GET

Geo Environmental Technology

SOIL VAPOR EXTRACTION FEASIBILITY STUDY

For

Livermore Gas and Mini Mart
160 Holmes Street
Livermore, California

Prepared by

Geo Environmental Tech
343 Soquel Avenue, #33
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7/14/03
Date

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7/14/03
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July 2003

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1.0 INTRODUCTION

This report presents the results of a 4/24/03 Soil Vapor Extraction (SVE) feasibility study at the Livermore Gas and Mini Mart located at 160 Holmes Street in Livermore, California.

The objective of this study was to determine whether high quantities of Total Petroleum Hydrocarbons (TPH) and MTBE could be extracted and treated using SVE technology. This work was requested on 2/22/02 by the Alameda County Environmental Health Services (ACEHS). The resulting information is being utilized in the development of a Remedial Action Plan (RAP).

An e-mail of the ACEHS directive is presented in Appendix A.

2.0 SITE INFORMATION

The site is currently operated as a gas station and mini mart. It is located in a commercial area of the City of Livermore, at the intersection of Holmes and Second Streets, directly across from Hanson Park and a shopping center.

The site is bordered by residential areas to the south and east, Hanson Park to the west and commercial businesses to the north. Vehicular traffic in and around the site is heavy.

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On 5/20/99 soil samples were collected beneath the dispenser islands. TPHg was found beneath the dispenser islands in varying concentrations ranging from 32 mg/kg to 6,500 mg/kg; TPHd beneath the diesel dispenser was detected at 1300 mg/kg; no MTBE was detected beneath the dispenser islands.

On 7/26/00, three 2-inch diameter groundwater monitoring wells (MW1, MW2 and MW3) were installed onsite to an approximate depth of 30' below ground surface (bgs). The wells were sampled on 8/11/00 and analyzed for TPHd, TPHg, BTEX and MTBE. The sample results indicated significant hydrocarbon impact in the groundwater. Directly downgradient well MW1 had concentrations of TPHg and MTBE of 170,000 µg/L and 320,000 µg/L respectively. A "Well Installation Report" was issued by ETIC Engineering on 9/22/00.

On 10/19/00 groundwater samples were collected as part of quarterly monitoring at the site. Samples were analyzed for TPHd, TPHg, BTEX and MTBE. The sample results confirmed the presence of significant hydrocarbon impact in the groundwater. Directly downgradient well MW1 had concentrations of TPHg and MTBE of 170,000 µg/L and 200,000 µg/L respectively. Geo Environmental Technologies (GET) issued a "Quarterly Monitoring Report" on 1/31/01.

On 02/22/01 groundwater samples were collected and analyzed for TPHd, TPHg BTEX and MTBE. The sample results confirmed significant hydrocarbon impact in the groundwater. Directly downgradient well MW1 had concentrations of TPHg and MTBE of 11,000 µg/L and 190,000 µg/L respectively. GET issued a "Quarterly Monitoring Report" on 3/31/01. On 05/30/01 groundwater samples were not collected because all three monitoring wells were found to be dry. The monitoring wells also were dry in August and December 2001.

On 11/14/01 groundwater samples were collected during the installation of an onsite extraction well and three off-site monitoring wells. Monitoring wells MW1, MW2 and MW3 were all dry. Groundwater samples were collected from the four newly installed wells. Samples were analyzed for TPHd, TPHg, BTEX and MTBE. The sample results confirmed the presence of significant hydrocarbon concentrations offsite and an areal impact to the groundwater. Directly downgradient extraction well EX1 contained concentrations of TPHg and MTBE of 2,000 µg/L and 2,200 µg/L respectively. GET issued a "Quarterly Monitoring Report" on 3/31/02.

Groundwater beneath the site has been monitored quarterly and relevant technical reports submitted to the ACEHS. All samples are being analyzed for TPHd, TPHg, BTEX and MTBE.

3.0 REMEDIAL FEASIBILITY STUDIES

Two feasibility tests have been undertaken in advance of the preparation of a RAP that will address site remediation. These included a pump test to determine aquifer recharge parameters and develop appropriate pumping rates and a soil vapor extraction test to measure potential contaminant recovery rates using existing wells.

