?)
		15/14/22	STP 100%		14			~13.0'-16.0' increase fine to medium sand (~10%), much white discoloration (wet, very slight gas odor)
					16	X		16.5'-23': much discoloration (leaching?), stiff, damp, no gas odor
					18			
		5/18/20	STP 100%		20	X		
					22			
					24			HOLE TERMINATED: 6.I.O.
					26			

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PRELIMINARY

EMCON ASSOCIATES

LOG OF EXPLORATORY BORING

PROJECT No. 431-[illegible] DATE [illegible]

CLIENT [illegible]

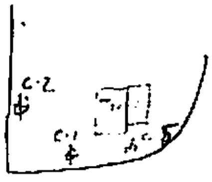
LOCATION [illegible]

LOGGED BY [illegible] DRILLER HEW

BORING No. C-5

Sheet 1 of 1

Field location of boring:



Ground Elev. Datum

Drilling method [illegible]

Hole dia. [illegible]

Casing installation data: case w/ 20' 3" PVC [illegible] 12 slotted sand to 6 bent. to 5 concrete to 0

Water level	14' ±			
Time	2:53			
Date	12/21			

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								7" AC; [illegible] baserock to 12"
					2		CL	CL - Black (5Y 2.5/1) silty CLAY FILL, [illegible] some crs gravel. [illegible] moist
		4/7/13	SS	1	4			
		18"	rec 0					
		lost	sample					[illegible] odor
					8		CL	CL - Olive gray (5Y 5/2) silty CLAY fine sand [illegible] in clay matrix 2%< faint petroleum
	3.1	5/9/11	SS	2	10			root holes infilled with clay, occ. open root
NOTE -		18"	rec 100%					holes 1% ± some gray [illegible] "se
[illegible]								[illegible] to [illegible] 10YR 5/6
[illegible]					14		SC	SC - Yellowish brown (10YR 5/6) Clayey fine SAND
		4/7/10	SS	3				[illegible] matrix very faint odor, [illegible] very
SC →	1.5	18"	rec 100%				CL	sandy [illegible] @ 16.5
CL →	2.5				18			CL - Light gray (10YR 7/2) silty CLAY stiff
								appears [illegible] - damp
	1.5	6/9/	SS	4	20			
		12"	rec 100%					
								TD 21.0 into same clay aquitard as C-1, C-2

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PRELIMINARY

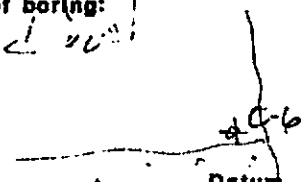
LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438-551 DATE 1-3-95
CLIENT GE Chevron
LOCATION LIVERMORE
LOGGED BY SM DRILLER XD

BORING No. C-6
Sheet ___ of ___

Field location of boring:



Ground Elev. ___ Datum ___

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT 22-7, BLANK TO SURF. SAND TO 6, BC TO SURF.

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
					2		CL	Asphalt & coarse gravel btx CLAY (FILL) Black to [illegible] (5Y2.5/1)-(5Y4/3) ~5% fine to medium sand, 10-15% silt, 80-85% fines - trace medium gravel - damp
					4			
					6			
					8			
		15/20/18	STP		10	X	SW	SAND dk brown (7.5YR 3/4), 0-5% fines, 40% fine to med gravels, 85-90% fine to coarse SAND - moist, STRONG GAS ODOR
					12			
					14	▽		(wet)
	2.0	10/6/9	STP		16	X	CL	CLAY Pale yellow (2.5Y 7/4), 0-5% silt, white caliche mottle, moist, no gas odor, occ. open root holes
					18			
		15/17/18	STP		20	X		~19.0 - 22.0' slightly sandy (~5%) with abundant leaching & discoloration
					22			H.T.: SIO
					24			
					26			
					28			
					30			

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PRELIMINARY

LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438-5[illegible] DATE 1-3-85
CLIENT GR Chevron
LOCATION Livermore
LOGGED BY GM DRILLER XD

BORING No. C-7
Sheet 1 of 2

Field location of boring: (see sketch)

Ground Elev. +C-7 Datum

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT 22-7, BLANK TO SURF. SAND TO 6, BC TO SURF.

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								Asphalt 2" ± 6" CFS gravel base
					2		CL	CLAY (Fill) Dk brown to black (5Y2.5/1 - 5Y2.4/3), ~5% fine to medium sand; ~10% silt, [illegible], trace fine to coarse gravel - damp, no gas odor
					4			
					6			
					8		CL	CLAY Olive (5Y5/3) 5-10% silt & very fine sand, moist to wet, strong gas odor
					10			
					12			12'-16': 30-40% silt & fine sand
	2.5	12/14/14	STP 100%		14	X		13'-14.5': Thin 1"-2" stringers of clayey fine sand - moist, nearly saturated w/ gas
					16	▽		
					18			-16.5-22': decrease silt & sand to 5-10%, heavily oxidized & leached - stiff - damp, no gas odor
	3.0	5/10/15	STP 100%		20	X		
					22			
					24			H.T. = 5.50.
					26			

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PRELIMINARY

LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438 · DATE 1-3-85
CLIENT GR Chevron
LOCATION Livermore
LOGGED BY [illegible] DRILLER X D

BORING No. C-8
Sheet 1 of ___

Field location of boring:

Ground Elev. Datum

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT 22½ 7, BLNK TO SURF, SAND TO 6, BC TO SURF

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
					0			3" Asphalt & 6" ctb gravel base
					2		CL Fill	CLAY (fill) Grayish brown (2.5Y 4/2), 5-10% fine to coarse sand, 10% silts - damp
					4		GW Fill	GRAVEL (fill) Grayish Brown (2.5Y 4/2) 25-30% medium to coarse SAND, 70-75% fine to medium gravel - damp
					6		CL Fill	CLAY Fill Dk brown (7.5YR 4/2) ~5% fine to medium sand, 5-10% silts, 85% clay, trace gravel - damp mcc
					8			
	1.75	5/8/12	STP		10	X	CL	CLAY Olive (5Y 5/3), 0-5% fine sand, 5% silts, 90% clays, caliche & Fe oxide mottle - damp mcc
					12			
					14			
		//	STP		16	X		14.5'-23': clay becomes heavily leached & oxidized, stiff - damp w/ root frags, trace coarse sand
					18			
	4.5	9/19/19	STP		20	X		
					22			
					24			T.H: SID
					26			
					28			
					30			
					32			
					34			
					36			

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PRELIMINARY

LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 458- DATE 1-3-94
CLIENT GR Chevron
LOCATION LIVERMORE
LOGGED BY GA DRILLER XD

BORING No. C-9
Sheet ___ of ___

Field location of boring:

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT 23-7, BENTN TO SURF. SAND TO 6, BENTN TO SURF.

Ground Elev. Datum

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								3 inches of 6" dia gravel base
					2		CL	CLAY (Fill) Grayish brown (2.5Y 4/2) 5-10% fine to coarse sand, 10% silt, trace fine to coarse gravel - damp, mp.
					4		FILL	4.0-4.5' : coarse sandy GRAVEL Fill - damp
					6			4.5-8' : Black (5Y 2.5/1) decreased sand (5%)
					8		CL	
	1.75	5/8/10	ST		10	X		CLAY - Olive (5Y 5/3), 5-10% silts, 15-20% fine sand, 70-75% clay - Ferric stain & particles - damp, strong gas odor, trace medium sand
					12			
					14			
	2.0	7/10/13	ST		16	X		(decrease silt (~5%) & fine sand (~5%), roothales moist) (slight gas odor
					18			~17.0-20' : clay becomes leached & discolored, stiff, damp, no prod odor
					20			
	4.0	8/19/20	ST		22	X		
					24			HT : SEB.
					26			
					28			
					30			

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PRELIMINARY

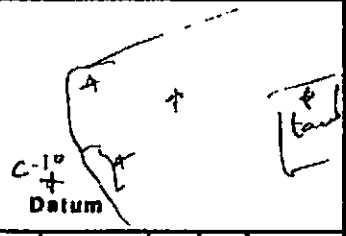
LOG OF EXPLORATORY BORING

EMCON ASSOCIATES

PROJECT No. 438-5~~5~~4 DATE 1-3-85
CLIENT GR Chevron
LOCATION LIVERMORE
LOGGED BY BR DRILLER XD

BORING No. C-10 & C-11 Sheet ___ of ___

Field location of boring:



Ground Elev. Datum

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT - , BLANK TO SURF. SAND TO , DC TO SURF.

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								3" Asphalt & 6" CMS gravel base
					2		CL	CLAY (Fill) Grayish brown (2.5Y 4/2), 5-10% fine to coarse sand, 10% silt, ~~50-55%~~ clay
					4		GW	GRAVEL
					6			BORING TERMINATED - HIT CONCRETE BUT DID NOT PENETRATE
					8			
					10			
					12			
					14			
					16			
					18			
					20			
					22			
					24			
					26			
					28			
					30			

9 - 23' 16/7
8 - 22½ 16/6½"
7 - 22 11/6
6 - 22 16/6
4 - 23' 16/7

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PRELIMINARY

EMCON ASSOCIATES

LOG OF EXPLORATORY BORING

C-12 (0) 10 MOBIL

PROJECT No. 938-56.1 DATE 1-10-85

CLIENT GR Chevron

LOCATION Livermore

LOGGED BY SBL DRILLER XD

BORING No. C-12

Sheet ___ of ___

Field location of boring:

84

Ground Elev. Datum

Drilling method 7½" HS

Hole dia. 7½"

Casing installation data 3" PVC SLOT 20 - 10, BLANK TO SURF. SAND TO 9, BC TO SURF.

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								Asphalt
					2		CL	CLAY (Fill) Dk grayish brown (2.5Y 3/2), 0-5% silt, trace sand & fine gravel - damp nco
					4			
					6			
					8			
	2.5	7/8/11	STP 75% 18"		10	X		Light Olive gray (5Y 6/2), 5% fine to coarse sand, 5-10% silt, damp, no gas odor - iron stained, firm
					12			
		27/45/-	STP 100% 12"		14		GW ▽	SANDY GRAVEL Brown (10YR 4/3), 0-3% Clay binder, 35-40% fine to coarse sand, 55-60% fine to coarse gravel - wet, nco, trace rounded cobblesize gravel
					16	X		
					18		GC	CLAYEY GRAVEL Olive (5Y 5/3), ~15% silty clay binder, 20% fine to coarse sand, 65% fine to coarse gravel -
		16/50/-	STP 0%	12"	20	X		
		14/36/-	STP	12"	22	X		
					24			B.T.: 8IO
					26			Pulled augers - hole caved to 18½ ft. Pushed casing to 20'
					28			
					30			
					32			

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PRELIMINARY

EMCON ASSOCIATES

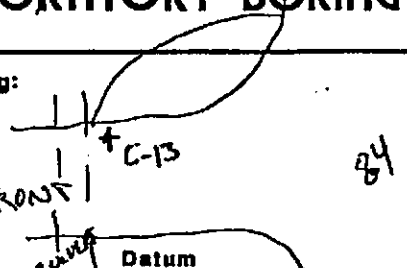
LOG OF EXPLORATORY BORING

npo - no product odor

PROJECT No. 438-56.1 DATE 1-10-25
CLIENT CR Chevron
LOCATION LIVERMORE
LOGGED BY SR DRILLER XD

BORING No. C-13
Sheet 1 of 1

Field location of boring:



Drilling method 7½" HS
Hole dia. 7½"

Casing installation data 3" PVC SLOT BLANK TO SURF. SAND TO , BC TO SURF.

Ground Elev.

Water level				
Time				
Date				

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
					2		CL	Asphalt CLAY (FILL) - Dk brown, 20% fine to coarse sand, trace gravel, damp, no odor
					4		SW	GRAVELLY SAND - Light Olive brown (2.5Y 5/4) 25-30% fine gravel, 70% - 75% fine to coarse gravel, damp, no gas odor
					6			TERMINATED HOLE: HIT CONCRETE UTILITY
					8			
					10			
					12			
					14			
					16			
					18			
					20			
					24			
					26			
					28			
					30			

PRELIMINARY DRAFT

LOG OF EXPLORATORY BORING

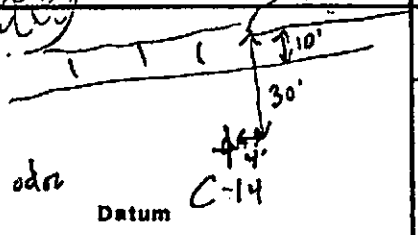
EMCON ASSOCIATES

Chevron

PROJECT No. 438-56.1 DATE 1-10-85
CLIENT GR Chevron
LOCATION Livermore
LOGGED BY _____ DRILLER _____

BORING No. C-14
Sheet ____ of ____

Field location of boring:



upo = no product odor

Ground Elev. Datum

Drilling method 7½" HS
Hole dia. 7½"

Casing installation data HOLE BACKFILLED W/CONCRETE TO 22', 3" PVC SLOT 20-10, BLANK TO SURF. SAND TO 9', BC TO SURF.

Water level					
Time					
Date					

Pocket Torr vane TSF	Pocket Penetrometer TSF	Blows/ft. or Pressure PSI	Type of Sample	Sample Number	Depth	Sample	Soil Group Symbol (U.S.C.S.)	DESCRIPTION
								Asphalt/Concrete
					2		CL	SILTY CLAY, Very dark gray (5Y 3/2), 20% silt, firm - damp, upo
					4			3-4': 10% fine to coarse sand, 10% fine to medium gravel
					6			6-9': Yellowish brown (10YR 5/4), 10% well graded sand, 35% well graded gravels, well rounded - damp, upo
					8			
	-	16/24/35	STP 75%		10	X	SW	GRAVELLY SAND - Brown (7.5YR 5/4) 5% silty clay binder, 25-30% well graded well rounded gravels, 69-70% well graded sand - moist to wet, strong product odor
					12			
					14		▽	
	3.0	5/7/9	STP 100%		16	X	CL	CLAY - (5Y 7/4) Pale yellow, 0-5% silt, white caliche discoloration, damp upo
					18			
	4.5	9/11/22	STP 100%		20	X		19': Becomes stiff w/ trace fine sand, upo
					22			
					24			(Trace iron oxide stains & particles)
	4.0	6/6/10	STP 100%		26	X		
					28			
	1.5	7/8/13	STP 100%		30	X		Olive (5Y 5/4) 29.5': Becomes very silty (30-35%) no caliche mottle, iron oxide stains, moist to wet
					32			
	1.5	15/8/20	STP		34	X		T.H.: 31.0
					36			
					38			

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PRELIMINARY

J. H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS — MATERIALS TESTING

BORING LOG

C-16

HOLE NO. C-16	PROJECT NO.	PROJECT Chevron	SHEET 1 OF 2
MFG. DESIGNATION OF DRILL CME 75		LOCATION 4707 First St Livermore, CA	
TYPE OF BIT 10" Hollow Stem	HAMMER DATA: WT. 140 LBS. DROP 30 INCHES	ELEV.	TOTAL DEPTH OF HOLE 36.5'
DATE STARTED 10:00 1-9-85	DRILLING AGENCY Kleinfelder		
COMPLETED 3:00 1-9-85	INSPECTOR Eric Findlay	GROUNDWATER DEPTH 20.6'	TIME
BACKFILLED	CREW Ron + Randy Ashley		
SURFACE CONDITIONS			

DRAFT

DIST. FROM SURF.	LEGEND	SAMPLE TYPE	SAMPLE NO.	RECOVERY	BLOWS PER 6 IN.	USCS	LOG OF MATERIAL
						3'	Asphalt 4"
1							
2						Grout	SILT, Brown - Little Clay - Little Gravel - 1" rounded - Stiff - Low Plasticity, Moist NOSC.
3							
4						Bent. / Blank	
5						Sand	CLAY - Brown, Little Silt Soft, High Plasticity, Moist NOSC
6						Screen	
7							
8	SS			2"	2 2 3		CLAY - Brown - Little tan Silty Clay - Soft High Plasticity, Moist NOSC, Trace fine gravel angular 1/8 to 1/4"
9							
10	SS			2"	1 ↓ 2		~~Silt~~ CLAY - Dark Brown - Soft High Plasticity, NOSC Moist. Bottom of sampler - Fine Gravel, Some Sand - 1/4" rounded poorly sorted
11							
12							
13	SS			10"	5 6 9		SILTY CLAY - Tan Little Gravel Poorly sorted 1/2" sub rounded, Stiff, Low Plasticity, Moist, NOSC Trace Black Organics.
14							
15	SS			12	9 10 16	fill	Gravelly CLAY - Tan w/ Light grey Mottling, Gravel and Sand Poorly Sorted 1/4" rounded Very Stiff - Low Plasticity, Moist NOSC - Little Silt.
16							
17							
18	SS			18	4 6 9		SILTY CLAY - Tan - Rust Staining White Areas 1/8" silt - (Chalky) Stiff - Med to high Plasticity Moist NOSC.
19							
20	SS			18	4 6 12		CLAY SILT, Tan - Rust Staining Trace fine gravel 1/8" subangular Very Stiff, Medium Plasticity Slightly Wet, NOSC
21							

J. H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS — MATERIALS TESTING

BORING LOG

HOLE NO.	PROJECT NO.	PROJECT	SHEET OF
C-16			2 1/2

MFG. DESIGNATION OF DRILL	LOCATION

TYPE OF BIT	HAMMER DATA: WT. LBS. DROP INCHES	ELEV.	TOTAL DEPTH OF HOLE

DATE		
STARTED	DRILLING AGENCY	
COMPLETED	INSPECTOR	GROUNDWATER DEPTH TIME
BACKFILLED	CREW	

SURFACE CONDITIONS

DRAFT

DIST. FROM SURF.	LEGEND	SAMPLE TYPE	SAMPLE NO.	RECOVERY	BLOWS PER 6 IN.	USCS	LOG OF MATERIAL
20							
1						20.6	
2							
3							
4							
25	SS		—	18	6 9 23		Sandy Silt tan - Fine Sand - Stiff Med. Plasticity - Moist NOSC
6							SAND - Tan - Trace fine gravel ¼" poorly sorted, fine to medium Sand Some Silt. Medium Dense, Wet NOSC
7							
8							
9							
30	SS		—	18	4 6 9		CLAY - Tan - Trace Black Organics Stiff - High Plasticity, Wet NOSC
11							
12							
13							
14							Screen
35	SS		—	18	4 19 37		SAND - GREY - Very Dense - Wet NOSC Fine to Medium Sand
16							
17							
18							
19							
20							
21							

J. H. KLEINFELDER & ASSOCIATES — BORING LOG C-17

GEOTECHNICAL CONSULTANTS — MATERIALS TESTING

HOLE NO.	PROJECT NO.	PROJECT	SHEET
C-17		Chevron	OF 1/2

MFG. DESIGNATION OF DRILL	LOCATION
CME-75	4707 First St Livermore, CA

TYPE OF BIT	HAMMER DATA: WT. 140 LBS. DROP 30 INCHES	ELEV.	TOTAL DEPTH OF HOLE
			30

DATE		
STARTED 2:23 - 1-9-85	DRILLING AGENCY Kleinfelder	
COMPLETED 6:00 1-9-85	INSPECTOR E Findley	GROUNDWATER DEPTH 17.5' TIME
BACKFILLED	CREW Ron + Randy Oakley	

SURFACE CONDITIONS

DRAFT

DIST. FROM SURF.	LEGEND	SAMPLE TYPE	SAMPLE NO.	RECOVERY	BLOWS PER 6 IN.	USCS	LOG OF MATERIAL
						3"	Asphalt 1' - In Street S. Front
1						Gravel	
2						Bed Sand	Blank
3							
4							
5	SS			12	3	Sand	Screen
6					5		SILTY CLAY Black Trace Root Fragments Stiff, High Plasicity, NOSC Moist.
7					6		
8	SS			18	5		CLAY - Tan - Little Silt Light grey or white mottling Rust Staining - Black organics (Trace) Very Stiff, High Plasticity, Moist NOSC
9					6		
10	SS			16"	8		SILTY CLAY - Tan - light grey mottling Trace fine gravel & rounded Rust Staining Very Stiff, Med Plasticity NOSC Moist.
11					7		
12					11		
13	SS			18	13		CLAY - TAN & Rust Little Silt - Trace black organics Rust staining - Very Stiff - Med Plasticity Moist - Slight Gas Odor; CLAY - TAN - Black Organics & fissures Cracks Stiff - Med Plasticity Moist - Slight Gas Odor
14					7		
15	SS				16		
16					13		
17					4		
18				18	5	First	CLAY - Tan w White Mottling Trace Rust Staining Very Stiff Low to Medium Plasticity Moist - NOSC - Trace Black Organics
19					8		
20					10		
21							

JHK&A Form 1-22A

SHEET _____ OF _____ HOLE NO. _____

J. H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS — MATERIALS TESTING

BORING LOG

DRAFT

HOLE NO.	PROJECT NO.	PROJECT	SHEET
C-17			OF 2/2

MFG. DESIGNATION OF DRILL	LOCATION

TYPE OF BIT	HAMMER DATA: WT. LBS. DROP INCHES	ELEV.	TOTAL DEPTH OF HOLE

DATE			
	STARTED	DRILLING AGENCY	GROUNDWATER DEPTH ____ TIME ____
	COMPLETED	INSPECTOR	____ ____
	BACKFILLED	CREW	____ ____

SURFACE CONDITIONS

DIST. FROM SURF.	LEGEND	SAMPLE TYPE	SAMPLE NO.	RECOVERY	BLOWS PER 6 IN.	USCS	LOG OF MATERIAL
0							Gas Odor Coming out of Hole During Drill
1							
2							
3	SS			14	5		CLAY - Tan with White Mottling, Trace Rust Staining, Hard, Medium Plasticity, Wet, MOSC
4					10		
					14		
5							
6							
7							CLAY As Above
8	SS			12	7		SAND Gray - Fine to Medium Grained - Medium Dense, MOSC Wet
9					12	Sand	
10					16	Screen	
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Drilling Log

Well Number RW-1

Project Chevron — Owner Chevron U.S.A.

Location Livermore — Project Number 20-3229

Date Drilled 1/16/85 — Total Depth of Hole 32' — Diameter 24"

Surface Elevation ____ — Water Level, Initial ~13.5' — 24-hrs. ____

Screen: Dia. 12" — Length 30' — Slot Size .020

Casing: Dia. 12" — Length 5' — Type PVC

Drilling Company Malcolm — Drilling Method Auger/Bucket

Driller Rip/Bill — Log by C. Harper

Sketch Map

On Mobil property
Northwest corner

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		VAULT			
4"					Asphalt
6					Silty clay with gravel and sand, some roots
7		CEMENT			Ilitting side of concrete? Gravels Moved 8" to the side of concrete pipe
8					Moved, hit water line at 2', moved
10		BENTONITE			Gravels (pea gravel fill for culvert pipe) Stopped at 10' due to caving of gravels
16					Yellow silty clay with fine sand intermixed, moist
18					Gray silty clay
21					Sand with clay
22					Tight light brown clay
23.5					Very tight clay
26					
32.5		BOTTOM CAP			Gravely clay and sand
					Bottom
					Cased to 32.5'
					15 ppm reading of gas vapors in gravel backfill
					Odors to the nose

02100144

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Drilling Log

Well Number 18

Project Chevron/Livermore Owner Chevron U.S.A.