3.1 Groundwater Pump Test

The groundwater pump test was performed on 6/27/02. The test was conducted using well EX1. Pump test results indicated that there is need for redevelopment of well EX1 and that a "pump and treat" system under present conditions is not the most viable means of migration control. Implementation of such a system without redevelopment of EX1 would incur large costs for small quantities of contaminants removed. However, a small scale, low intensity, source removal system may be utilized that can be expanded if well redevelopment increases aquifer yield

3.2 Soil Vapor Extraction Test

The soil vapor extraction test was conducted on 4/24/03 to assess the following:

- the vacuum required to induce vapor flow through the soil

- estimation of the radius of influence of the vapor extraction well

- concentrations of hydrocarbons in vapors extracted from the well

- potential rates of hydrocarbon mass removal

- effectiveness of soil vapor extraction using the existing monitoring wells

Preliminary test results indicated that SVE is a viable technology for soil remediation. However, rather than using existing monitoring wells, new vadose wells should be installed for better utilization of SVE technology.

4.0 METHODS AND PROCEDURES

4.1 Site Lithology Evaluation

Site and area lithology was evaluated using offsite lithologic logs with descriptions provided by Ms. Chu of the ACEHS and from borings and monitoring wells installed on and off site, to prescreen the use of SVE technology as a remediation tool.

The soil horizon is comprised of tightly packed sands and gravels with varying percentages of silt and clay at different depths. A driller independently described it on 11/18/24 as "cement gravel" to a depth of 68 feet bgs. The shallow soil lithology was described during installation of monitoring wells as "sandy, gravelly, clay" and "sandy, clayey, gravel." Cooper labs (a geotechnical testing laboratory), described soil at 12.5 feet bgs as sandy silty clay and soil at 17 feet bgs as "sandy, clayey gravel."

Soil boring and well installation logs and the Cooper Labs report used to evaluate lithology and its suitability for SVE remediation are presented in Appendix B.

4.2 Soil and Groundwater Contamination Review

The 2/26/99 soil boring advanced in the northern section of the property, first indicated that groundwater was impacted. At the boring location 10-feet east of First Street, TPHg was 100,000 µg/L and MTBE was 60,000 µg/L.

Soil contamination was confirmed on 4/5/99 when three gasoline and one diesel USTs, were removed and on 5/20/99, when the dispensers and piping were removed. Highest concentrations of TPHg were 6,500 mg/kg, of TPHd 1,300 mg/kg and MTBE 110 mg/kg.

Samples from the three 7/26/00, 30-foot monitoring wells at a depth of 20-feet below ground surface (bgs) indicated that soil in MW1 was impacted by 800 mg/kg of TPHg and 21 mg/kg of MTBE. Soil samples from wells MW2 and MW3 were not impacted. Groundwater in all three wells was impacted, with maximum concentrations in well MW1 of TPHd, TPHg and MTBE of 57,000 µg/L, 170,000 µg/L and 320,000 µg/L respectively.

Soil samples from the 11/14/01 installation of three offsite wells indicated that soil off site was not impacted. Groundwater was impacted by 90 µg/L TPHd, 510 mg/l TPHg and 14 µg/L MTBE.

Data review indicated that soil contamination was limited to the middle and west part of the site itself and around wells MW1 and EX1, impact was limited to a depth of about 20-feet bgs. The soil horizon shallower than 15-feet bgs, not directly beneath the USTs and islands, was not impacted. Shallow soil contamination is found only in the section beneath the dispenser islands. Tabulated values of soil and groundwater contamination have been copied from the archives and are presented in Appendix C.

4.3 Soil Vapor Extraction Test Equipment and Methods

Prior to test startup, depth to water (DTW) was measured in wells MW1, MW2 and EX1; DTW was 21.47, 21.32 and 21.92 feet bgs respectively.

A Rontron blower EN454, capable of generating 65" of H_2O vacuum and 125 scfm flow, was used to apply vacuum to 2"-diameter well MW1. The test was conducted by connecting the vacuum extraction system directly to the well for 6.5 hours continuously. Induced vacuum was measured in well MW2 using a 5" H2O magnahelic gauge. A PID was used to record field measurements of volatile organic compounds. Applied vacuum, vapor flow rate, and induced vacuum were recorded at periodic intervals. The field data log and a transcribed representation of the data are presented in Appendix D.