Location 1stSt. & S. Front Rd. Project Number 20-3229

Date Drilled 3-29-85 Total Depth of Hole 29 ft Diameter 8 inch

Surface Elevation _____ Water Level, Initial 14.0ft. 24-hrs. 13.35 ft.

Screen: Dia. 2 inch Length 20 ft. Slot Size .020

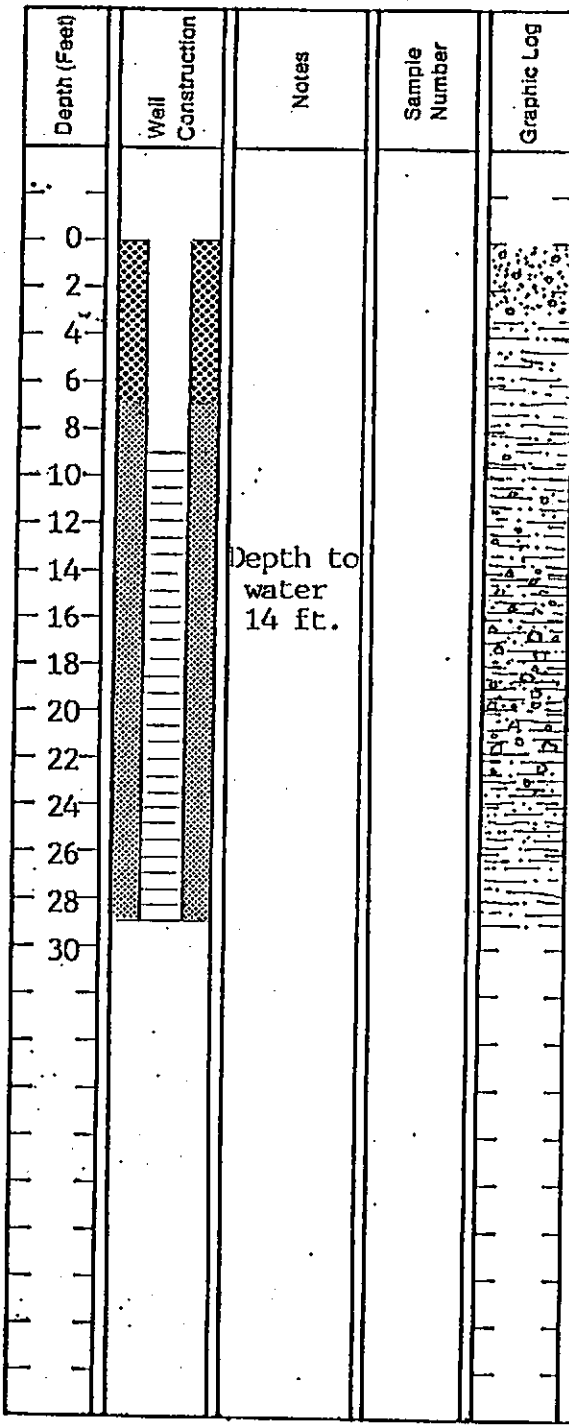
Casing: Dia. 2 inch Length 9 ft. Type PVC

Drilling Company Sierra Pacific Drilling Method 8 " H.S. Auger

Driller Gary Taggert Log by R. Juncal

Sketch Map

Notes



Description/Soil Classification (Color, Texture, Structures)

4" asphalt

Road base to 3', sand to gravel

Dark brown silty clay, 20% sand

Black clay, 10% silt to small pebbles

Brown clay, 10% sand to pebbles

Brown clay to pebbles, some gravel (1 inch)

Black silty clay to gravel (2 inch)

Brown silty clay to gravel

Gray silty clay, 30% sand

Gray silty clay, some sand

Screen	29 to 9 ft.
Blank	9 to 0 ft.
Sand	29 to 7 ft.
Bentenite	7 to 6 ft.
Cement	6 to 0 ft.

02100144

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Well Number 19

Drilling Log

Project Chevron/Livermore Owner Chevron U.S.A.

Location 1stSt. & S. Front Rd. Project Number 20-3229

Date Drilled 3-29-85 Total Depth of Hole 25 ft. Diameter 8 inch

Surface Elevation _____ Water Level, Initial 14.5 ft 24-hrs. 14.84 ft.

Screen: Dia. 2 inch Length 17 ft. Slot Size .020

Casing: Dia. 2 inch Length 8 ft. Type PVC

Drilling Company Sierra Pacific Drilling Method 8" H.S. Auger

Driller Gary Taggart Log by R. Juncal

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0					4" asphalt
2					Road base to 3', sand and gravel
4					Dark brown silty clay, 5% small pebbles
6					
8					Dark brown silty clay, creamy
10					
12					Dark brown clay, 5% sand, slight odor
14		Depth to water 14.5 ft.			Light brown silty clay
16					
18					Light brown clay
20					
22					Light brown clay
24					Same
26					

Screen	25 to 9 ft.
Blank	9 to 0 ft.
Sand	25 to 7 ft.
Bentonite	7 to 6 ft.
Cement	6 to 0 ft.

02100144

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
4 Mill St., Greenville, NH 03048
Tel: (603) 878-2500

Consulting Offices:
Needham, MA — Redondo Beach, CA
Chadds Ford, PA — Concord, CA
Novi, MI

Laboratory Test Results

1/24/85
Report No. 20-3229-1
Submitted to: Cliff Harper
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 13772 taken by P. Walsh at site 20-3229, Livermore, California analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst J.P.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb

Michael D. Webb
Technical Director

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C7-C10	TOTAL	
13772	RW	1/21/85	1/23/85	3630	6830	562	2820	13000	2750	29600	*2

*NOTES:

2 = METHANE DETECTED AT 100-1000 PPB

Report No. 20-3229-1

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY

4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

McKesson Environmental Services
6363 Clark Avenue P O Box 2277, Dublin CA 94568 Tel 415 828 1446
Outside California 800 227 1316

McKesson

951-ZS(135)

February 11, 1985

CHEV. LIVERMORE

Ms. Jan Jacobson
Groundwater Technology
5047 Clayton Road
Concord, CA 94521

Dear Jan:

Attached are results from one water sample submitted January 30, 1985, for selected inorganic parameters.

If you have any questions regarding this information, please call.

Sincerely,

Karen E. Bankert

Karen E. Bankert
Project Manager

KEB/ds
Attch.

SAMPLES NOT DESTROYED IN TESTING ARE RETAINED A MAXIMUM OF 30 DAYS UNLESS OTHERWISE REQUESTED.

McKESSON ENVIRONMENTAL SERVICES 951-ZS(135)

Analytical Results
GROUNDWATER TECHNOLOGY

Lab Number:	19616/17/18
Sample I.D.:	Background Water

Parameter	Concentration, mg/L
pH	7.56
Alkalinity	800
Chloride	140
Orthophosphate (PO_4^{-3})	0.30
Sulfate	140
Total Suspended Solids	5.0
Calcium	110
Iron	<0.10
Magnesium	72
Potassium	10
Sodium	380

N. W. Flynn, Laboratory Manager

CERTIFICATION OF REPRESENTATIVE SAMPLE OR SAMPLE INTEGRITY IS NOT MADE BY McKESSON ENVIRONMENTAL SERVICES (MES) FOR SAMPLES NOT TAKEN BY MES.

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
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Tel: (603) 878-2500

(sulting Offices:
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hadds Ford, PA — Concord, CA
ovi, MI

Laboratory Test Results

2/14/85
Report No. 20-3229-3
Submitted to:

Cliff Harper
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14086-14089 taken by C. Harper at site 20-3229, Livermore, California analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst J.P.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb
Technical Director

H :OC ..JON_ ..N W...ER ug/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C7-C10	TOTAL
14086	INF-1	2/9/85	2/13/85	7910	11500	755	4850	19300	4570	48900
14087	INF-2	2/9/85	2/13/85	7640	9750	194	4390	26500	3460	51900
14088	EFF-3	2/9/85	2/13/85	ND	ND	ND	ND	ND	ND	ND
14089	EFF-4	2/9/85	2/13/85	ND	ND	ND	ND	ND	ND	ND

*NOTES:

INF = INFLUENT
EFF = EFFLUENT

ND = NONE DETECTED

Report No. 20-3229-3

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

GROUNDWATER TECHNOLOGY LABORATORY

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nsulting Offices:
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Laboratory Test Results

2/28/85
Report No. 20-2013-4
Submitted to:

Cliff Harper
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14294 taken by C. Harper at site 20-2013, Davis, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst J.P.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb

Michael D. Webb
Technical Director

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C7-C10	TOTAL	
14294	1	2/22/85	2/27/85	ND	ND	ND	ND	ND	ND	ND	*7

*NOTES:

7 = BUBBLE IN SAMPLE CONTAINER.

ND = NONE DETECTED.

REPORT NO. 20-2013-4

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY

4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

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:nadds Ford, PA — Concord, CA
lovi, MI

Laboratory Test Results

3/4/85
Report No. 20-3229-5
Submitted to:

Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14306-14309 taken by F. Seiler at site 20-3229, Livermore, California analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst D.G.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb
Technical Director

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C7-C10	TOTAL
14306	INF-A	2/26/85	2/28/85	7360	10600	169	5200	30800	2980	57100
14307	INF-B	2/26/85	3/1/85	8350	11700	145	5800	35100	3180	64300
14308	EFF-A	2/26/85	3/1/85	ND	ND	ND	ND	ND	ND	ND
14309	EFF-B	2/26/85	3/1/85	ND	ND	ND	ND	ND	ND	ND

*NOTES:

ND = NONE DETECTED

INF = INFLUENT
EFF = EFFLUENT

Report No. 20-3229-5

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY

4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

GROUNDWATER TECHNOLOGY LABORATORY

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Novi, MI

Laboratory Test Results

3/8/85
Report No. 20-3229-6
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14421-14424 taken by R. Juncal at site 20-3229, Livermore, California analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst D.G.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb
Technical Director

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
14421	INF-A	3/4/85	3/7/85	6060	7790	410	5300	19000	2300	40900
14422	INF-B	3/4/85	3/7/85	6180	7880	469	4240	17800	2730	39300
14423	EFF-A	3/4/85	3/7/85	ND	ND	ND	ND	ND	ND	ND
14424	EFF-B	3/4/85	3/7/85	ND	ND	ND	ND	ND	ND	ND

*NOTES:

ND = NONE DETECTED

INF = INFLUENT
EFF = EFFLUENT

Report No. 20-3229-6

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

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ovi, MI

Laboratory Test Results

3/13/85
Report No. 20-3229-7
Submitted to:

Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14485-14487 taken by R. Juncal at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst D.G.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

Respectfully submitted,

Michael D. Webb
Technical Director

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
14485	INF	3/11/85	3/13/85	3260	5370	4	4190	23000	2210	38000
14486	EFF-A	3/11/85	3/13/85	ND	ND	ND	ND	61	ND	61
14487	EFF-B	3/11/85	3/13/85	ND	ND	ND	ND	64	ND	64

*NOTES:

ND = NONE DETECTED

INF = INFLUENT
EFF = EFFLUENT

Report No. 20-3229-7

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

GROUNDWATER TECHNOLOGY LABORATORY

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Tel: (603) 878-2500

onsulting Offices:
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..dds Ford, PA — Concord, CA
ovi, MI

Laboratory Test Results

4/1/85
Report No. 20-3229-8
Submitted to:

Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14765-14766 taken by R. Juncal at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analysts S.E.B., and J.P.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
14765	INF	3/20/85	3/27/85	912	506	10	548	1530	1440	4950
14766	EFF	3/20/85	3/27/85	ND	ND	ND	ND	87	ND	87

*NOTES:

ND = NONE DETECTED

INF = INFLUENT
EFF = EFFLUENT

Report No. 20-3229-8

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
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Tel: (603) 878-2500

Consulting Offices:
leedham, MA — Redondo Beach, CA
hadds Ford, PA — Concord, CA
Novi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Exceptions are as follows:
The reproducibility of duplicate samples was not acceptable.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
4 Mill St., Greenville, NH 03048
Tel: (603) 878-2500

nsulting Offices:
edham, MA — Redondo Beach, CA
hadds Ford, PA — Concord, CA
lovi, MI

4/4/85
Report No. 20-3229-9
Submitted to:

Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14993-14994 taken by R. Juncal at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.E.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
14993	INF	3/26/85	4/3/85	5610	15600	633	12500	43100	3910	81400
14994	EFF	3/26/85	3/3/85	ND	ND	ND	ND	84	ND	84

*NOTES:

ND = NONE DETECTED

INF = INFLUENT
EFF = EFFLUENT

Report No. 20-3229-9

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY

4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

GROUNDWATER TECHNOLOGY LABORATORY

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Division of Oil Recovery Systems, Inc.
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Tel: (603) 878-2500

onsulting Offices:
edham, MA — Redondo Beach, CA
dds Ford, PA — Concord, CA
ovi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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nsulting Offices:
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4/9/85
Report No. 20-2053-4
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 14995-14996 and 15088-15089 taken by R. Juncal and W. Smith, at site 20-2053, Martinez, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.E.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
14995	INF	3/28/85	4/8/85	6150	1150	114	2110	2860	1490	13900 *2
14996	EFF	3/28/85	4/8/85	ND	ND	ND	ND	ND	ND	ND
15088	INF	4/4/85	4/8/85	7760	1790	647	2480	3040	1380	17100 *2
15089	EFF	4/4/85	4/8/85	3	ND	ND	ND	ND	ND	3

*NOTES:

ND = NONE DETECTED
2= METHANE DETECTED AT 100-1000 PPB.
INF= INFLUENT
EFF= EFFLUENT

REPORT NO. 20-2053-4

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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hadds Ford, PA — Concord, CA
lovi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Exceptions: The presence of benzene in sample #15809 is determined only by retention time on a single column. Only one sample was provided and a second column identification was not performed.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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4/26/85
Report No. 20-3229-11
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 15321-15322 taken by R. Juncal at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL	
15321	INF	4/17/85	4/26/85	1000	204	ND	3410	15500	2040	22200	
15322	EFF	4/17/85	4/26/85	ND	ND	ND	ND	22	ND	22	*5

*NOTES:

ND = NONE DETECTED

EFF = EFFLUENT
INF = INFLUENT

5= THE DUPLICATE SAMPLE WAS ANALYZED ON A DISSIMILAR COLUMN TO CONFIRM THE ABSENCE OF BENZENE.

Report No. 20-3229-11

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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Needham, MA — Redondo Beach, CA
Chadds Ford, PA — Concord, CA
Novi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Exceptions: Samples were received at 15'C.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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vi, MI

Laboratory Test Results

5/6/85
Report No. 20-3229-12
Submitted to:

Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 15440-15441 taken by R. Dominic Jones at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.E.B./M.J.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
15440	INF	4/24/85	5/2/85	3450	4910	2	7170	27000	4750	47300
15441	EFF	4/24/85	4/25/85	3	2	ND	11	46	ND	62

*NOTES:

ND = NONE DETECTED

EFF = EFFLUENT
INF = INFLUENT

Report No. 20-3229-12

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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GROUNDWATER TECHNOLOGY LABORATORY

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ovi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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:vi, MI

5/13/85
Report No. 20-3229-13
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 15634-15635 taken by Charles Carmel at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst S.E.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
15634	A/S EFF	5/1/85	5/10/85	ND	ND	ND	ND	TRACE	ND	TRACE
15635	A/S INF	5/1/85	5/10/85	392	7	ND	1830	11800	2150	16200

*NOTES:

ND = NONE DETECTED
TRACE = COMPOUNDS DETECTED BUT BELOW LEVEL FOR RELIABLE QUANTITATION.

EFF = EFFLUENT
INF = INFLUENT

Report No. 20-3229-13

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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vi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

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Novi, MI

5/17/85
Report No. 20-3229-14
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 15789-15790 taken by C. Carmel at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst M.J.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
15789	EFF	5/8/85	5/16/85	ND	ND	ND	ND	38	ND	38
15790	INF	5/8/85	5/16/85	204	ND	ND	1090	7370	1110	9770

*NOTES:

ND = NONE DETECTED

EFF = EFFLUENT
INF = INFLUENT

Report No. 20-3229-14

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY

4 MILL STREET, GREENVILLE, NEW HAMPSHIRE 03048

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Consulting Offices:
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Chadds Ford, PA — Concord, CA
Novi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
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Quality Assurance Specifications:
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Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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lovi, MI

Laboratory Test Results

5/20/85
Report No. 20-3229-15
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 15866-15867 taken by C. Carmel at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst L.L.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
15866	EFF	5/15/85	5/17/85	ND	ND	ND	ND	27	ND	27
15867	INF	5/15/85	5/17/85	1870	612	ND	1540	13000	909	17900

*NOTES:

ND = NONE DETECTED

EFF = EFFLUENT
INF = INFLUENT

Report No. 20-3229-15

Oil Recovery Systems

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GROUNDWATER TECHNOLOGY LABORATORY

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lovi, MI

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report has been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY
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LABORATORY SERVICES

6/17/85
Report No. 20-3229-16
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples 16320-16321 taken by F.C.Seiler at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst M.J.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
16320	A/S/INF	6/5/85	6/14/85	3370	1970	ND	3260	23700	1130	33400
16321	A/S EFF	6/5/85	6/14/85	ND	ND	ND	ND	ND	ND	ND

*NOTES:

ND = BELOW DETECTION LIMIT
A/S EFF = EFFLUENT
A/S INF = INFLUENT

Report No. 20-3229-16

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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LABORATORY SERVICES

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report have been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY
4 Mill Street, Greenville, NH 03048 (603) 878-2500, Telex 752858
LABORATORY SERVICES

7/10/85
Report No. 20-3229-17
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water sample 16896 taken by C. Carmel at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst M.J.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

HYDROCARBONS IN WATER µg/L (ppb)

SAMPLE NO.	I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	C4-C12 ALIPHATIC HYDROCARBONS	MISC. AROMATICS C8-C12	TOTAL
16896	A/S EFF	7/8/85	7/9/85	ND	ND	ND	ND	ND	ND	ND

*NOTES:

ND = BELOW DETECTION LIMIT
A/S EFF = EFFLUENT

Report No. 20-3229-17

Oil Recovery Systems

GROUNDWATER TECHNOLOGY LABORATORY
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LABORATORY SERVICES

Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Exception: Sample was received at 25°C.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report have been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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Laboratory Test Results

10/3/85
Report No. 20-3229-18
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples #18537-18539 taken by C. Carmel at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analysts J.B./S.B.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

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HYDROCARBONS IN WATER ug/L (ppb)
REPORT NO. 20-3229-18

Sample I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	TOTAL BTEX
18537 AS-INF	9/30/85	10/2/85	3110	3550	102	3630	10400
18538 AS-EFF	9/30/85	10/2/85	ND	ND	ND	104	104
18539 BLANK	9/30/85	10/2/85	ND	ND	ND	ND	ND

*NOTES:

ND = BELOW DETECTION LIMIT

TOTAL BTEX = THE SUM OF BENZENE, TOLUENE, ETHYL BENZENE, AND XYLENES, ROUNDED TO THREE SIGNIFICANT FIGURES.

GROUNDWATER TECHNOLOGY LABORATORY

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HYDROCARBONS IN WATER ug/l
REPORT NO. 20-3229-18

SAMPLE NO.	I.D.	C4-C12 ALIPHATIC HYDROCARBONS	MISC AROMATICS C8-C12	TOTAL
18537	AS-INF	21400	2340	34100 *2
18538	AS-EFF	120	242	470 *5
18539	BLANK	ND	ND	ND

*NOTES:

TOTAL = THE SUM OF THE TOTAL BTEX AND THE ABOVE PARAMETERS.

ND = BELOW DETECTION LIMIT

2 = METHANE DETECETED AT 100-1000 PPB.
5 = UNCATEGORIZED COMPOUNDS PRESENT AT LESS THAN 200 PPB.

AS-INF = AIR STRIPPER INFLUENT
AS-EFF = AIR STRIPPER EFFLUENT

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
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Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report have been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY LABORATORY

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Laboratory Test Results

10/29/85
Report No. 20-3229-19
Submitted to: Robert Juncal
Groundwater Technology
5047 Clayton Rd.
Concord, CA 94519

The attached report covers water samples #18998-18999 taken by K. Greenfield at site 20-3229, Livermore, California and analyzed by GC/FID Static Headspace Analysis for volatile hydrocarbons, analyst L.L.

Method Detection Limits (MDL) listed are the levels above which quantitation is considered reliable: benzene and toluene 1 ppb, ethylbenzene 2 ppb, total xylenes 6 ppb. The level for reliable quantitation for total aliphatic hydrocarbons and miscellaneous aromatics is 20 ppb.

If noted on report, MDL is increased by a factor of 44 for dilutions made in order to maintain calibrated range. Precision for levels above 10 times MDL is 10%. Precision at MDL equals 30%. Hexane and ortho-xylene used as calibration standards for aliphatic hydrocarbons and miscellaneous aromatics, respectively.

GROUNDWATER TECHNOLOGY LABORATORY

ANALYTICAL & CONSULTING SERVICES
Division of Oil Recovery Systems, Inc.
4 Mill St., Greenville [illegible] 03048
Tel: (60 [illegible]00

HYDROCARBONS IN WATER ug/L (ppb)
REPORT NO. 20-3229-19

Sample I.D.	DATE SAMPLED	DATE RUN	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	TOTAL BTEX
18998 A/S INF	10/22/85	10/25/85	4470	4680	14	6030	15200
18999 A/S EFF	10/22/85	10/25/85	ND	ND	ND	ND	ND

*NOTES:

ND = BELOW DETECTION LIMIT

TOTAL BTEX = THE SUM OF BENZENE, TOLUENE, ETHYL BENZENE, AND XYLENES, ROUNDED TO THREE SIGNIFICANT FIGURES.

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Division of Oil Recovery Systems, Inc.
4 Mill St., Greenville, NH 03048
Tel: (603) 878-2500

HYDROCARBONS IN WATER ug/l
REPORT NO. 20-3229-19

SAMPLE NO.	I.D.	C4-C12 ALIPHATIC HYDROCARBONS	MISC AROMATICS C8-C12	TOTAL
18998	A/S INF	40100	4270	59600 *3
18999	A/S EFF	100	9	110

*NOTES:

TOTAL = THE SUM OF THE TOTAL BTEX AND THE ABOVE PARAMETERS.