In order to comply with the Bay Area Air Quality Management District's (BAAQMD) hydrocarbon vapor abatement requirements during pilot soil vapor extraction tests, two 200-pound granular activated carbon (GAC) vessels were used to capture vapors generated during the test.

4.4 Blower capacity and vacuum flow

A maximum of 60 inches of H_2O vacuum was applied to well MW1 and a maximum vapor flow of 1.42 scfm was obtained. A greater amount of flow could not be obtained; it is speculated that this was caused by diminishing availability of screen in the well due to aquifer mounding effect inside the well pipe. It appears that as vacuum rates increased groundwater rose in the well and ultimately submerged the free screen interval. The field technician reported that normal flow regime was interrupted at maximum vacuum because flow became constricted. Lower applied vacuum, resulted in a lower vapor flow and higher volatile organic concentrations in the vapor flow. The highest VOC concentrations were obtained when applied vacuum was less than 20" of H2O.

4.5 Radius of Influence

An effective radius of influence has been determined to be between 0.1% to 1% value of the applied vacuum that can be observed at a remote well (Buscheck and Peargin, 1991).

On the basis of the magnahelic gauges readings of vacuum levels measured in well MW2 (0.01 - 0.02 inches of H2O) during the SVE test, the radius of influence for well MW1 during application of 10-60 inches of water vacuum, extends to well MW2 which is located 45' southwest of MW1. A more conservative radius of influence would be 40 feet.

4.6 Concentration of VOCs in the extracted vapor

A Thermo Photo Ionization Detector (PID) model 580D was utilized to record TPH concentrations from the soil vapor stream at frequent intervals. The PID-read concentrations are included in the field data presented in Appendix D.

Two soil vapor samples were collected using the PID vacuum pump into Tedlar bags. These air samples were transported to Entech Analytical Laboratories, a State certified laboratory for hazardous materials analysis. The samples were analyzed for MTBE, TPHg and BTEX fractions. Sample MW1#1 was collected at 07:25, the beginning of the SVE test and sample MW1#2 was collected at 14:00, at the end of the SVE test. The results are tabulated below.

Sample name	MTBE (mg/m^3)	TPHg (mg/m^3)	Benzene (mg/m^3)	Toluene (mg/m^3)	Ethyl-Benzene (mg/m^3)	Total Xylenes (mg/m^3)
MW1#1	210	4,000	23	280	60	207
MW1#2	440	5,100	39	480	120	480
Detection limits	50	500	5	5	5	10

Copies of the laboratory report and chain of custody for the vapor samples are presented in Appendix E.

The concentrations shown above were converted from mg/m^3 to ppmv and the converted results are shown below. The calculations for the conversion are presented in Appendix F.

Sample name	MTBE (ppmv)	TPHg (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethyl-Benzene (ppmv)	Total Xylenes (ppmv)
MW1#1	53	943	7	68	13	44
MW1#2	112	1,203	11	117	25	101

A series of three graphs was generated from this data, illustrating the relationship between applied vacuum, PID concentrations, vapor flow and time. The graphs are presented in Appendix F.

4.7 Projected Hydrocarbon Mass Removal Rate

The following are the projected contaminant removal rates at this site, based on the laboratory analytical data generated from vapor samples obtained at the end of the 6-hour long pilot soil vapor extraction test, at a high flow rate of 1.4 scfm. The laboratory analytical concentrations were converted to ppmv as tabulated on the previous page; TPHg: 1,202 ppmv, Benzene: 11 ppmv, Toluene: 117 ppmv, Ethyl Benzene: 25 ppmv Total Xylenes: 101, and MTBE: 112 ppmv.

TPHg extraction rate = 0.597 lbs./day

Benzene extraction rate = 0.005 lbs./day

Toluene extraction rate = 0.056 lbs./day

E Benzene extraction rate = 0.014 lbs./day

Tot. Xylenes extraction rate = 0.056 lbs./day

MTBE extraction rate = 0.051 lbs./day

Calculations for deriving these values are presented in Appendix F.