ND = BELOW DETECTION LIMIT
3 = METHANE DETECTED AT 1000-10000 PPB.

A/S INF = AIR STRIPPER INFLUENT
A/S EFF = AIR STRIPPER EFFLUENT

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Quality Assurance Documentation

Statement of Sample Integrity:
The samples in this data set meet the Groundwater Technology Laboratory criteria for physical integrity as per GTL Method Code 103 throughout the sampling, handling and analytical process.

Quality Assurance Specifications:
The data in this set conforms to the GTL Quality Assurance program and provisions specified in EPA Method 602 including daily calibration with freshly made standards, blanks before trace level samples, surrogate spikes, spikes in untested matrices, a minimum of 10% duplicates and a minimum of 6% reference samples traceable to the U.S. EPA.

Certification:
The data in this report have been checked for accuracy and completeness.

Respectfully Submitted,

Michael D. Webb
Technical Director

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING GROUNDWATER MONITORING
SOP 8

Groundwater monitoring of wells at the site shall be conducted using an ORS Interface Probe and Surface Sampler. The Interface Probe is a hand held, battery operated device for measuring depth to petroleum product and depth to water as measured from an established datum (i.e., top of the well casing which has been surveyed). Product thickness is then calculated by subtracting the depth to product from the depth to water. In addition, water elevations are adjusted for the presence of fuel with the following calculation:

(Product Thickness)(.8)+(Water Elevation)
= Corrected Water Elevation

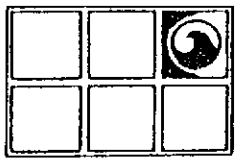
Note: The factor of 0.8 accounts for the density difference between water and petroleum hydrocarbons.

The Interface Probe consists of a dual sensing probe utilizing an optical liquid sensor and electrical conductivity to distingish between water and petroleum products. A coated steel measuring tape transmits the sensor's signals to the reel assembly, where an audible alarm sounds a continuous tone when the sensor is immersed in petroleum product and an oscillating tone when immersed in water. The Interface Probe is accurate to 1/16-inch.

A Surface Sampler shall be used for visual inspection of the groundwater to note sheens (difficult to detect with the Interface Probe), odors, microbial action, etc.

The Surface Sampler used consists of a 12-inch long cast acrylic tube with a Delrin ball which closes onto a conical surface creating a seal as the sampler is pulled up. The sampler is calibrated in inches and centimeters for visual inspection of product thickness.

To reduce the potential for cross contamination between wells the monitorings shall take place in order from the least to most contaminated wells. Wells containing free product should be monitored last. Between each monitoring the equipment shall be washed with laboratory grade detergent and double rinsed with distilled water.



GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING WATER SAMPLING METHODOLOGY
SOP 9

As per the Work Plan the monitoring wells will be on a monthly sampling schedule. Prior to water sampling, each well shall be purged by pumping a minimum of four well volumes or until the discharge water indicates stabilization of temperature, conductivity,and pH. If the well is evacuated before four well volumes are removed or stabilization is achieved, the sample should be taken when the water level in the well recovers to 80% of its initial level.

Retrieval of the water sample, sample handling and sample preservation shall be conducted in accordance with Groundwater Technology Laboratory Standard Operating Procedure (GTL SOP 10) concerning Sampling For Volatiles in Water". The sampling equipment used shall consist of a teflon and/or stainless steel samplers, which meets EPA regulations. Glass vials with teflon lids should be used to store the collected samples.

To insure sample integrity, each vial shall be filled with the sampled water such that the water stands above the lip of the vial. The cap should then be quickly placed on the vial and tightened securely. The vial should then be checked to ensure that air bubbles are not present prior to labeling of the sample. Lable information should include a sample identification number, job identification, date, time, type of analysis requested and the sampler's name. Chain-of-Custody forms shall be completed as per Groundwater Technology Laboratory Standard Operating Procedure (SOP 11) concerning Chain of Custody.

The vials should be immediately placed in high quality coolers for shipment to the laboratory. The coolers should be packed with sufficient ice or freezer packs to ensure that the samples are kept below 4C. Samples which are received at the Groundwater Technology Laboratory above 10 C. will be considered substandard. To minimize sample degradation the prescribed analysis shall take place within seven days of sample collection unless specially prepared acidified vials are used.

To minimize the potential for cross contamination between wells, all the well development and water sampling equipment which contacts the groundwater shall be steam cleaned between each well sampling. As a second precautionary measure, the wells shall be sampled in order of increasing contaminant concentrations as established by previous analysis.

GROUNDWATER TECHNOLOGY LABORATORY (GTL)
STANDARD OPERATING PROCEDURE
CONCERNING SAMPLING FOR VOLATILES IN WATER (DISSOLVED GASOLINE, SOLVENTS, ETC.).
SOP 10

1. Use only vials properly washed and baked, available from GTL or Pierce Chemical.

2. Use clean sampling equipment. Scrub with Alconox or equivalent laboratory detergent and water followed by a thorough water rinse. Complete with a distilled water rinse.

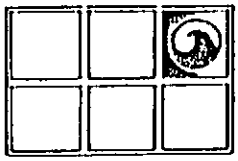
   Sampling equipment which has come into contact with liquid hydrocarbons (free product) should be regarded with suspicion. Such equipment should have tubing and cables replaced and all resilient parts washed with laboratory detergent solution, as above. Visible deposits may have to be removed with hexane, followed by methanol or acetone. CAUTION: do not breath methanol fumes. Solvent washing should be followed by detergent washing as above.

   This procedure is valid for volatile organics analysis only. For extractable organics (for example, pesticides, or base neutrals for EPA method 625) a final rinse with pesticide grade isopropyl alcohol, followed by overnight or oven drying, will be necessary.

3. Take duplicate samples for GTL. Mark on forms as a single sample with two containers to avoid duplication of analysis.

4. Take a site blank using distilled water or known uncontaminated source. This sample will be run at the discretion of the project manager.

5. Fill out labels and forms as much as possible ahead of time. Use an indelible laundry marker or a Space pen.



6. Preservatives are required for some types of samples. Use specially prepared vials from GTL, marked as indicated below, or use the appropriate field procedure (SOP 12 for acidification). Make note on forms that samples were preserved. Always have extra vials in case of problems.
For samples from dissolved gasoline sites or other samples potentially containing benzene, toluene, or xylenes, samples should be acidified below pH 2 with sulfuric acid. Use vials labelled "CAUTION: CONC. SULFURIC ACID". Handle these vials with care and keep them upright. Eye protection, foot protection, and disposable vinyl gloves are required for handling. Samples designated for expedited service and analyzed within seven (7) days of sampling will be acceptable without preservation.

   Acid causes burns. Glasses or goggles (not contacts) are necessary for protection of the eyes. Wash eyes with fresh water for 15 minutes if contact occurs and seek medical attention. Rinse off hands frequently with water during handling.

   For sampling chlorinated drinking water supplies for chlorinated volatiles, samples shall be preserved with sodium thiosulfate. Use vials labelled "CONTAINS THIOSULFATE". No particular cautions are necessary.

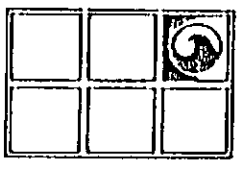
7. Fill vial to overflowing with water, avoiding turbulence and bubbling as much as possible. Water should stand above lip of vial.

8. Carefully but quickly slip cap onto vial. Avoid dropping the teflon disc from cap by not inverting cap until in contact with vial. Disc should have teflon face toward the water. Also avoid touching white teflon face with dirty fingers.

9. Tighten cap securely, invert vial and tap against hand to see that there are no bubbles inside.

10. Label vial using indelible ink as follows:

    a) Sample I.D. No. (and "Groundwater Technology" if not on preprinted label).
    b) Job I.D.
    c) Date and time.
    d) Type of analysis requested.
    e) Your name.

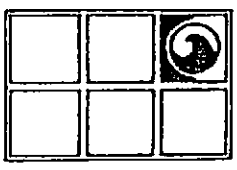


11. Unless the fabric type label is used, place scotch tape over the label to preserve its integrity.

12. For chain of custody reasons, sample vial should be wrapped end-for-end with scotch tape or evidence tape and signed with indelible ink where the end of the tape seals on itself. The septum needs to be covered.

13. Chill samples immediately. Samples to be stored should be kept at 4°C (39°F). Samples received at the laboratory above 10°C (as measured at glass surface by a thermocouple probe), after overnight shipping will be considered substandard, so use a high quality cooler with sufficient ice or freezer packs. (Coolers are available from GTL).

14. Fill out Chain of Custody and Analysis Request form. (See Chain of Custody Procedures SOP11).



GROUNDWATER TECHNOLOGY LABORATORY (GTL)
STANDARD OPERATING PROCEDURE
CONCERNING CHAIN OF CUSTODY
SOP 11

1. Samples must be maintained under custody until shipped or delivered to the laboratory. The laboratory will then maintain custody. A sample is under custody if:

   a) It is in your possession, or
   b) It is in your view after being in your possession, or
   c) You locked it up after being in your possession, or
   d) It is in a designated secure area.

2. Custody of samples may be transferred from one person to the next. Each transferee and recipient must date, sign and note the time on the chain of custody form.

3. In shipping, the container must be sealed with tape, bearing the sender's signature across the area of bonding at the ends of the tape in order to prevent undetected tampering. Each sampling jar should be taped and signed as well. Scotch tape works well.

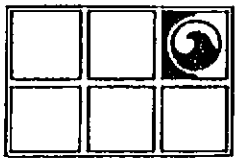
4. Write "sealed by" and sign in the Remarks box at the bottom of the form before sealing up the box. Place form in a plastic bag and seal inside the box.

5. The "REMARKS" section in the upper right part of the form is for documenting details such as:

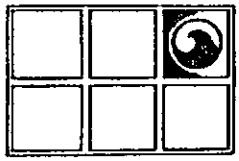
   a) correlation of sample numbers if samples are split between labs.
   b) QC numbers when lab is logging in the samples.
   c) Sample temperature and condition when received by lab.
   d) Preservation notation.
   e) pH of samples when opened for analysis (if acidified).

6. The chain of custody form should be included inside the shipping container. A copy should be sent to the project coordinator.

7. When the samples are received by the lab, the chain of custody form will be dated, signed, and a note of the time made by a laboratory representative. The form along with shipping bills and and receipts will be retained in the laboratory files.



8. At the time of receipt of samples by the laboratory, the shipping container will be inspected and the sealing signature will be checked, the samples will be inspected for condition and bubbles and the temperature of a representative sample container will be measured externally by a thermocouple probe (held tightly between two samples) and recorded. The laboratory QC numbers will be placed on the labels, in the accession log, and on the chain of custody form. If samples are acidified their pH will be measured by narrow range pH paper at the time of opening for analysis. All comments concerning procedures requiring handling of the samples will be dated and initialed on the form by the laboratory person performing the procedure. A copy of the completed chain of custody form with the comments on sample integrity will be returned to the sampler.



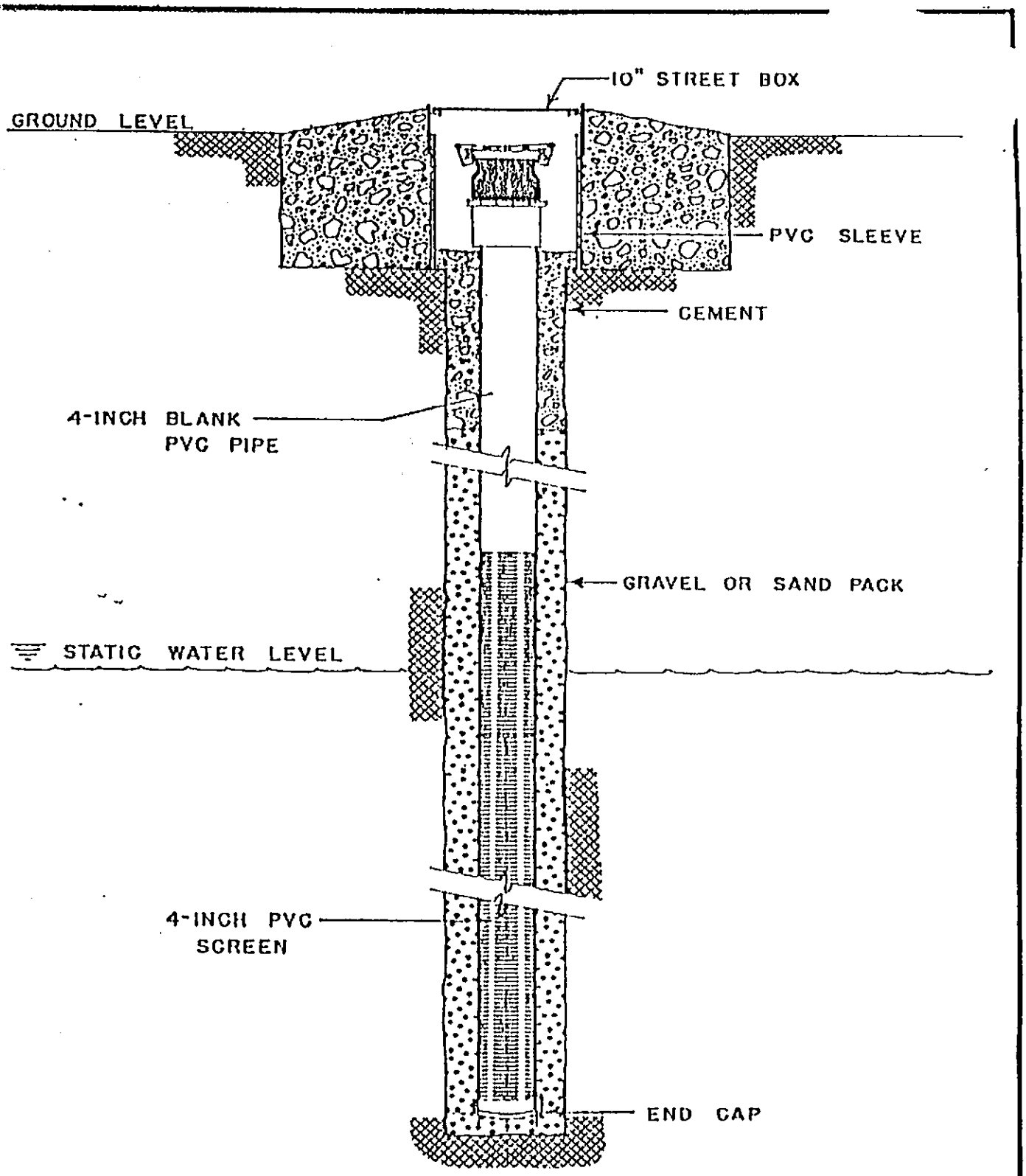
GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING MONITORING WELL INSTALLATION
SOP 13

The boreholes for the monitoring wells shall be drilled using a truck mounted hollow stem auger drill rig. The outside diameter (O.D.) of the auger should be a minimum of eight inches when installing 4-inch well screen. The hollow stem auger provides minimal interuption of drilling while permitting soil sampling at specific intervals. Soil samples can be taken at desired depths by hammering a conventional split barrel sampler containing precleaned 2 inch brass sample tubes.

The construction details of the monitoring wells to be drilled at the site are graphically depicted in the attached figure titled "Typical Detail of Monitoring Well Construction" (See Figure 1). The wells should be constructed of 4 inch PVC, .020 inch machine slotted screen and blank casing. A sand pack of #3 aquarium sand shall be placed in the annular space between the casing and drilled hole to inhibit silt buildup around the well. An annular seal installed above the sand pack should consist of bentonite pellets overlain by neat cement or cement grout to the surface. The wellhead shall be protected below grade within a traffic rated street box. Each well shall have a permanently attached identification plate containing the following information (1) Well Number, (2) Wellhead Elevation, (3) Depth of Well, (4) Screened Interval.

Subsequent to installation the wells shall be developed to remove silts and improve well performance. The well development shall be conducted by air lifting the water within the well followed by the introduction of clean water into the well and sparging. This process should continue until groundwater pumped from the wells is silt free.

To assure that cross contamination does not occur between the drilling and development of successive wells all equipment contacting subsurface soils or ground water shall be steam cleaned. The steam cleaned equipment should include but not limited to the following (1) Drilling Augers, (2) Split Barrel Sampler, (3) Groundwater Monitoring and Sampling Equipment, (4) Well Development Piping and Sparging Equipment.



TYPICAL DETAIL
MONITORING WELL CONSTRUCTION

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

JANUARY 28, 1985
DATE SAMPLE REC'D: 01/17/85
REPORT #: 104054

OIL RECOVERY SYSTEMS
5047 CLAYTON ROAD
CONCORD, CALIFORNIA 94521

ATTN: JAN JACOBSON

SAMPLE DESCRIPTION/ ANLAB ID#	BENZENE, UG/L	TOLUENE, UG/L	XYLENES, UG/L	GASOLINE, UG/L
CHEVRON/LIVERMORE				
MW-11 1-16-85 104054-1	27	15	5	120
MW-16 1-16-85 104054-2	110	*	1000	5000

*TOLUENE NOT CHROMATOGRAPHICALLY RESOLVED FROM LARGE BENZENE PEAK.

DATA CERTIFIED BY Ken Narle

REPORT APPROVED BY Roger Elliott

LJY

ANLAB/T. IKESAKI

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: May 17, 1985

DATE	ELEV. (ft.)	WELL 1	WELL 2	WELL 3	WELL 4	WELL 5	WELL 6	WELL 7	WELL 8	WELL 9	WELL 10
01/16/85	DTW	13.26	13.50	13.94	13.42	13.23	12.79	13.15	13.06	13.15	14.60
	DTP	13.00	13.47	-	-	-	12.38	13.02	13.05	12.32	-
	PT	0.26	0.03	0.00	0.00	0.00	0.41	0.13	0.01	0.83	0.00
01/17/85	DTW	13.82	14.00	14.73	14.14	13.90	13.48	13.95	-	13.49	14.74
	DTP	13.58	13.97	-	14.13	-	13.39	13.85	-	12.78	-
	PT	0.24	0.03	0.00	0.01	0.00	0.09	0.10	-	0.71	0.00
01/18/85	DTW	13.77	13.97	14.72	14.12	13.88	13.43	13.93	13.68	13.44	14.64
	DTP	13.55	13.96	-	-	-	13.37	13.82	-	12.72	-
	PT	0.22	0.01	0.00	0.00	0.00	0.06	0.11	0.00	0.72	0.00
01/19/85	DTW	13.92	14.10	14.73	14.20	13.91	13.62	14.01	-	13.83	15.72
	DTP	13.62	14.05	-	14.19	-	13.47	13.91	-	12.89	-
	PT	0.30	0.05	0.00	0.01	0.00	0.15	0.10	-	0.94	15.72
01/23/85	DTW	13.43	13.63	14.04	13.54	13.29	12.72	13.29	13.23	13.31	14.12
	DTP	13.10	13.60	-	-	-	12.61	13.15	-	12.52	-
	PT	0.33	0.03	0.00	0.00	0.00	0.11	0.14	0.00	0.79	0.00
01/27/85	DTW	-	-	-	-	-	-	-	-	13.31	15.20
	DTP	-	-	-	-	-	-	-	-	12.75	-
	PT	-	-	-	-	-	-	-	-	0.56	0.00
01/30/85	DTW	13.87	14.09	14.79	14.19	14.01	13.43	14.05	13.77	13.43	14.89
	DTP	13.65	14.08	-	-	-	13.42	13.93	-	12.92	-
	PT	0.22	0.01	0.00	0.00	0.00	0.01	0.12	0.00	0.51	0.00

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: May 17, 1985

DATE	ELEV. (ft.)	WELL 11	WELL 12	WELL 13	WELL 14	WELL 15	WELL 16	WELL 17	WELL RW
01/16/85	DTW	14.41	-	14.47	13.16	14.86	13.56	14.18	-
	DTP	-	-	-	-	-	-	14.17	-
	PT	0.00	-	0.00	0.00	0.00	0.00	0.01	-
01/17/85	DTW	14.94	-	15.01	14.26	-	13.69	14.90	-
	DTP	-	-	-	-	-	-	14.89	-
	PT	0.00	-	0.00	0.00	-	0.00	0.01	-
01/18/85	DTW	14.49	14.30	15.00	-	15.44	13.67	14.88	12.60
	DTP	-	-	-	-	-	-	Bailed	-
	PT	0.00	0.00	0.00	-	0.00	0.00	0.01	0.00
01/19/85	DTW		14.32	15.02	13.84	15.43	14.58	15.05	23.56
	DTP	Dry	-	-	-	-	-	-	22.27
	PT		0.00	0.00	0.00	0.00	0.00	0.00	1.29
01/23/85	DTW	11.45	13.97	14.54	13.20	14.95	13.70	14.22	-
	DTP	-	-	-	-	-	-	-	-
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
01/27/85	DTW	14.27	-	-	-	-	-	-	13.02
	DTP	-	-	-	-	-	-	-	12.45
	PT	0.00	-	-	-	-	-	-	0.57
01/30/85	DTW	14.47	14.39	15.11	13.63	15.54	13.90	14.99	16.55
	DTP	-	-	-	-	-	-	-	14.00
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.55

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: May 17, 1985

DATE	ELEV. (ft.)	WELL 1	WELL 2	WELL 3	WELL 4	WELL 5	WELL 6	WELL 7	WELL 8	WELL 9	WELL 10
02/06/85	DTW	13.75	14.00	14.75	14.18	13.93	13.47	13.98	13.71	13.32	14.76
	DTP	13.63	-	-	-	-	13.41	13.89	-	12.84	-
	PT	0.12	0.00	0.00	0.00	0.00	0.06	0.09	0.00	0.48	0.00
02/08/85	DTW	13.77	13.97	14.74	14.14	13.91	13.41	13.94	-	13.30	14.65
	DTP	13.59	13.95	-	-	-	13.36	13.82	-	12.79	-
	PT	0.18	0.02	0.00	0.00	0.00	0.05	0.12	-	0.51	0.00
02/12/85	DTW	13.35	13.46	14.14	13.76	13.64	13.00	13.51	13.29	13.26	15.04
	DTP	13.26	-	-	-	-	-	13.44	-	12.85	-
	PT	0.09	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.41	0.00
02/26/85	DTW	13.83	13.97	14.65	14.15	13.98	13.45	13.96	13.74	13.25	-
	DTP	13.66	13.96	-	-	-	13.44	13.90	-	12.91	-
	PT	0.17	0.01	0.00	0.00	0.00	0.01	0.06	0.00	0.34	-
03/20/85	DTW	13.61	13.73	14.44	13.96	13.77	13.22	13.66	13.54	13.02	-
	DTP	13.46	13.72	-	-	-	-	13.65	-	12.73	-
	PT	0.15	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.29	-
04/04/85	DTW	14.35	14.53	15.19	-	14.61	14.05	14.56	14.37	13.83	16.08
	DTP	14.31	-	-	-	-	-	14.51	-	13.58	-
	PT	0.04	0.00	0.00	-	0.00	0.00	0.05	0.00	0.25	0.00
04/23/85	DTW	13.62	13.93	14.61	-	13.89	13.38	13.87	14.30	12.95	15.12
	DTP	13.48	-	-	-	-	-	13.80	-	12.84	-
	PT	0.14	0.00	0.00	-	0.00	0.00	0.07	0.00	0.11	0.00

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: May 17, 1985

DATE	ELEV. (ft.)	WELL 11	WELL 12	WELL 13	WELL 14	WELL 15	WELL 16	WELL 17	WELL RW
02/06/85	DTW	14.65	14.34	15.07	13.46	15.46	13.77	14.95	-
	DTP	-	-	-	-	-	-	-	-
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
02/08/85	DTW	14.39	14.30	15.02	13.59	15.46	13.64	14.90	16.36
	DTP	-	-	-	-	-	-	-	13.98
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.38
02/12/85	DTW	15.12	14.25	14.63	13.13	14.82	13.84	14.76	22.91
	DTP	-	-	-	-	-	-	-	17.90
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.01
02/26/85	DTW	15.26	14.46	15.01	13.50	15.36	14.13	15.13	19.26
	DTP	-	-	-	-	-	-	-	18.78
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48
03/20/85	DTW	-	14.27	14.83	13.21	15.17	13.93	14.89	20.46
	DTP	-	-	-	-	-	-	-	19.68
	PT	-	0.00	0.00	0.00	0.00	0.00	0.00	0.78
04/04/85	DTW	16.15	15.17	15.62	13.95	15.93	14.92	15.82	21.62
	DTP	-	-	-	-	-	-	-	-
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/23/85	DTW	15.34	14.30	14.90	13.79	15.34	14.08	14.99	20.78
	DTP	-	-	-	-	-	-	-	19.80
	PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: May 17, 1985

DATE	ELEV. (ft.)	WELL 1	WELL 2	WELL 3	WELL 4	WELL 5	WELL 6	WELL 7	WELL 8	WELL 9	WELL 10
05/08/85	DTW	13.24	13.50	13.94	-	13.27	12.54	13.15	13.15	12.74	14.80
	DTP	13.08	-	-	-	-	-	13.07	-	12.58	-
	PT	0.16	0	0	-	0	0	0.08	0	0.16	0
05/21/85	DTW	13.41	13.65	14.08	-	13.42	12.70	13.29	13.30	12.91	14.88
	DTP	13.20	-	-	-	-	-	13.21	-	12.74	-
	PT	0.21	0	0	-	0	0	0.08	0	0.17	0
06/05/85	DTW	14.10	14.15	14.89	-	14.16	13.62	14.19	13.89	13.28	15.10
	DTP	13.80	-	-	-	-	-	14.03	-	13.09	-
	PT	0.30	0	0	-	0	0	0.16	0	0.19	0
07/03/85	DTW	13.35	13.61	14.02	-	13.47	12.69	13.28	13.22	12.88	14.99
	DTP	13.23	-	-	-	-	-	13.20	-	12.73	-
	PT	0.12	0	0	-	0	0	0.08	0	0.15	0
07/15/85	DTW	13.55	13.86	14.30	-	13.61	13.90	13.42	13.48	13.12	15.01
	DTP	13.41	-	-	-	-	-	-	-	12.93	-
	PT	0.14	0	0	-	0	0	0	0	0.19	0
07/30/85	DTW	14.06	14.34	15.07	-	14.25	13.79	14.19	14.09	13.29	15.24
	DTP	13.98	-	-	-	-	-	14.11	-	13.22	-
	PT	0.08	0	0	-	0	0	0.08	0	0.07	0

DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

PROJECT: Chevron-Livermore
JOB NUMBER: 20-3229
DATE: August 9, 1985

DATE	ELEV. (ft.)	WELL 11	WELL 12	WELL 13	WELL 14	WELL 15	WELL 16	WELL 17	WELL 18	WELL 19	WELL RW
05/08/85	DTW	14.42	13.95	14.44	12.92	14.88	13.68	14.28	-	-	16.30
	DTP	-	-	-	-	-	-	-	-	-	16.04
	PT	0	0	0	0	0	0	0	-	-	0.26
05/21/85	DTW	14.69	14.02	14.59	13.07	15.02	13.82	14.38	13.12	14.70	18.60
	DTP	-	-	-	-	-	-	-	-	-	18.25
	PT	0	0	0	0	0	0	0	0	0	0.35
06/05/85	DTW	15.11	14.46	15.21	13.58	15.63	14.05	15.14	13.66	15.24	18.16
	DTP	-	-	-	-	-	-	-	-	-	17.73
	PT	0	0	0	0	0	0	0	0	0	0.43
07/03/85	DTW	15.12	14.12	14.61	13.01	14.97	13.90	14.47	13.19	14.78	19.00
	DTP	-	-	-	-	-	-	-	-	-	18.90
	PT	0	0	0	0	0	0	0	0	0	0.10
07/15/85	DTW	14.81	14.14	14.82	13.25	15.26	13.98	14.53	13.22	14.85	19.20
	DTP	-	-	-	-	-	-	-	-	-	19.00
	PT	0	0	0	0	0	0	0	0	0	0.20
07/30/85	DTW	15.38	14.49	15.33	13.83	15.83	14.21	15.18	13.65	15.30	19.05
	DTP	-	-	-	-	-	-	-	-	-	18.49
	PT	0	0	0	0	0	0	0	0	0	0.56

DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness

GROUNDWATER TECHNOLOGY
Consulting Groundwater Geologists

PROJECT: CHEVRON/LIVERMORE
JOB NUMBER: 20-3229
DATE: December 1985

DATE	ELEV. (ft.)	WELL 1	WELL 2	WELL 3	WELL 4	WELL 5	WELL 6	WELL 7	WELL 8	WELL 9	WELL 10	WELL 11
08-12-85	DTW	13.51	13.85	14.32	-	13.61	12.90	13.50	13.44	13.08	14.97	14.75
	DTP	13.41	-	-	-	-	-	13.42	-	12.93	-	-
	PT	0.10	0	0	-	0	0	0.08	0	0.15	0	0
08-26-85	DTW	13.55	13.88	14.33	-	13.64	12.92	13.57	13.42	13.10	14.96	14.79
	DTP	13.44	-	-	-	-	-	13.44	-	12.95	-	-
	PT	0.11	0	0	-	0	0	0.13	0	0.15	0	0
09-16-85	DTW	13.54	13.90	14.38	-	13.68	12.94	13.52	13.49	13.07	14.96	14.67
	DTP	13.48	-	-	-	-	-	13.47	-	-	-	-
	PT	0.06	0	0	-	0	0	0.05	0	0	0	0
09-30-85	DTW	13.59	13.93	14.39	-	13.72	12.95	13.58	13.55	12.99	14.97	14.38
	DTP	13.51	-	-	-	-	-	13.50	-	-	-	-
	PT	0.08	0	0	-	0	0	0.08	0	0	0	0
10-22-85	DTW	13.75	-	-	-	-	13.27	13.83	13.51	13.87	-	-
	DTP	13.69	-	-	-	-	-	13.80	-	13.78	-	-
	PT	0.06	0	0	0	0	0	0.03	0	0.09	0	0
10-27-85	DTW	14.18	14.38	15.09	-	14.42	13.85	13.51	14.12	13.51	15.37	15.46
	DTP	14.11	-	-	-	-	-	13.49	-	13.42	-	-
	PT	0.07	0	0	0	0	0	0.02	0	0.09	0	0

DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness

GROUNDWATER TECHNOLOGY
Consulting Groundwater Geologists

PROJECT: CHEVRON/LIVERMORE
JOB NUMBER: 20-3229
DATE: December 1985

DATE	ELEV. (ft.)	WELL 12	WELL 13	WELL 14	WELL 15	WELL 16	WELL 17	WELL 18	WELL 19	WELL RW 1	WELL RT
08-12-85	DTW	14.10	14.82	13.39	15.29	13.92	14.48	13.18	14.75	17.67	4.11
	DTP	-	-	-	-	-	-	-	-	17.36	3.95
	PT	0	0	0	0	0	0	0	0	0.31	0.16
08-26-85	DTW	14.12	14.86	13.47	15.33	14.91	14.56	13.20	14.83	-	4.13
	DTP	-	-	-	-	-	-	-	-	19.85	3.96
	PT	0	0	0	0	0	0	0	0	0	0.17
09-16-85	DTW	14.15	14.88	13.42	15.34	13.91	14.53	13.23	14.83	19.11	4.01
	DTP	-	-	-	-	-	-	-	-	17.59	3.91
	PT	0	0	0	0	0	0	0	0	1.52	0.10
09-30-85	DTW	14.20	14.94	13.39	15.36	13.81	14.56	13.27	14.78	19.94	4.10
	DTP	-	-	-	-	-	-	-	-	19.80	3.94
	PT	0	0	0	0	0	0	0	0	0.14	0.16
10-22-85	DTW	14.59	-	13.39	-	14.08	-	-	-	19.74	-
	DTP	-	-	-	-	-	-	-	-	19.60	-
	PT	0	0	0	0	0	0	0	0	0.14	0
10-27-85	DTW	14.65	15.44	-	16.84	14.34	15.27	13.84	15.34	-	-
	DTP	-	-	-	-	-	-	-	-	-	-
	PT	0	0	0	0	0	0	0	0	0	0

DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness

GROUNDWATER TECHNOLOGY
Consulting Groundwater Geologists

PROJECT: CHEVRON/LIVERMORE
JOB NUMBER: 20-3229
DATE: December 1985

DATE	ELEV. (ft.)	WELL 1	WELL 2	WELL 3	WELL 4	WELL 5	WELL 6	WELL 7	WELL 8	WELL 9	WELL 10	WELL 11
11-26-85	DTW	13.59	13.64	14.32	-	14.04	13.13	13.67	13.35	12.71	15.12	DRY
	DTP	13.57	-	-	-	-	-	-	-	-	-	-
	PT	0.02	0	0	0	0	0	0	0	0	0	0

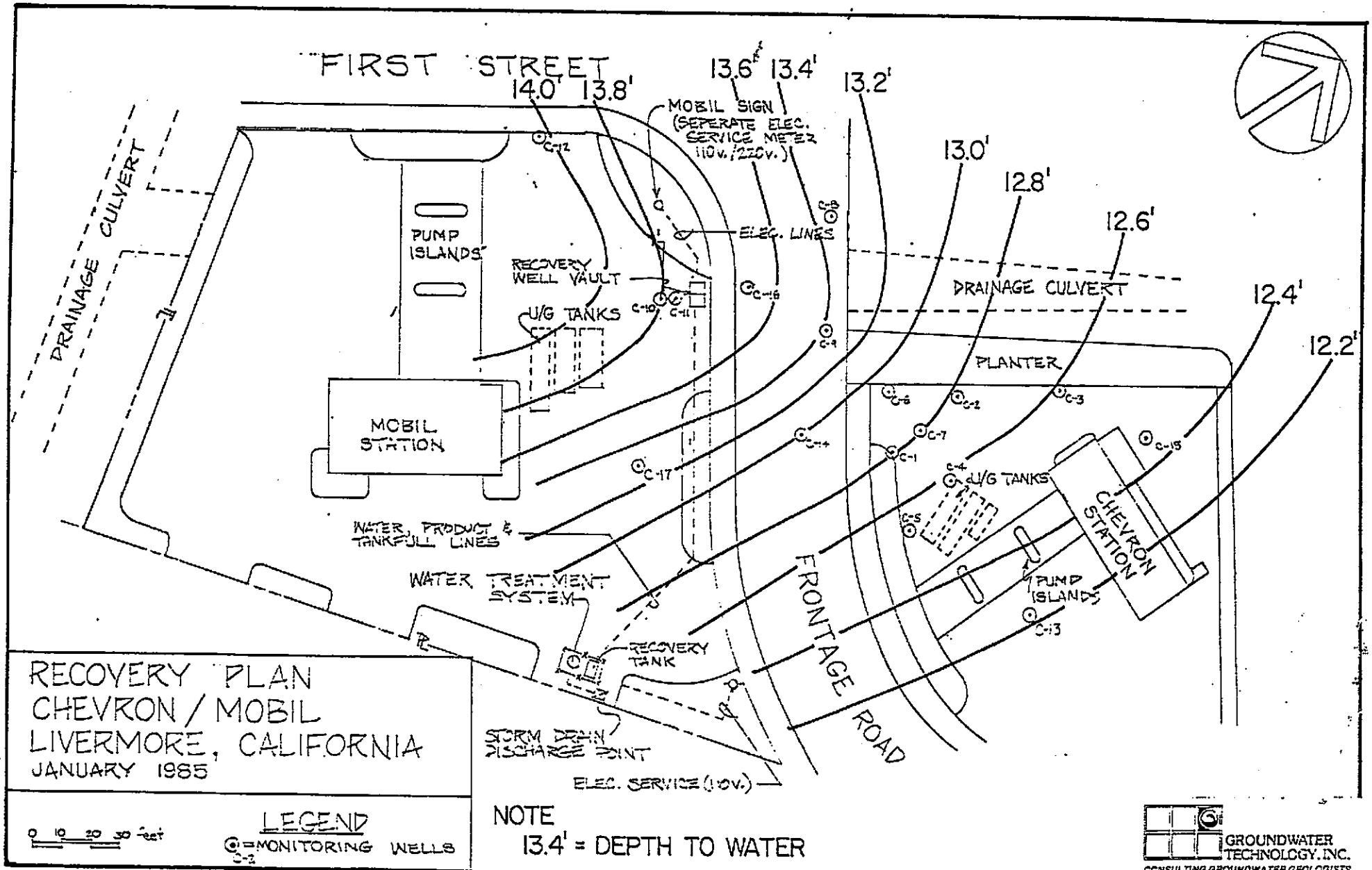
DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness

GROUNDWATER TECHNOLOGY
Consulting Groundwater Geologists

PROJECT: CHEVRON/LIVERMORE
JOB NUMBER: 20-3229
DATE: December 1985

DATE	ELEV. (ft.)	WELL 12	WELL 13	WELL 14	WELL 15	WELL 16	WELL 17	WELL 18	WELL 19	WELL RW 1	WELL RT
11-26-85	DTW	14.57	14.98	-	15.50	13.88	15.22	13.76	15.32	-	2.20
	DTP	-	-	-	-	-	-	-	-	-	2.07
	PT	0	0	0	0	0	0	0	0	0	4.20