5.0 DISCUSSION AND RECOMMENDATIONS

Results from the soil vapor extraction test indicate that by applying vacuum at well MW1, small quantities of petroleum hydrocarbons present in the unsaturated soil zone can be removed. The radius of influence of the vapor extraction well is assumed to be approximately 40 feet. Elevated levels of hydrocarbons exist in the unsaturated soil beneath the dispensers, downgradient of the former UST pit at depths between 15 to 20 feet, and in saturated soil above groundwater. The existing monitoring wells cannot be efficiently utilized as soil vapor extraction points. Groundwater in the monitoring wells beneath the site was found at a depth of about 21.5 feet bgs. Monitoring well MW1 is screened from 15 feet to 30 feet bgs. Static groundwater elevation prior to startup was 21.47 feet bgs, which provided 6.53 feet of available well screen. However, when applied vacuum in MW1 exceeded 60" of water, groundwater mounding inside the well constricted the available screened interval and restricted VOC extraction in vapor form.

Therefore, soil vapor extraction is feasible at this site as a remedial method for soils impacted with petroleum hydrocarbons, however, the existing monitoring wells cannot be utilized efficiently for that purpose.

If soil vapor extraction is chosen as a remediation method for this site, then soil vapor extraction wells properly screened in the target vadose zones (10-15 and 15-20 feet bgs) must be installed.

The area of impacted soil is the western quadrant of the property, at the change-over from First Street to Holmes Street and is roughly centered around monitoring well MW1 where TPHg at 19 feet bgs was 800 mg/kg. A shallower area of impacted soil is found beneath the west pump island line at a depth of 6' bgs where TPHg was found at 6,500 mg/kg. First water during monitoring well installation in July of 2000 was encountered at a depth of about 20' bgs. TPHg in groundwater was detected at levels of 170,000 µg/L; MTBE was found at 320,000 µg/L concentrations.

Seasonal groundwater elevation changes in the area are quite pronounced. When the SVE test was performed, DTW in MW1 was 21.47' bgs and a small interval of contaminated soil was exposed. It is expected that as the summer and fall seasons progress, DTW beneath the site will increase and it is possible that wells MW1, MW2 and MW3 will become dry (as they did in May and August 2001).

Given the existing configuration of structures, tanks and public utilities and reviewing previous soil borings data, and, if SVE is chosen as a remedial method, two soil vapor extraction wells will be sufficient to augment soil contaminant removal. One well should be 18' deep, screened between 15-18 feet and located in the planter area, about 5 feet south of monitoring well MW1; the second well should be 12' deep, screened between 7-12 feet and located in the lane between the planter and the pump island. These locations are shown in the Site Plan (Figure 2). Additionally, monitoring well MW1 should be equipped for possible connection to an SVE system, so that during the dry season, it too can be used as a vapor extraction point for impacted soil.

GET recommends the following:

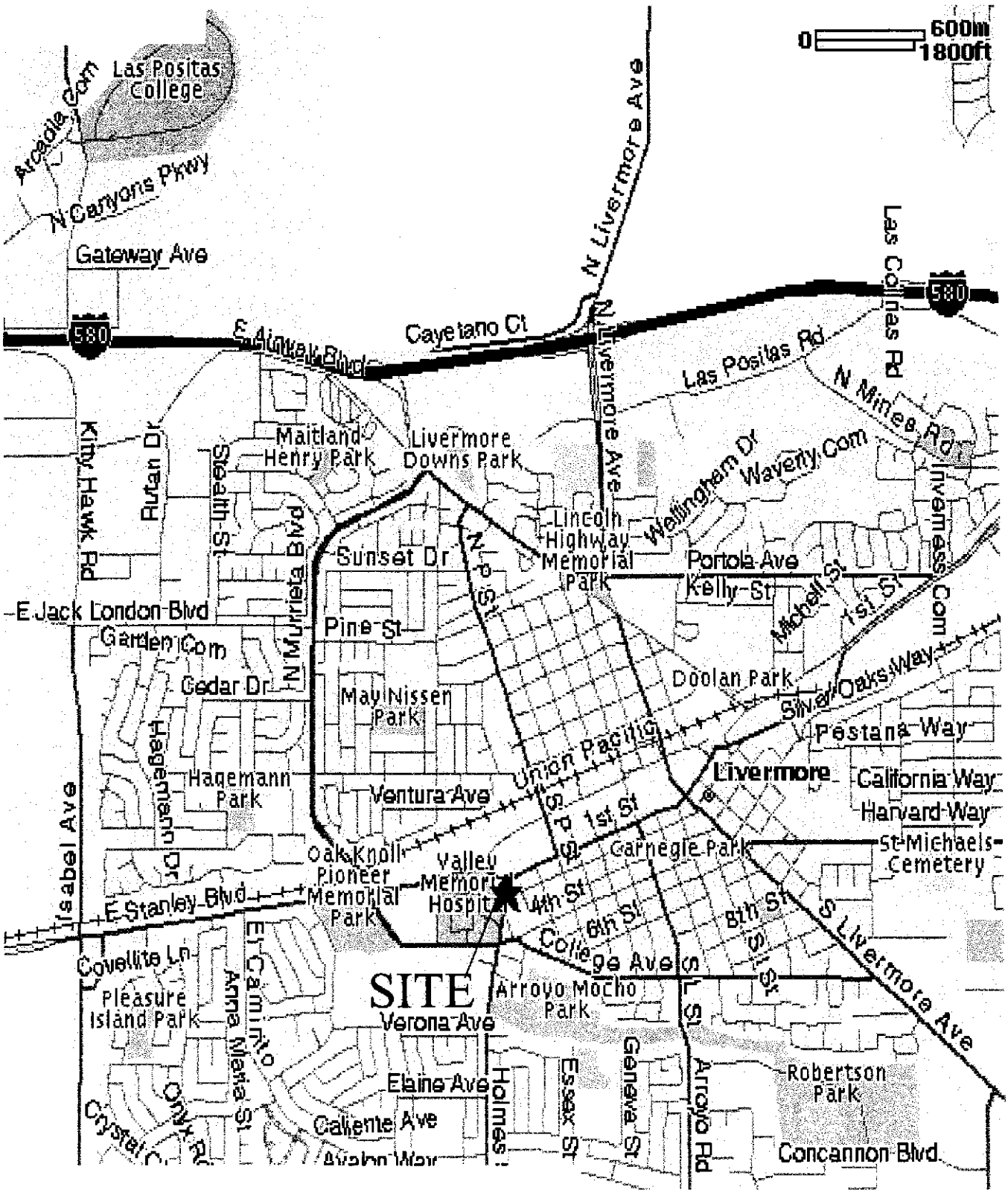
1 Prepare a remedial action plan (RAP) that will evaluate all the available options and capital/annual costs per option for site remediation.

2 Independently of the schedule for RAP preparation, perform a conduit survey and identify potential downgradient receptors.