DTW = Depth To Water
DTP = Depth To Product
PT = Product Thickness



RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

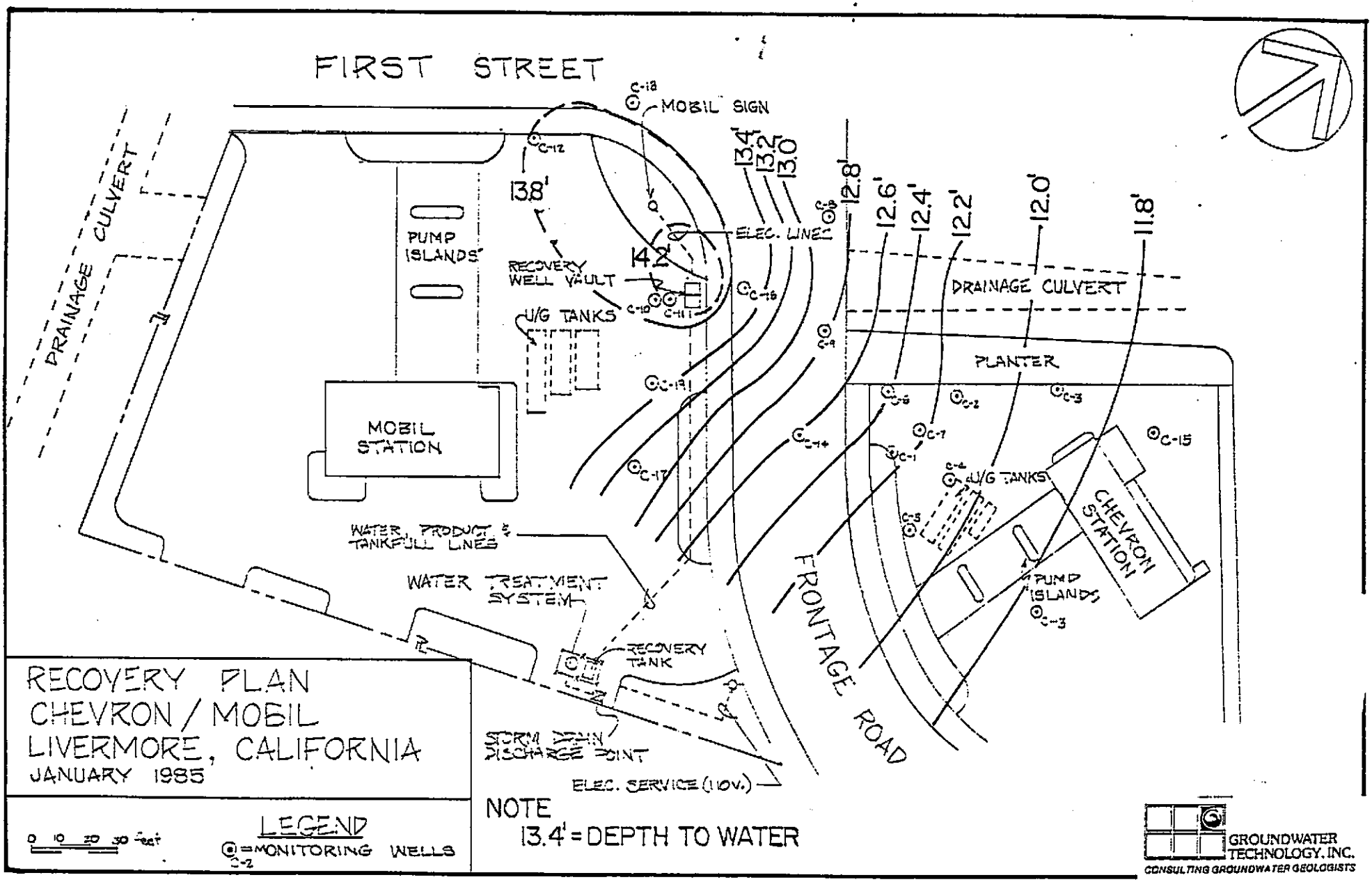
0 10 20 30 feet

LEGEND
⊙ C-2 = MONITORING WELLS

NOTE
13.4' = DEPTH TO WATER

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

GROUNDWATER GRADIENT
30 JANUARY 1985



RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

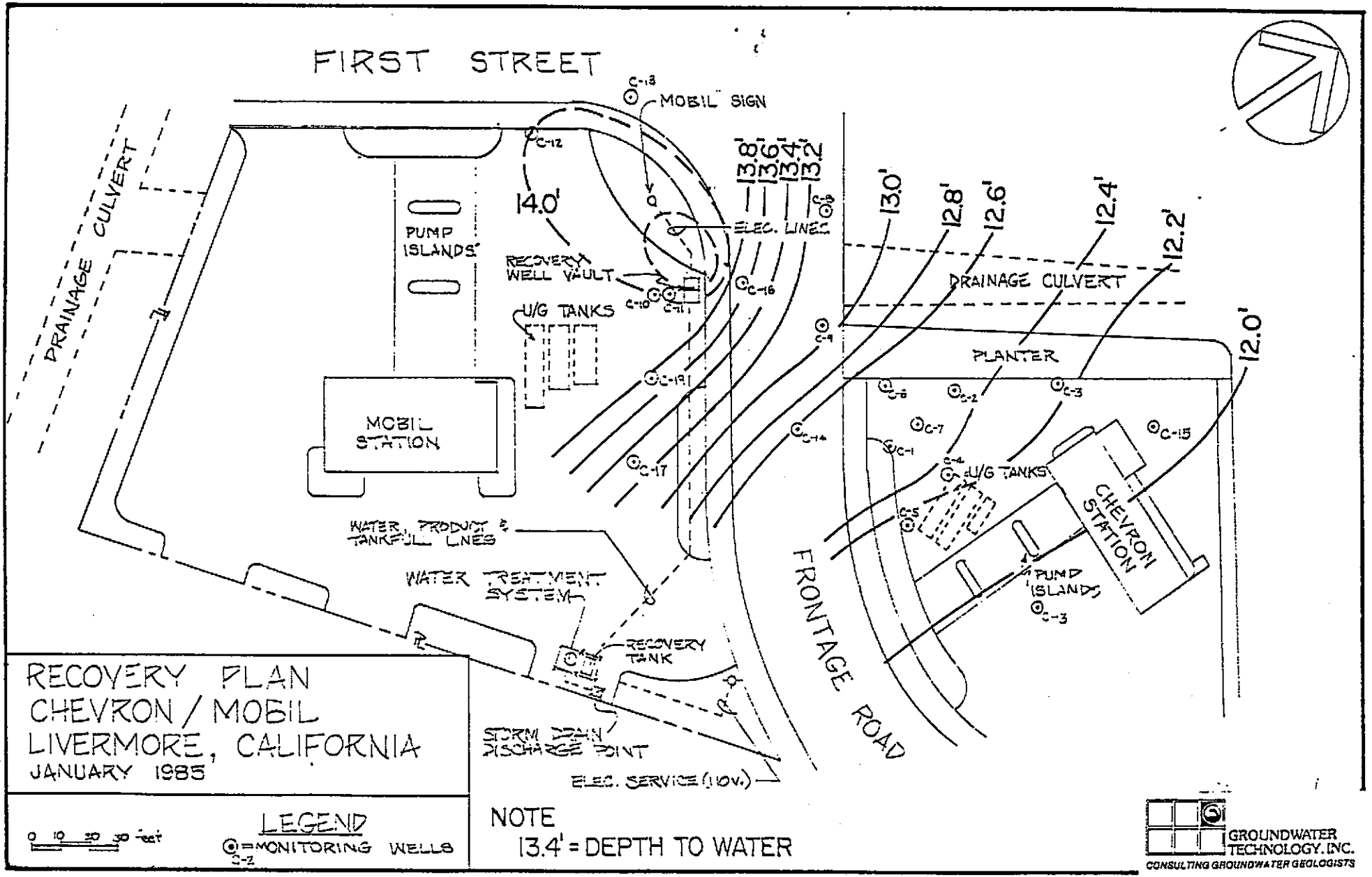
0 10 20 30 Feet

LEGEND
⊙ C-2 = MONITORING WELLS

NOTE
13.4' = DEPTH TO WATER

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

GROUNDWATER GRADIENT
12 FEBRUARY 1985



RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

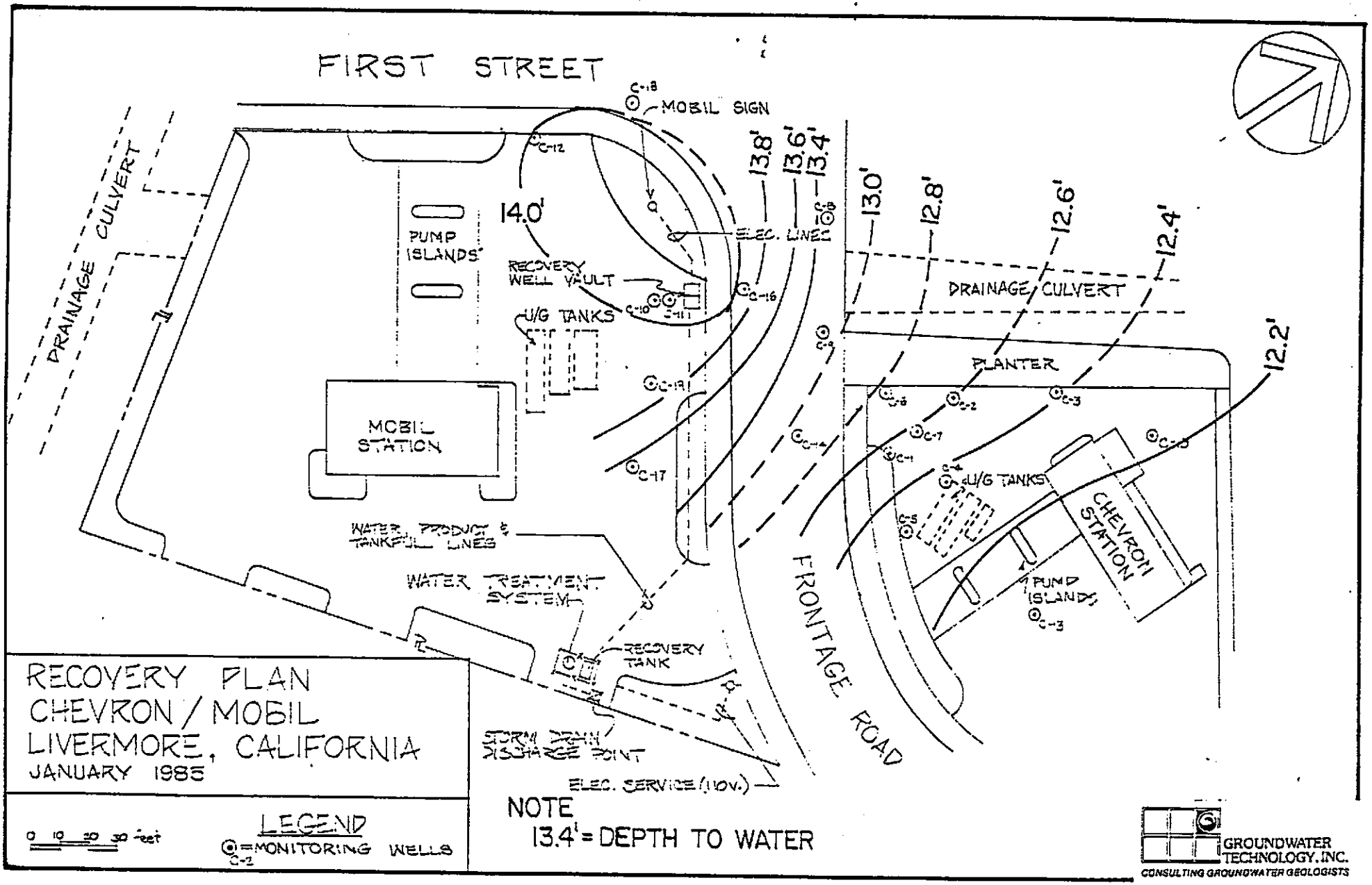
0 10 20 30 feet

LEGEND
⊙ = MONITORING WELLS
C-2

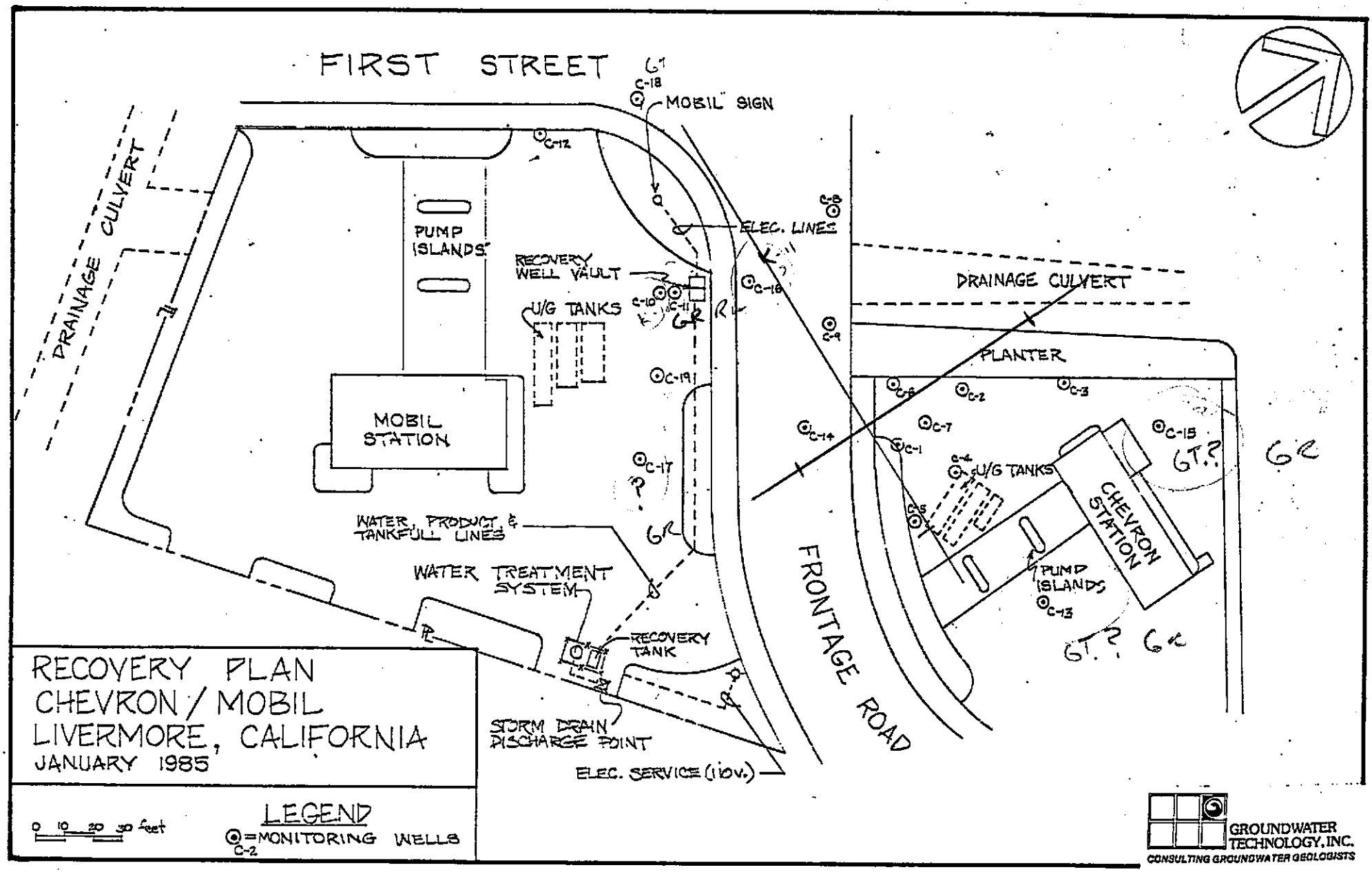
NOTE
13.4' = DEPTH TO WATER

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

GROUNDWATER GRADIENT
20 MARCH 1985



GROUNDWATER GRADIENT
23 APRIL 1985



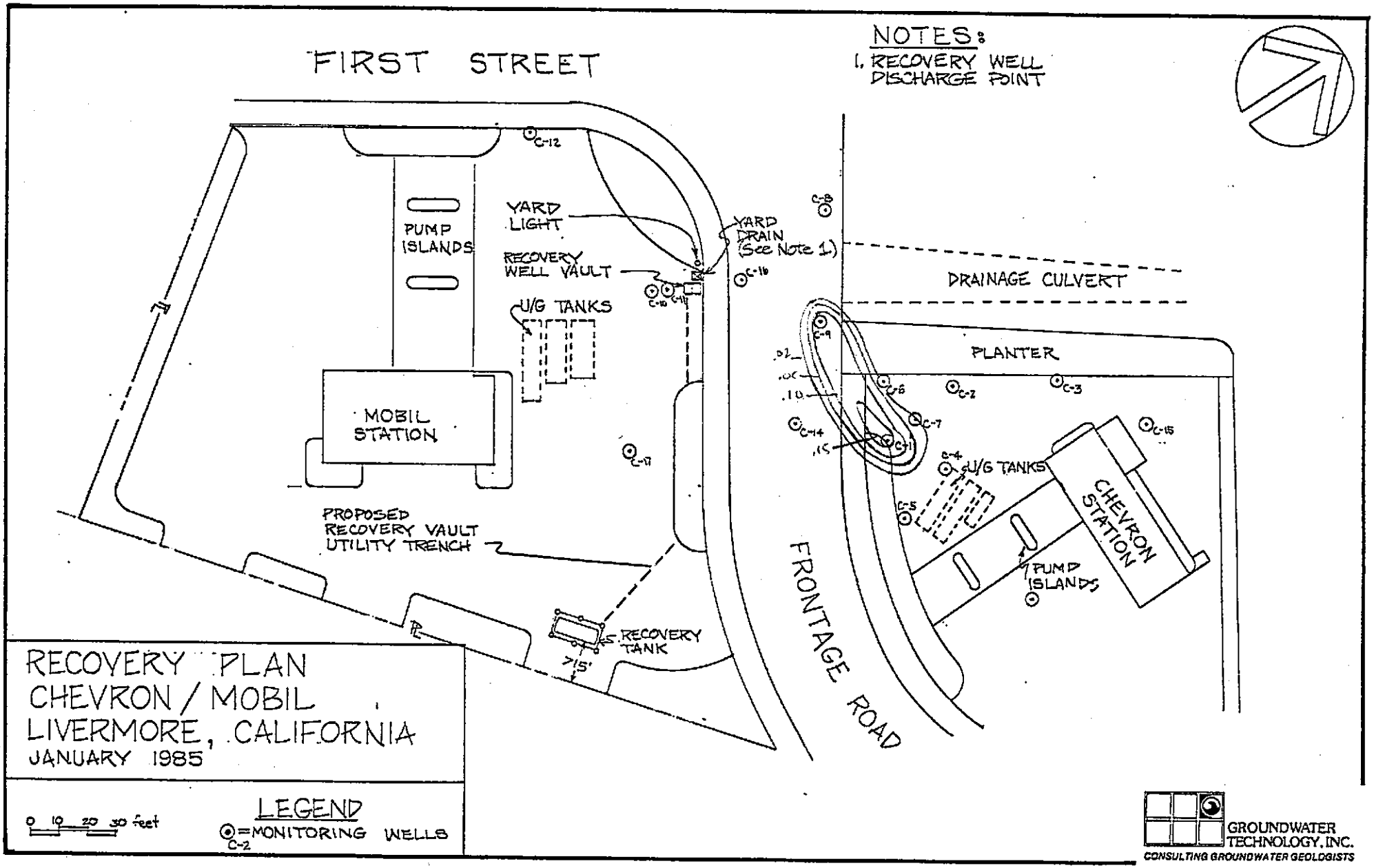
RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