3 Submit a copy of this report to:

ACEHS
Attention: Eva Chu
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

FIGURES



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Site Vicinity Map

Livermore Gas and Mini Mart
160 Holmes Street
Livermore, California

Figure No.
1

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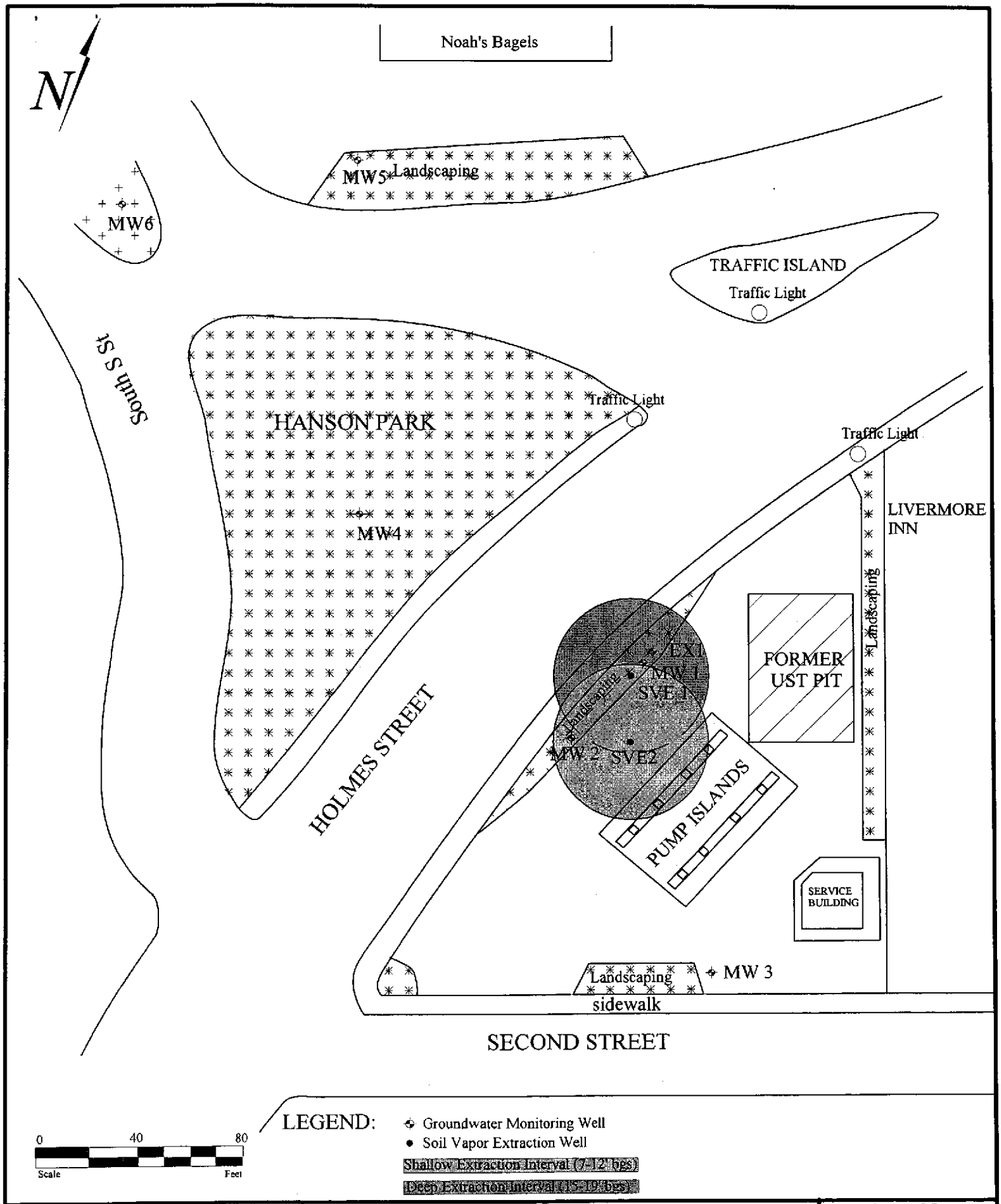

Geo Environmental Technologies	Site Plan 4/24/03 Livermore Gas and Minimart 160 Homes Street, Livermore, CA	Figure No. 2 Project Manwel

Appendix A

Appendix B

Test Boring Log No: DB-1

Project Number: 48016.18 **Project Name:** Livermore Arcade

Sample Information						Depth (feet)	Graphic Log	USCS	Soil Identification
Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I D #				Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
129.0'	36/60	SS				129			Silty Gravel (GM), light yellowish brown (10YR 5/6),
134.0'		Punch				130			dense, little sand, some fines, with large cobbles,
						131			poorly-sorted, iron oxides, moderate to high permeability
						132			
			OVM=0 (headspace)			133			Silty Sand (SM/SP), olive (5Y 4/4), loose, very fine to
						134			medium-grained, moderately-sorted, trace gravel, fines,
134.0'	34/60	SS				135			high permeability
139.0'		Punch				136			
						137			Gravelly Silt (ML), light yellowish brown (2.5Y 6/4),
						138			medium soft to stiff, iron oxide, staining, moderately
						139			plastic, little sand, some gravel, moderate permeability
139.0'	30/60					140			
144.0'						141			
						142			
						143			
						144			Clayey Silt (ML), yellowish brown (10YR 5/6), stiff,
						145			moderately plastic, low permeability
									Total Depth - 144'

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

Test Boring Log No: DB-1

Project Number: 48016.18 **Project Name:** Livermore Arcade

Sample Information						Depth (feet)	Graphic Log	USCS	Soil Identification
Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	ID #				Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
104.0' 109.0'	0/60 Punch	SS	OVM= 0.1 (headspace)			102			Gravelly Sand (SM), light olive brown (2.5Y 3/3), loose to mod. dense, little fines, moderately sorted
						103			Silty Gravel (GM), yellowish brown (10YR 5/6), med.
						104			dense, some silt and clay, little sand, poorly-sorted, high
						105			permeability
						106			
						107			
						108			
						109			
						110			
						111			
						112			
						113			Gravelly Sand (SW), light olive brown (2.5Y 5/3), loose,
						114			trace of fines, moderately-sorted, high permeability
114.0' 119.0'	30/60 Punch	SS				115			
						116			
						117			
						118			Silty Gravel (GM), yellowish brown (10YR 5/6), med. dense, some silt and
						119			clay, little sand, poorly-sorted, high permeability
119.0' 124.0'	48/60 Punch	SS	OVM=0 (headspace)			120			Clayey Silt (ML), yellowish brown (10YR 5/6), stiff, low plasticity
						121			Silty Gravel (GM) to Gravelly Silt (ML), light olive brown
						122			(2.5Y 5/3), very stiff (dense), little sand, poorly-sorted,
						123			iron oxides, moderate permeability
						124			Silty Sand (SM), light olive brown (2.5Y 5/3), loose, little
124.0' 129.0'	48/60 Punch	SS				125			fines, very fine to coarse-grained, poorly-sorted, high K
						126			Silty Gravel (GM), light yellowish brown (10YR 5/6),
						127			dense, little sand, some fines, iron oxides, moderate
						128			permeability

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY (140 lb. wt. X 30" fall on 2" O.D. sampler)		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

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Test Boring Log No: DB-1

Project Number: 48016.18 **Project Name:** Livermore Arcade

Sample Information						Depth (feet)	Graphic Log	USCS	Soil Identification
Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I.D.#				Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
74.0'	18/18	SS		23		75			
75.5'									
75.5'	18/18	SS	OVM=	34		76			Silty Clay (CL/CH), light yellowish brown (10YR 5/6)
77.0'			0.5 (headspace)			77			mod. to high plasticity, trace sand, soft to stiff
						78			Gravelly Clay(CL), yellowish brn (10YR 5/6), very soft, some gravel, low K
						79			Sand (SP), light olive brown (2.5Y 5/6), loose, very
79.0'	60/60	SS	OVM=0 (headspace)						
84.0'		Punch				80			fine-grained, trace of silt, high permeability
						81			Gravelly Silt (ML) & Sand, light yellowish brn (10YR 6/4),
						82			stiff, mod. plasticity, (some Gravel), mod. K
						83			Clayey Silt (ML), yellowish brown (10YR 5/6), medium
						84			soft to stiff, low plasticity, low permeability
84.0'	60/60	SS	OVM=0 (headspace)			85			Silty Clay (CL), brown (7.5YR 5/4), very stiff, trace
89.0'		Punch							pebbles, moderate plasticity, very low permeability
						86			Clayey Silt (ML), light olive brown (2.5Y 5/4), stiff, mod.
						87			plastic; manganese oxide stains color changes to light
						88			yellowish brown (2.5Y 6/4) at 89.0'
						89			
89.0'	18/18	SS				90			
91.0'		Punch							
						91			
						92			
						93			Clayey Silt (ML), strong brown (7.5YR 4/6), moderate
						94			plasticity, stiff, trace of sand
94.0'	48/60	SS	OVM=						Gravelly Silt (ML), strong brown (7.5YR 5/6), stiff, moderate plasticity, trace of sand, moderate permeability
99.0'		Punch	0.1 (headspace)			95			Clayey Silt (ML), strong brown (7.5YR 5/4) very stiff,
						96			mod. plastic, trace pebbles, and carbonate
						97			
						98			(At 98.7' becomes stiff with trace sand)
99.0'	48/60	SS				99			
104.0'		Punch				100			Sand (SP), olive brown (2.5Y 4/4), trace silt, very
						101			fine-grained, well-sorted, high permeability

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

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Environmental Scientists and Engineers