0 10 20 30 feet

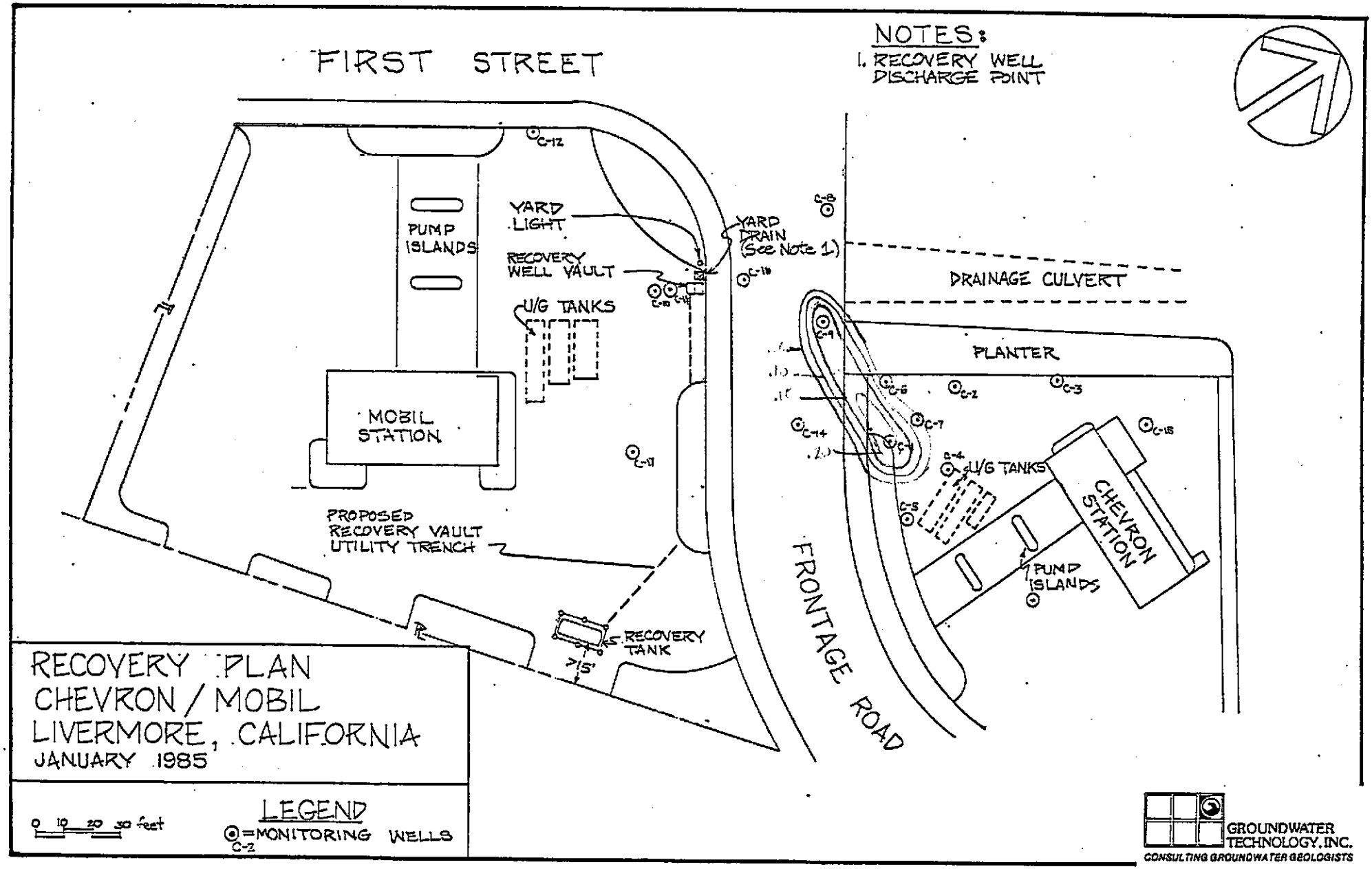
LEGEND

⊙ C-2 = MONITORING WELLS

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

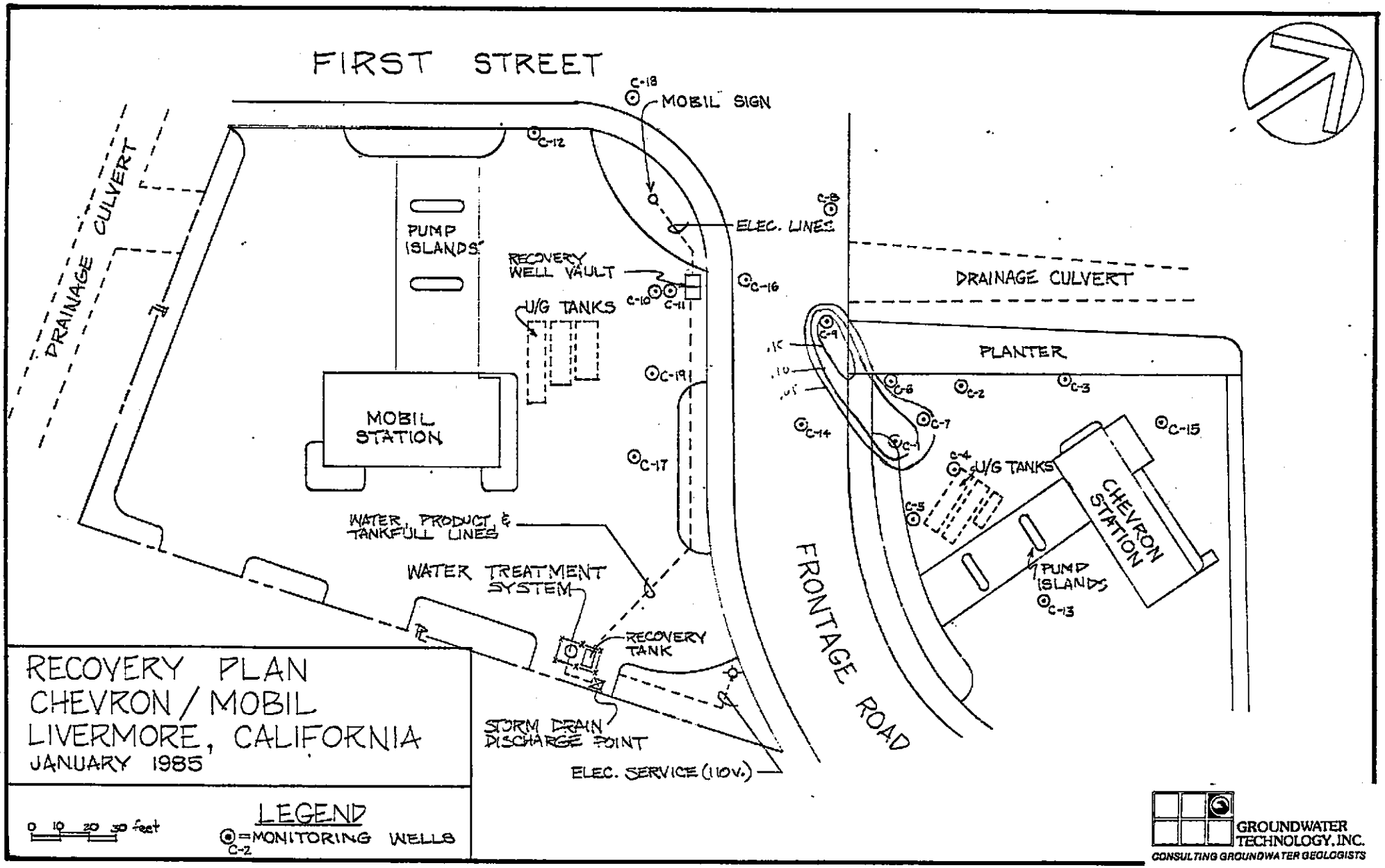


Product Thickness
23 April 1985

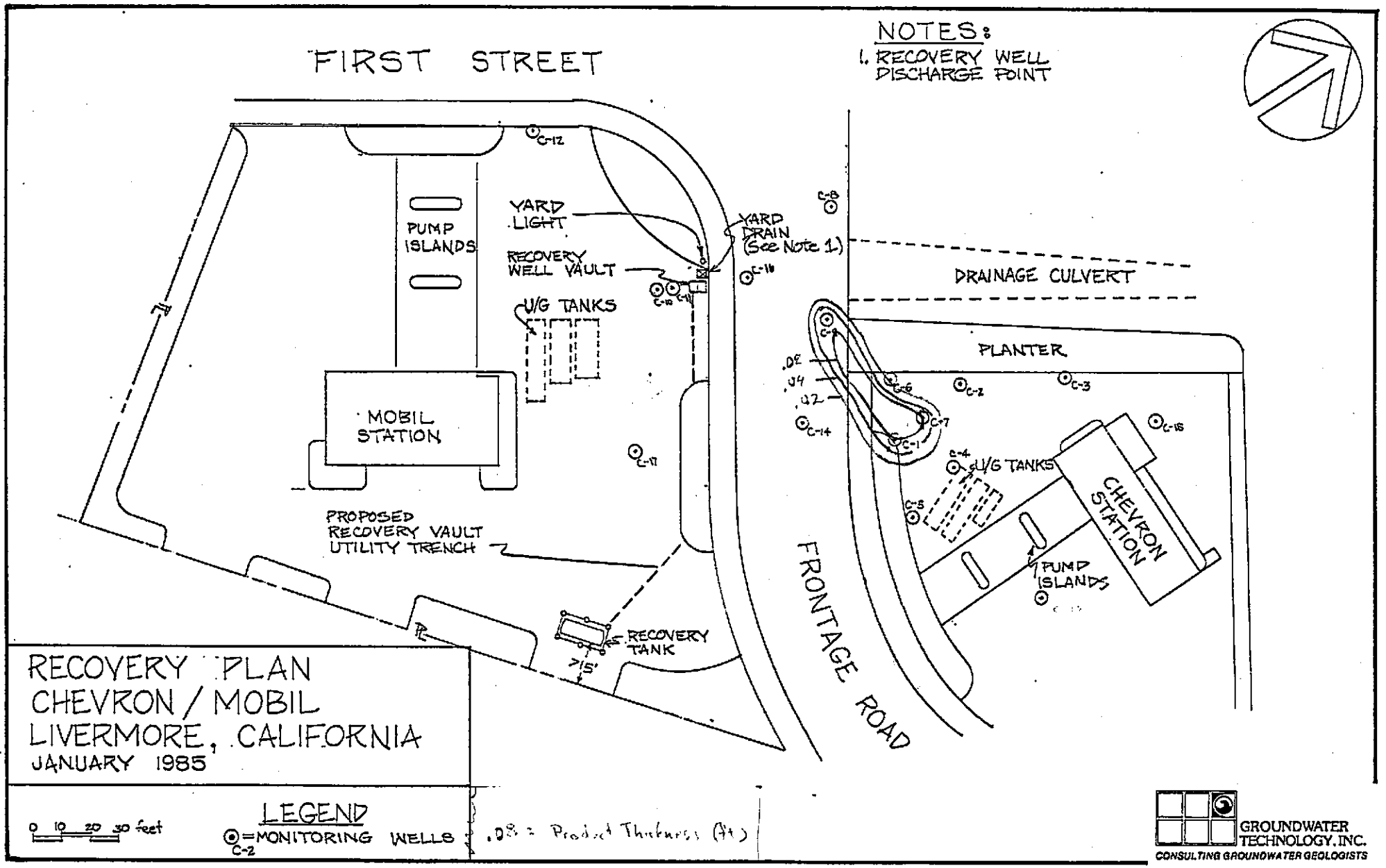


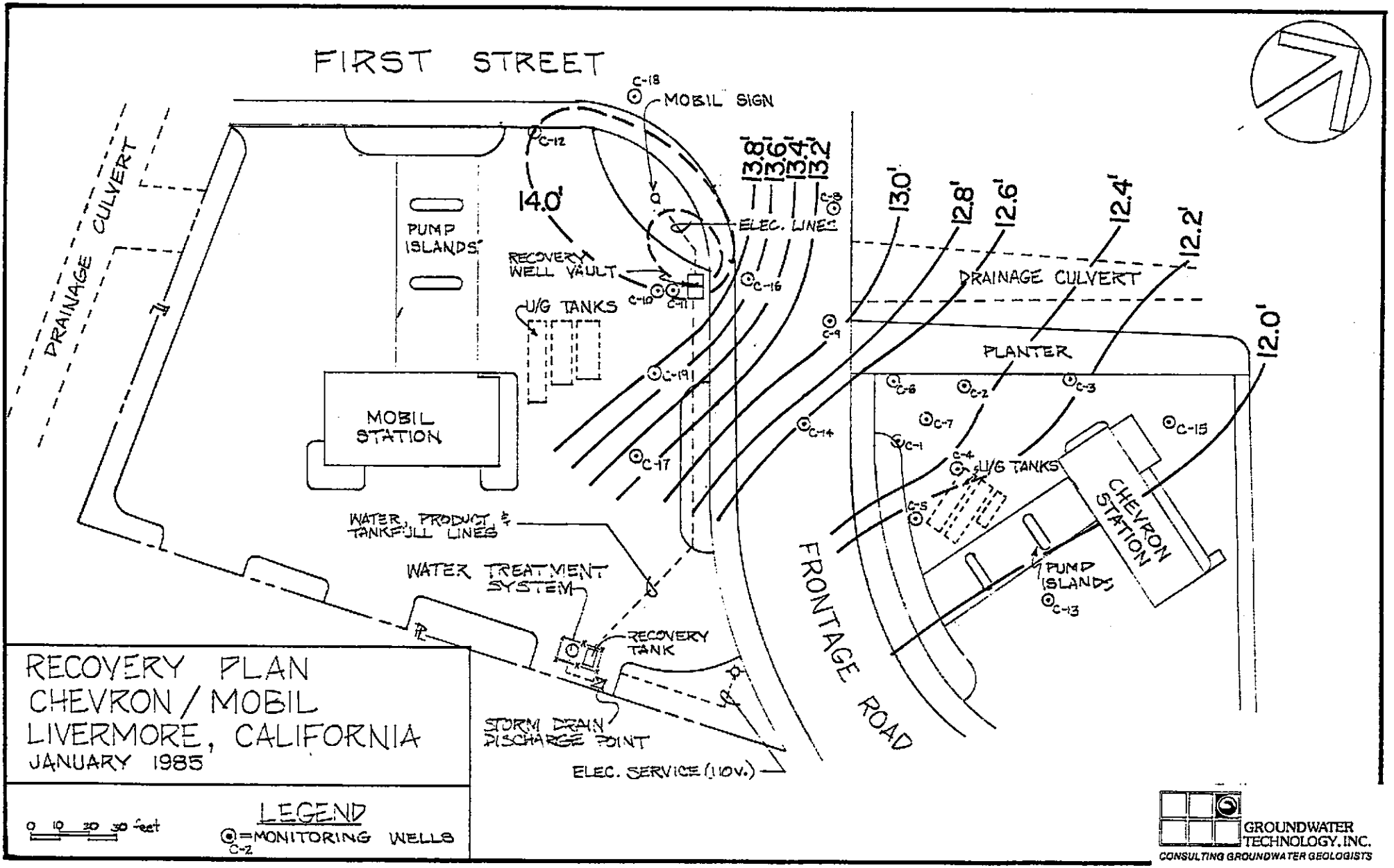
Project Manager

21 May 19



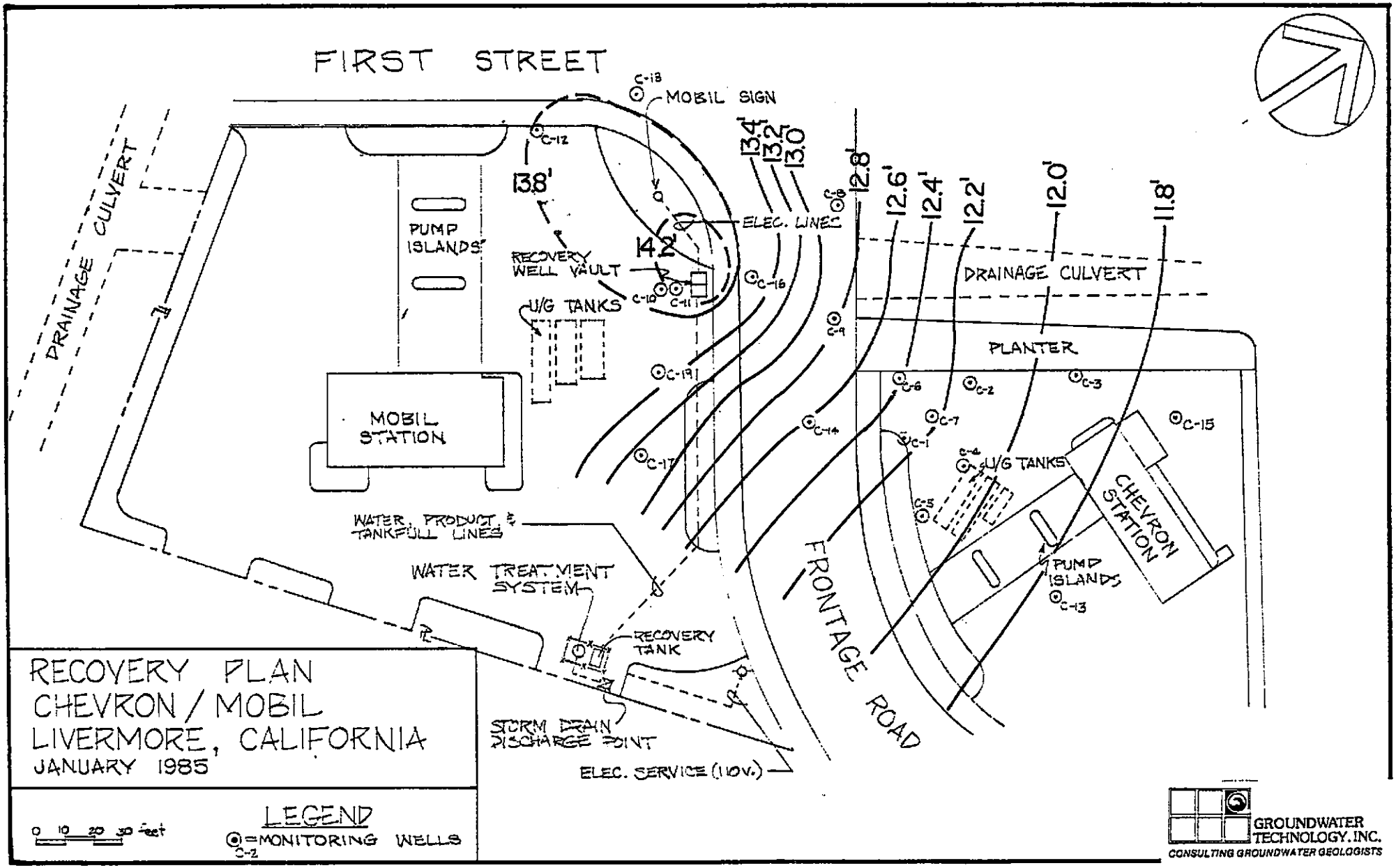
Previous Document
25 June 1985


FIRST STREET
NOTES:
1. RECOVERY WELL DISCHARGE POINT
C-12
PUMP ISLANDS
YARD LIGHT
RECOVERY WELL VAULT
U/G TANKS
MOBIL STATION
C-10
C-11
C-17
YARD DRAIN (See Note 1)
C-18
C-8
DRAINAGE CULVERT
PLANTER
C-9
C-2
C-3
C-6
C-7
C-1
C-14
.02
.04
.02
C-15
C-4
U/G TANKS
C-5
CHEVRON STATION
PUMP ISLANDS
PROPOSED RECOVERY VAULT UTILITY TRENCH
RECOVERY TANK
15'
FRONTAGE ROAD
RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985
0 10 20 30 feet
LEGEND
⊙C-2 = MONITORING WELLS
.08 = Product Thickness (ft.)
GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

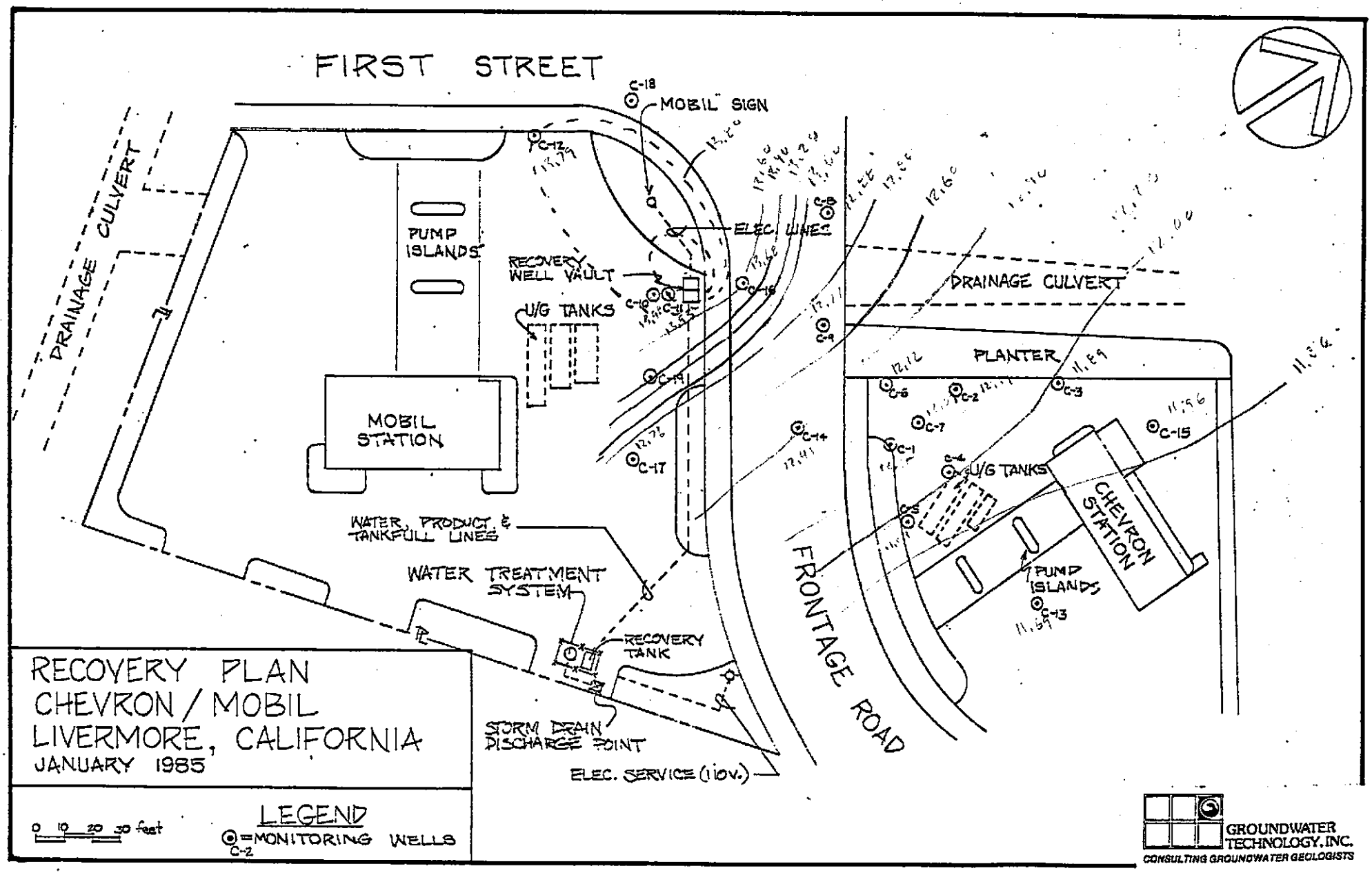


GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

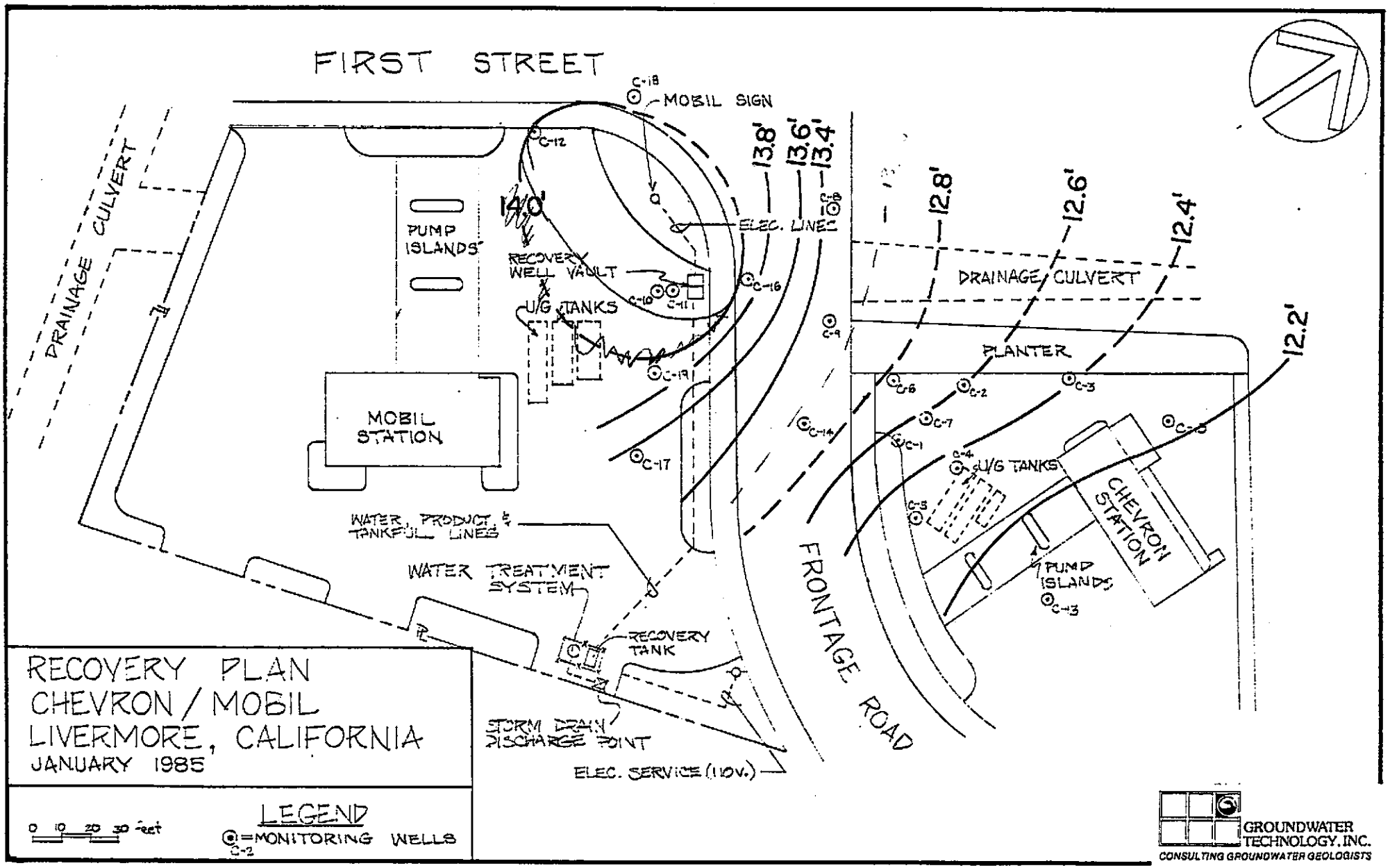
GROUNDWATER GRADIENT
20 MARCH 1985



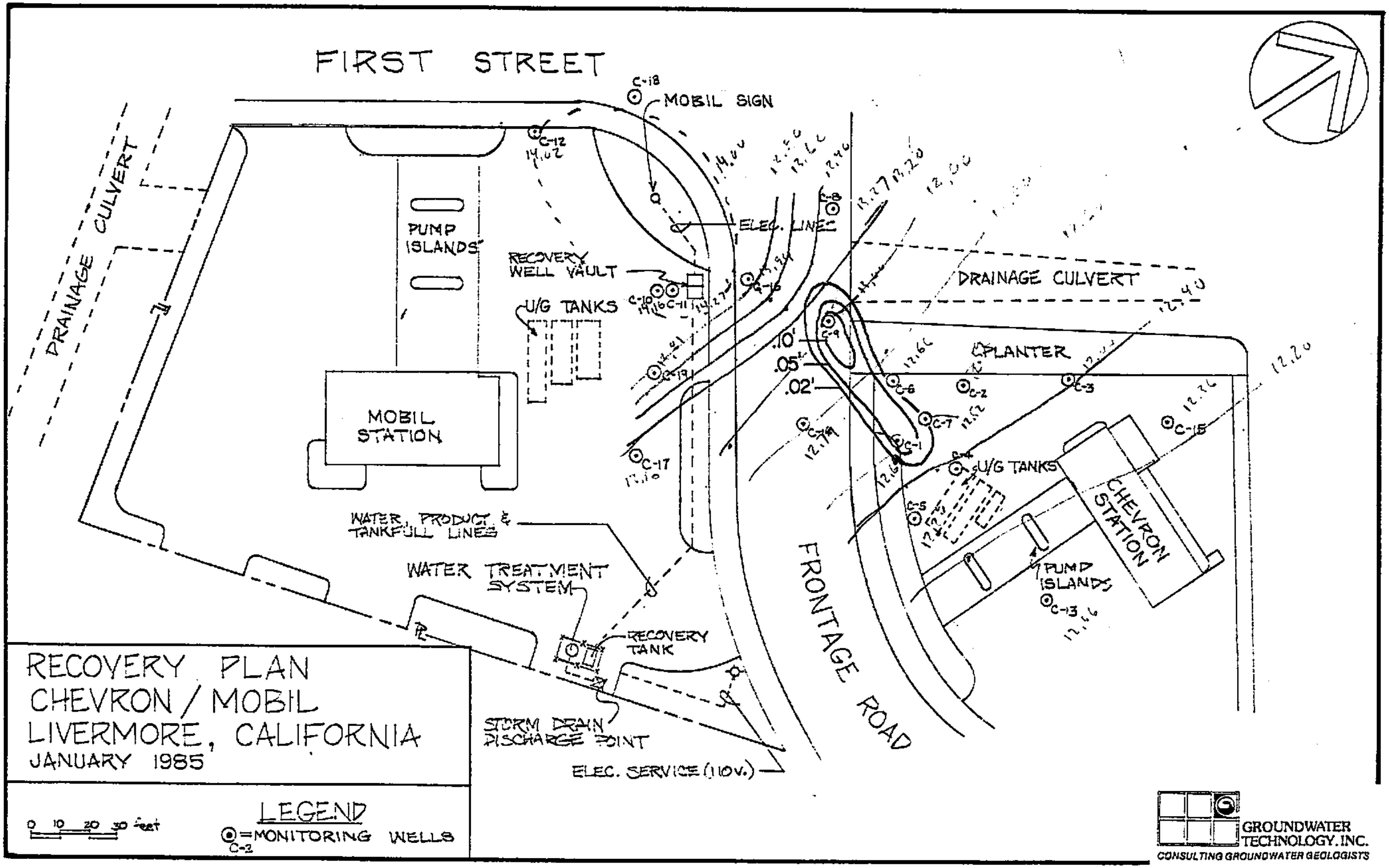
GROUNDWATER GRADIENT
12 FEBRUARY 1985



Groundwater Gradient
21 May 1985



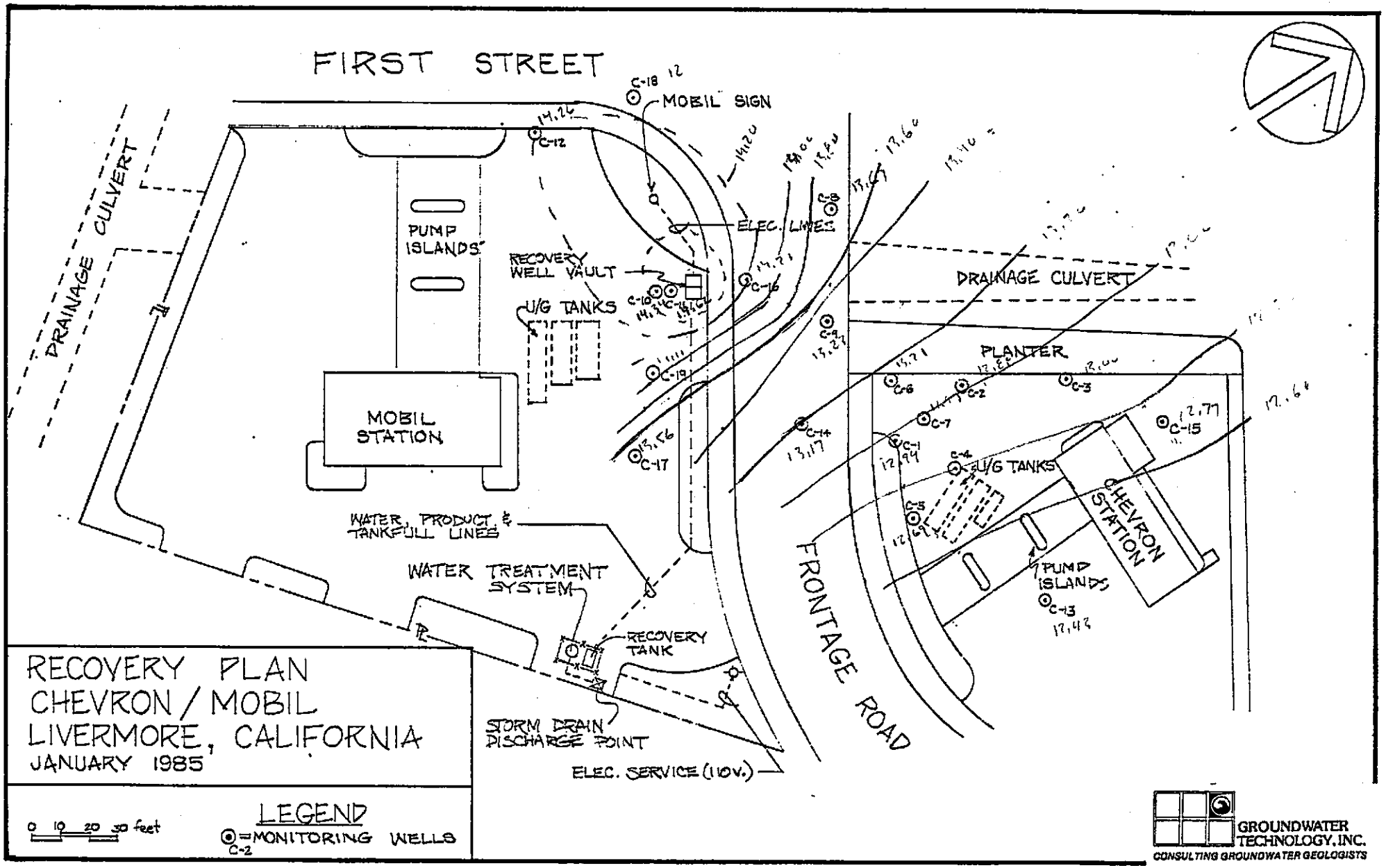
GROUNDWATER GRADIENT
23 APRIL 1985



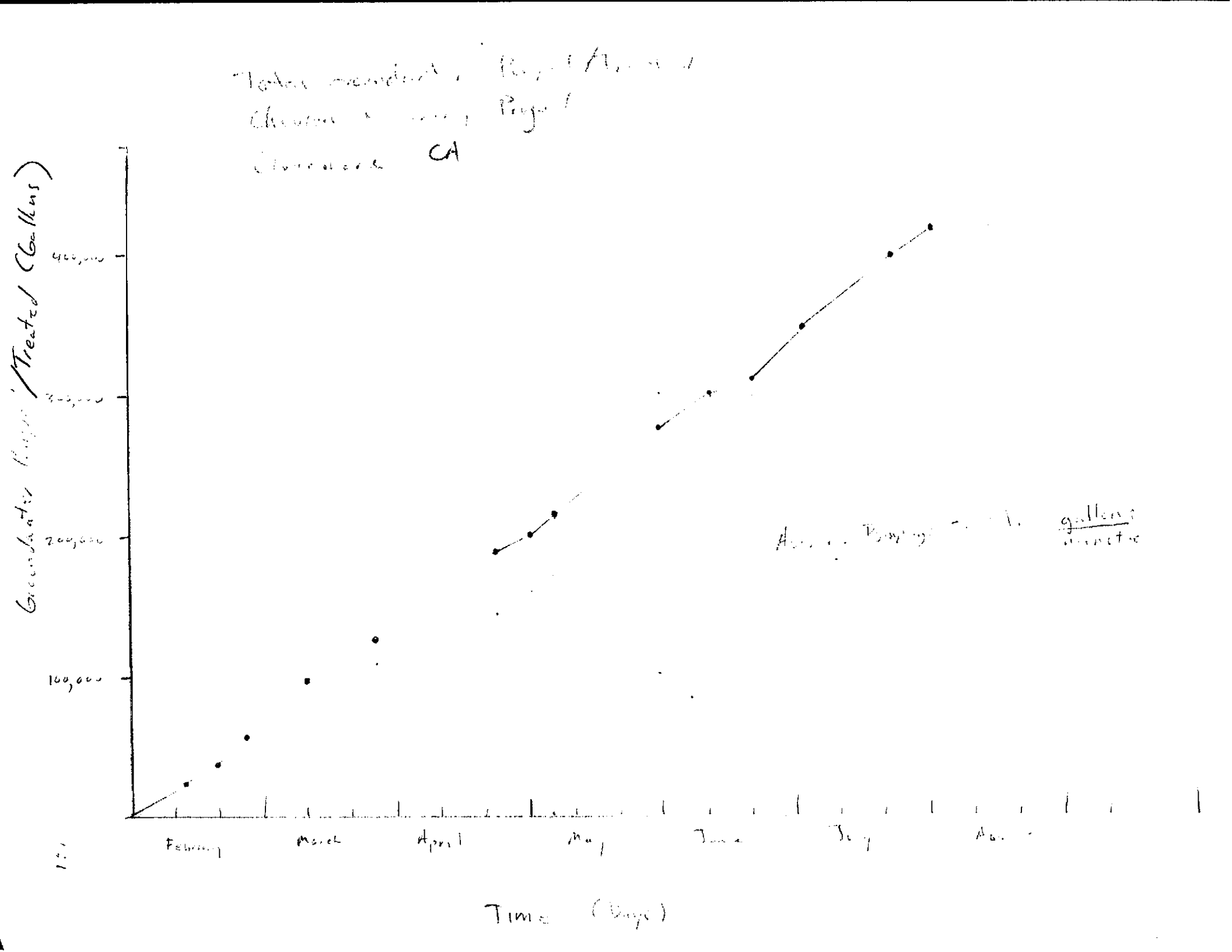
PRODUCT THICKNESS

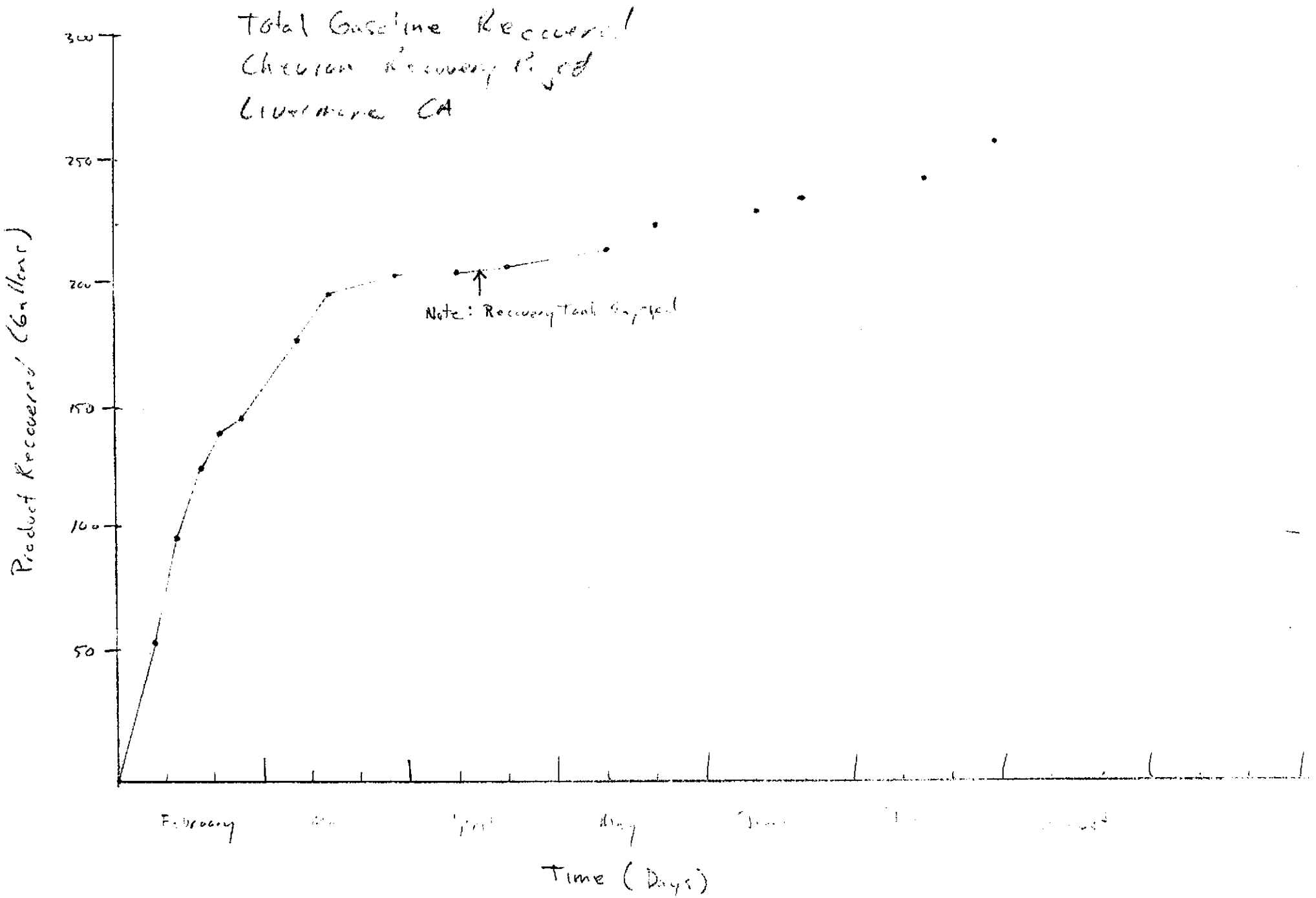
~~23 APRIL 1985~~

25 June 1985



Groundwater Gradient
30 July 1985


Cumulative Gallons Treated (Gallons)
100,000
200,000
Time (Days)


Total Gasoline Recovered
Chevron Recovery Project
Livermore CA
300
250
200
150
100
50
Product Recovered (Gallons)
Note: Recovery Tank Emptied
February
Time (Days)

GROUNDWATER
TECHNOLOGY
Consulting Groundwater Geologists
A Division of Oil Recovery Systems, Inc.
5047 CLAYTON ROAD • CONCORD, CA 94521 • (415) 671-2387

December 18, 1985

John Randall
Chevron U.S.A.,Inc.
2 Annabel Lane, Suite 200
San Ramon, Ca. 94583

Re: Chevron Livermore Project

Dear John,

Please find the enclosed final copies of the Recovery System Report for the Chevron project site located in Livermore, California. As requested I have added a section on the vapor monitoring of the borehole drilled through the base of the concrete drainage culvert at the site. I have included extra copies for distribution to the State Water Resources Control Board.

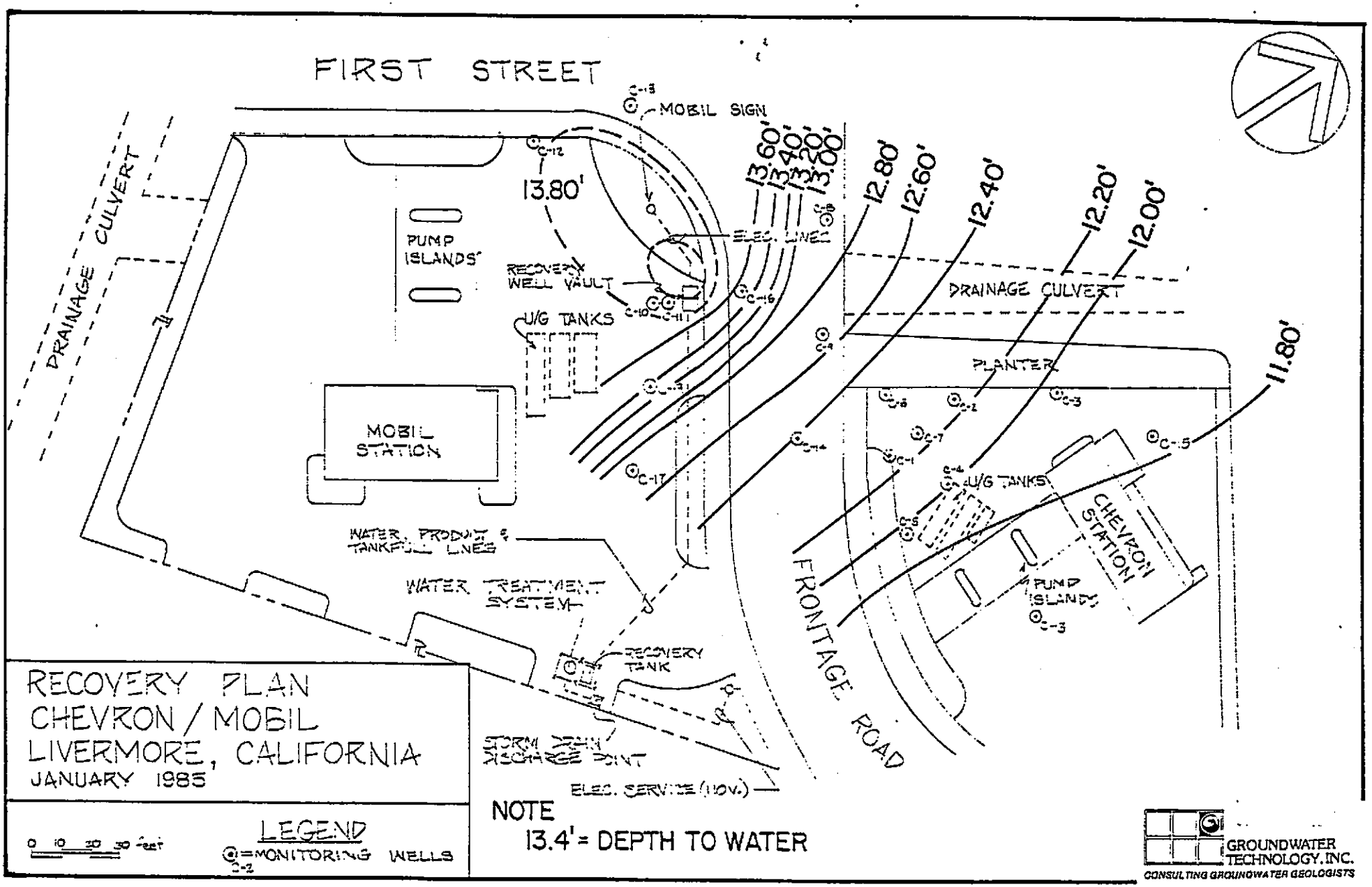
If you have any questions or comments on this report or the project in general please call.

Respectfully,

Robert Juncal

Robert Juncal
Project Geologist

RJ/asj



RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

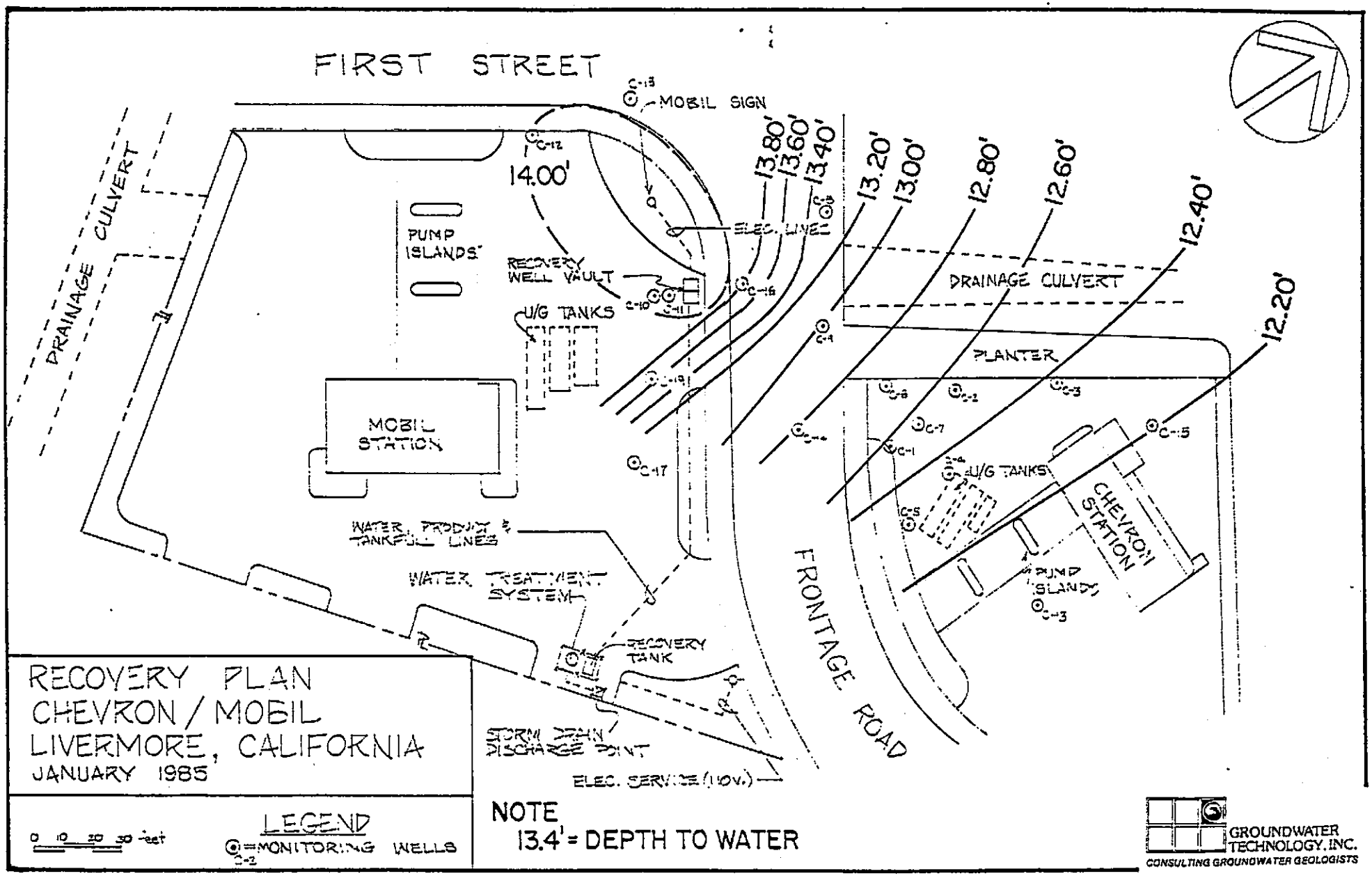
0 10 20 30 feet

LEGEND
⊙ = MONITORING WELLS
C-2

NOTE
13.4' = DEPTH TO WATER

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

GROUNDWATER GRADIENT
21 MAY 1985



RECOVERY PLAN
CHEVRON / MOBIL
LIVERMORE, CALIFORNIA
JANUARY 1985

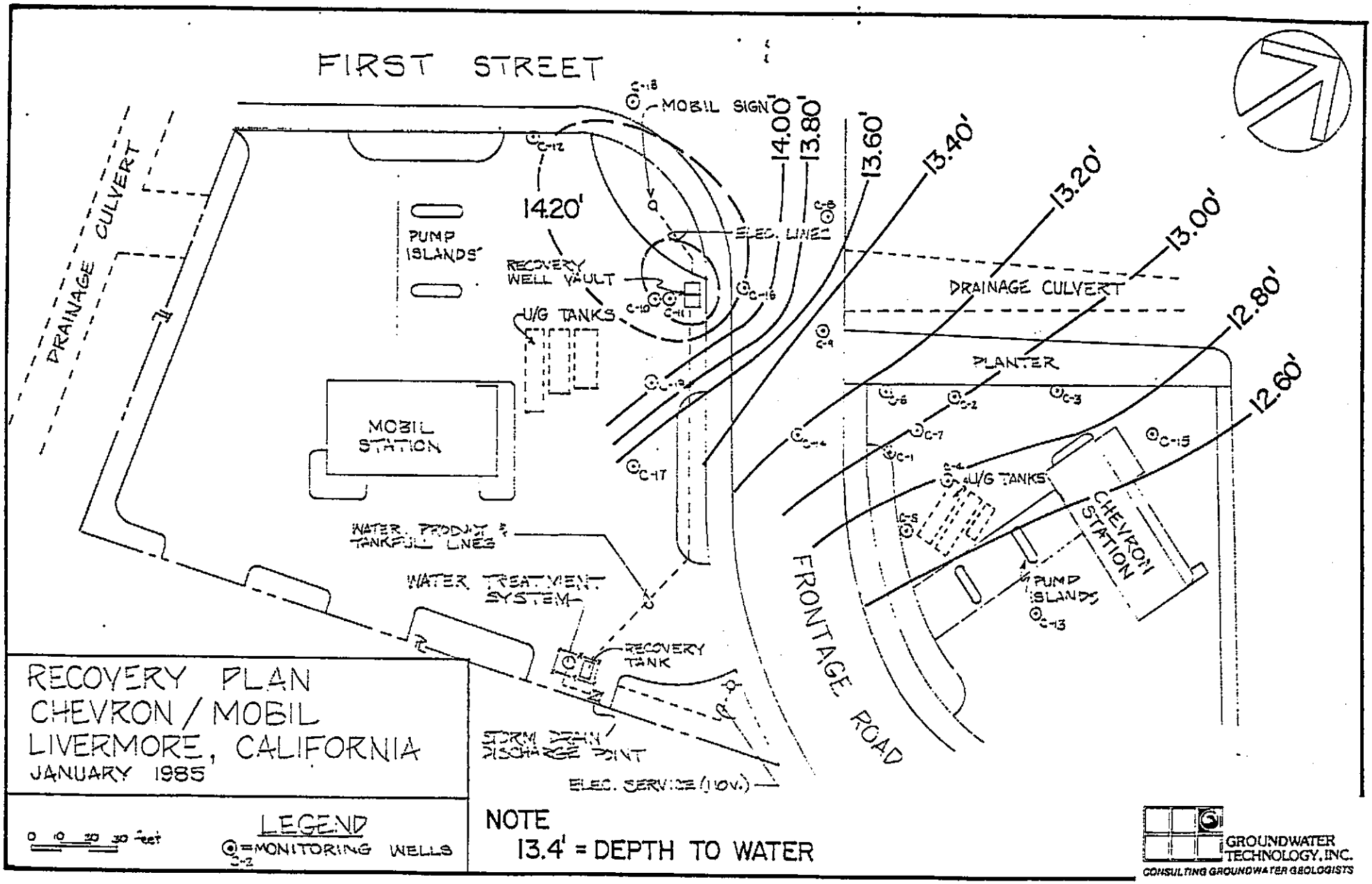
0 10 20 30 feet

LEGEND
⊙ C-2 = MONITORING WELLS

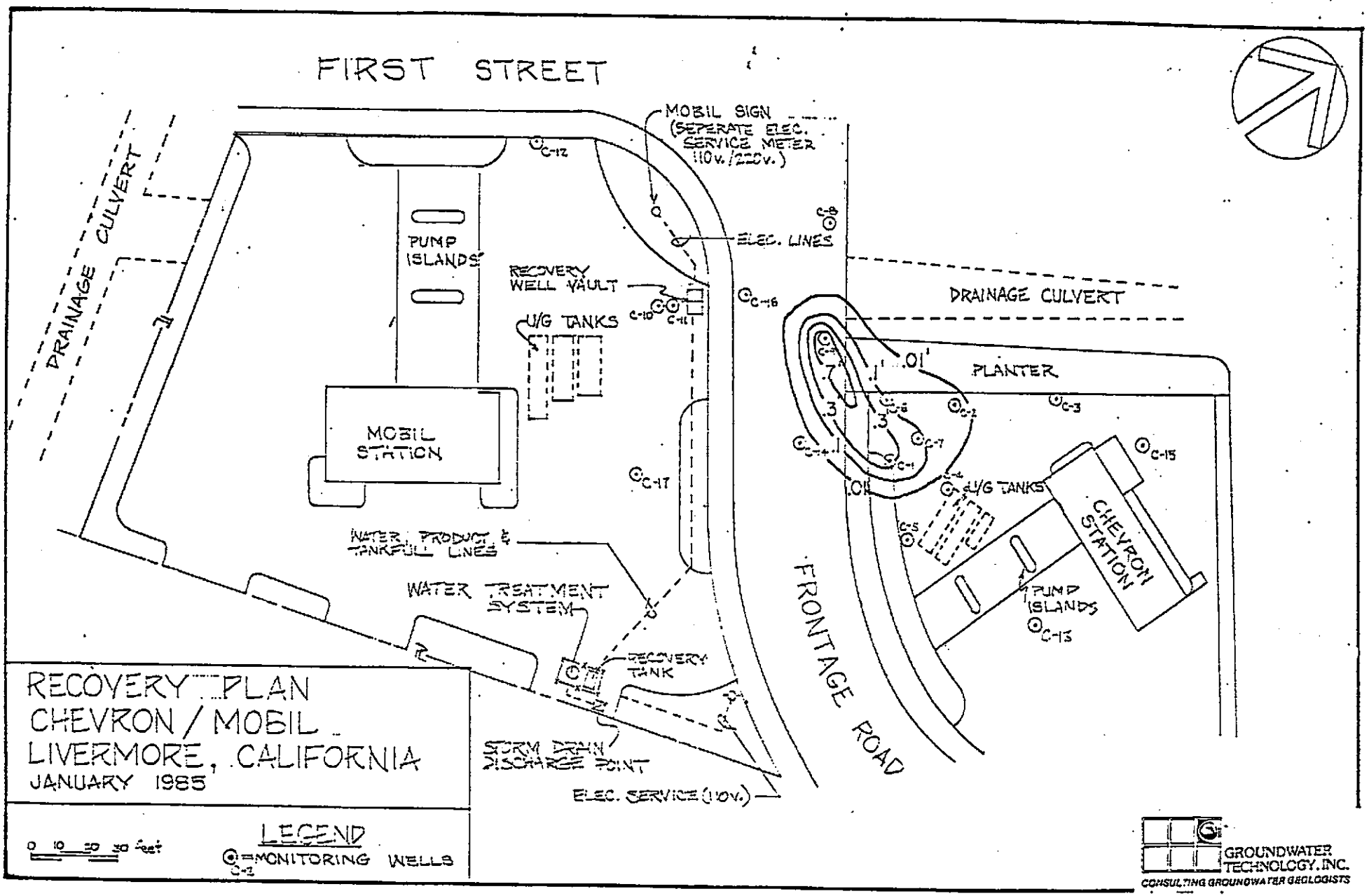
NOTE
13.4' = DEPTH TO WATER

GROUNDWATER TECHNOLOGY, INC.
CONSULTING GROUNDWATER GEOLOGISTS

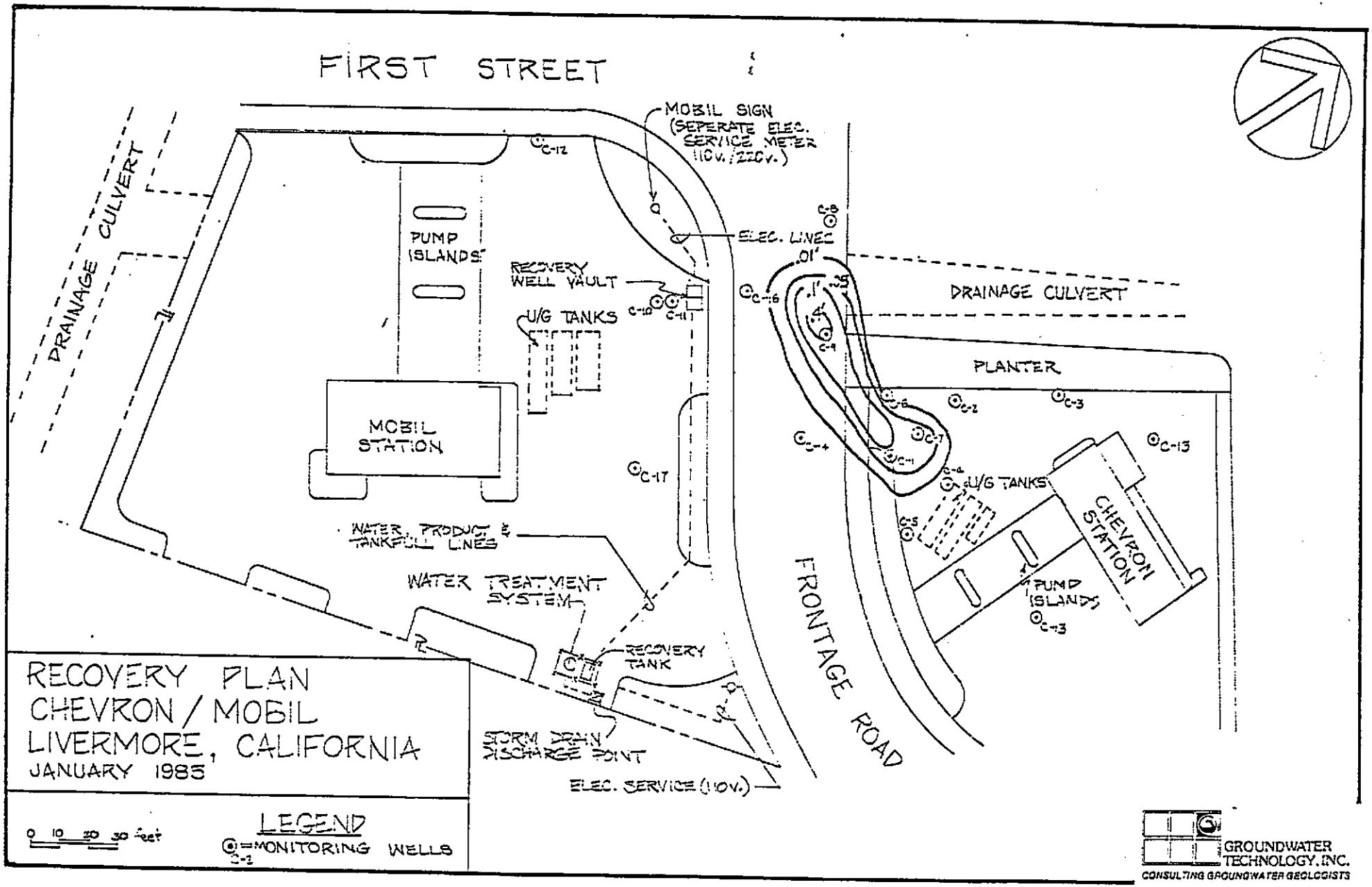
GROUNDWATER GRADIENT
25 JUNE 1985



GROUNDWATER GRADIENT
30 JULY 1985



PRODUCT THICKNESS
23 JANUARY 1985



PRODUCT THICKNESS

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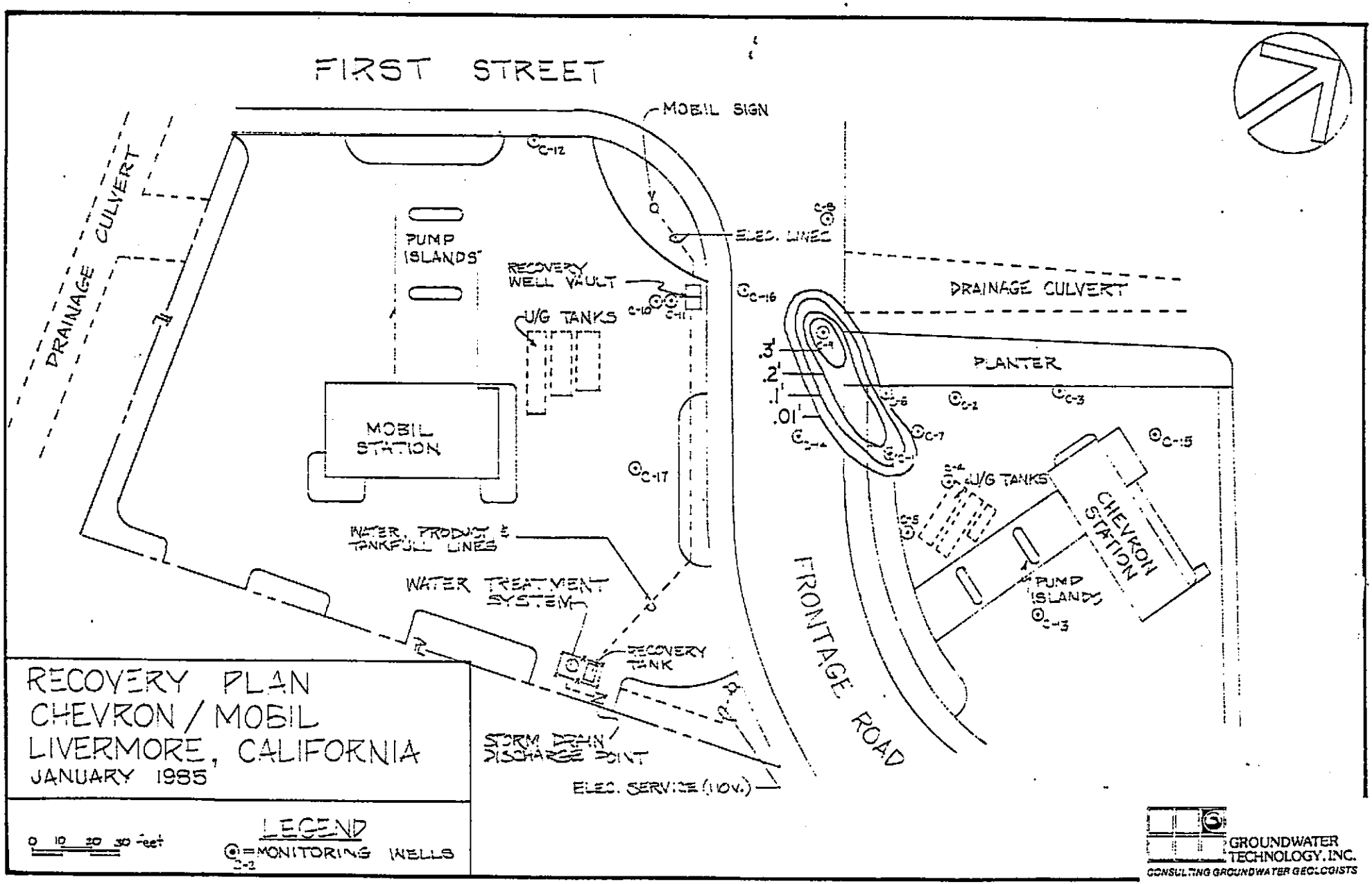

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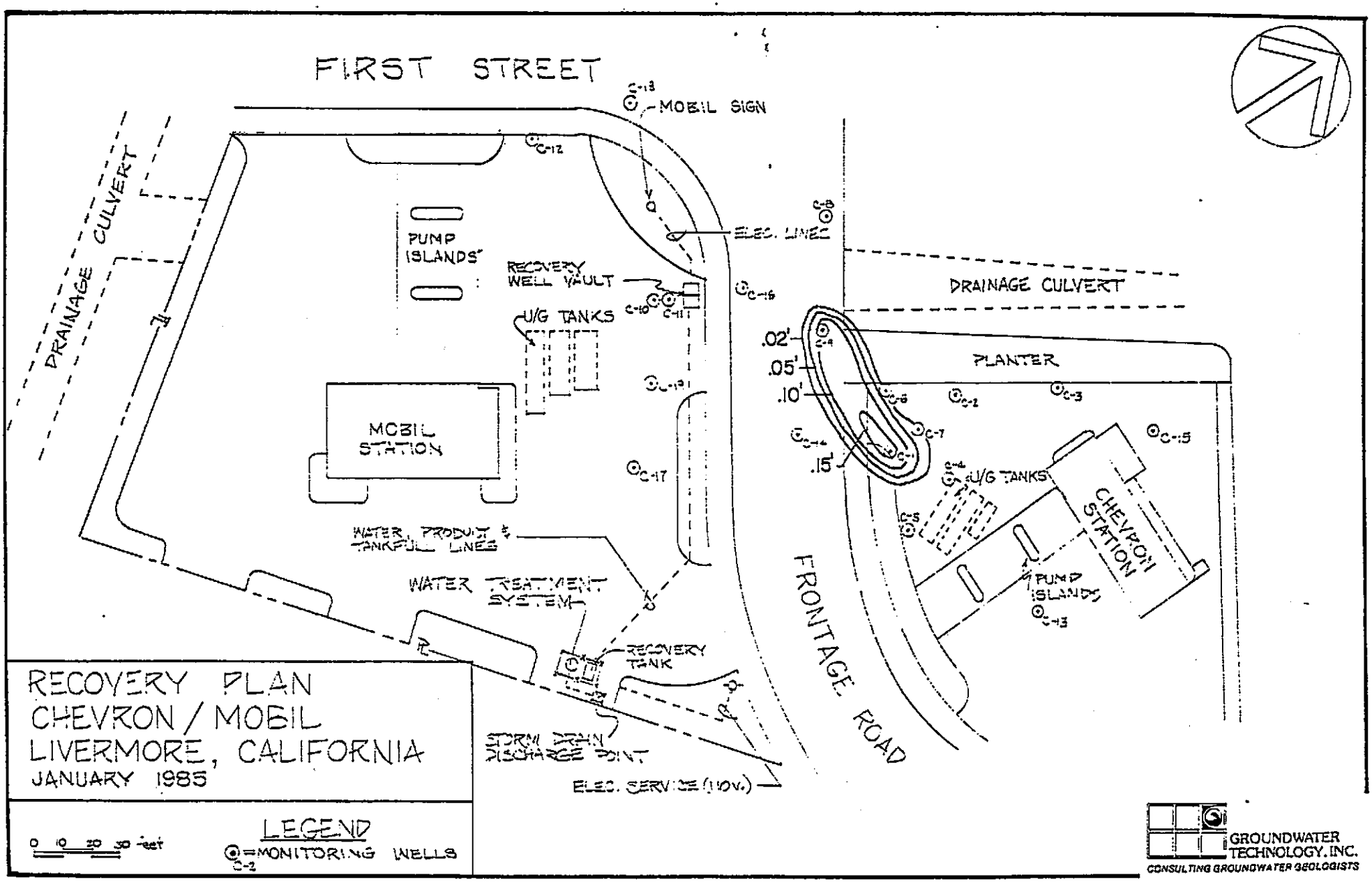

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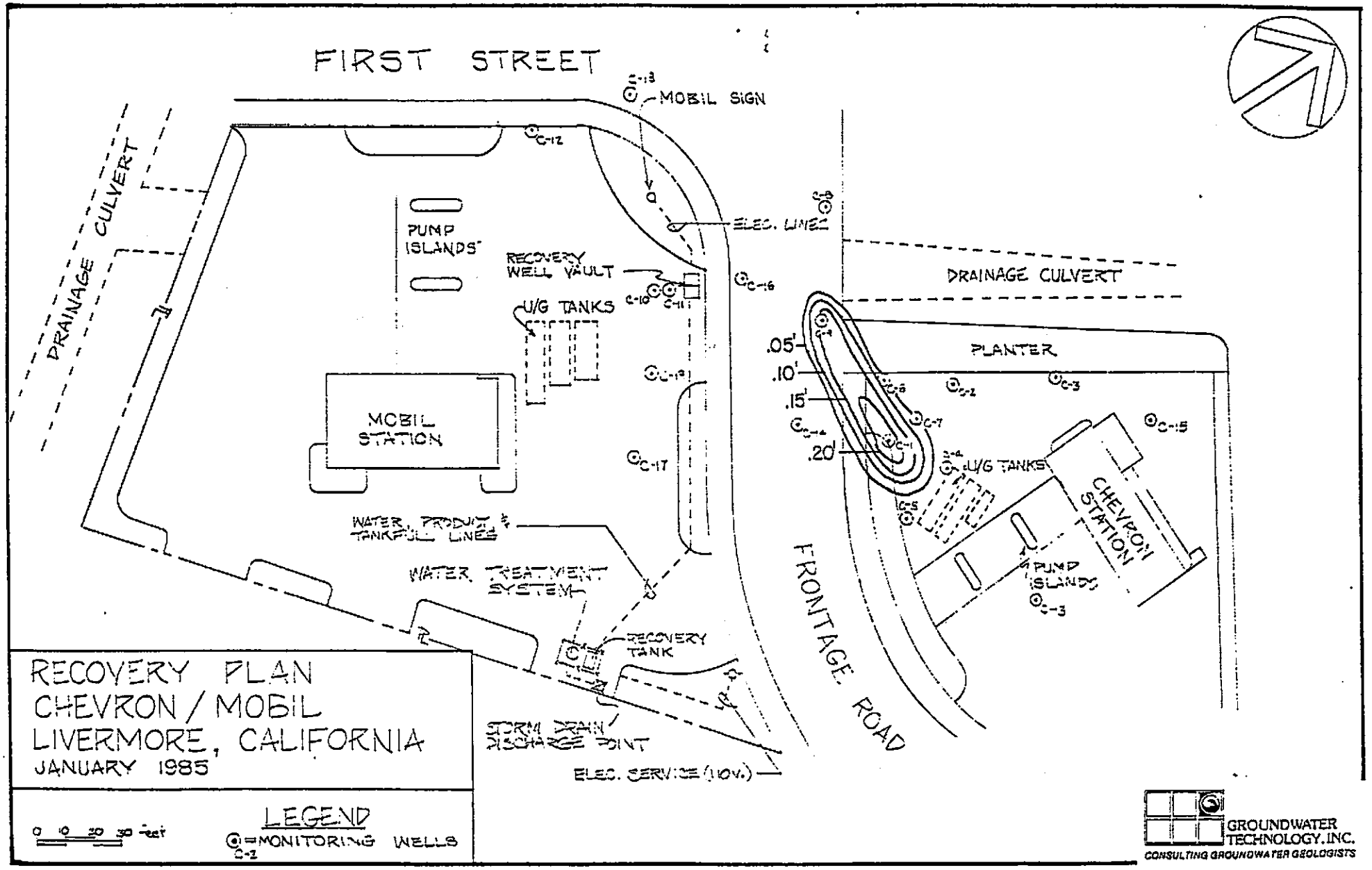

PRODUCT THICKNESS
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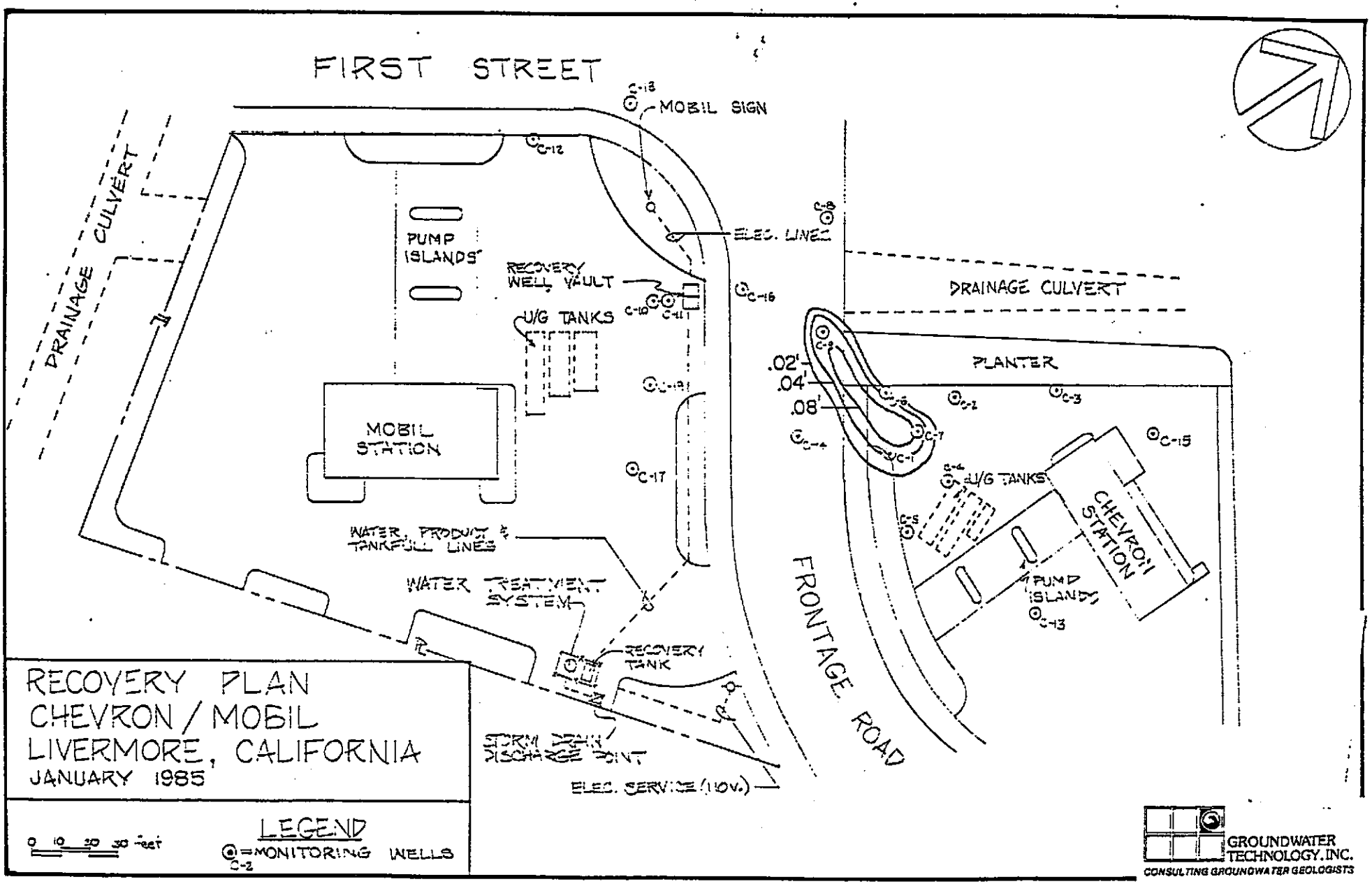

PRODUCT THICKNESS
30 JULY 1985