Test Boring Log No: DB-1

Project Number: 48016.18 **Project Name:** Livermore Arcade

Sample Information						Depth (feet)	Graphic Log	USCS	Soil Identification
Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I.D.#				Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						48			
48.5'	48/48	SS	OVM= 1.7 (headspace)		DB-1-48.5	49			Silty Clay (CL), light olive brown (2.5Y 6/4), wet, soft,
						50			trace pebbles, faint solvent odor
50.0' 51.5'	18/18	SS	OVM= 1.4 (headspace)	15	DB-1-50.0	51			Gravelly Silt (ML), yellowish brn (10Y 5/6), wet, soft,
						52			mod. plastic, little pebbles, low to mod. permeability
						53			Silty Clay (CL/CH), yellowish brown (10YR 5/6), very
						54			soft, moderate to high plasticity, trace of sand and
						55			pebbles
						56			
						57			
57.5' 59.0'	18/18	SS	OVM= 1.4 (headspace)	47	DB-1-57.0	58			Gravelly Silt (ML), light yellowish brown (10YR 5/4) stiff,
						59			moderate plasticity, little pebbles
						60			
						61			
62.0' 63.5'	18/18	SS	OVM= 0.7 (headspace)	65	DB-1-62.0	62			
						63			Gravelly Silt (ML), light yellowish brown (10YR 6/4),
						64			stiff, moderately plastic fines (soft), little sand color
						65			changes to dark yellowish brown (10YR 4/4) with some
						66			sand, high permeability
						67			
						68			
						69			
						70			Silty Sand (SM) 69.5'-70.0'
71.0' 72.5'	18/18	SS	OVM= 0.5 (headspace)	41	DB-1-70.0	71			Sandy Silt (ML), yellowish brown (10YR 5/6), mottled w/
						72			strong brown (7.5YR 5/6), oxides, stiff, little sand, gravel
72.5' 74.0'	18/18	SS	OVM= 2.0 (headspace)	34		73			Sandy Gravel (GM), light yellowish brown (10YR 6/4),
						74			loose to medium dense, some very fine to
									medium-grained sand, trace fines, high permeability

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY (140 lb. wt. X 30" fall on 2" O.D. sampler)		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

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Test Boring Log No: DB-1

Project Number: 48016.18 **Project Name:** Livermore Arcade

Sample Information: Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	ID #	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
20.0' - 21.5'	18/18	SS	OVM=0 (headspace)	27	DB-1-20.5u	21			Silty Clay (CL), olive yellow (2.5Y 6/6) mottled with
						22			pale olive (5Y 6/3) and yellowish brown (10YR 5/6),
						23			moist, stiff moderately plastic, very low permeability
						24			[Drilled ahead 21.5' - 25']
						25			Driller: clay "dried out", became harder Clayey Silt (ML)
25.0' - 26.5'	18/18	SS	OVM=0 (headspace)	43	DB-1-25.5u	26			yellowish brown (10YR 5/6), moist, stiff, moderately
						27			plastic, trace of sand and gravel, manganese staining,
						28			low permability
						29			
Cored from 26.5' to 35'	6/96	SS ↓ Punch				30			Silty Gravel (GM) (Gravel fell out of core barrel),
						31			(lithology call from cuttings)
						32			
						33			
						34			
						35			Clayey Silt (ML) light olive brown (2.5Y 5/14), moist,
35.0' - 40.0'	12/60	SS ↓ Punch	OVM=0 (headspace)		DB-1-35.0u	36			medium stiff, low plasticity, trace sand, low permeability
						37			
						38			Driller: Large cobble hit at 38', blew out remaining core
						39			Clayey material through 44'
						40			
40.0' - 41.5'	7/18	SS				41			Clayey Silt (ML) to Silty Clay (CL) (from cuttings)
41.5' - 44.0'		SS ↓ Punch			1st water ▽	42			
						43			
						44			
44.0' - 45.5'	0/18					45			
						46			
						47			

Notes:

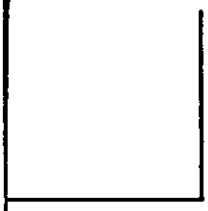
PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY (140 lb. wt. X 30" fall on 2" O.D. sampler)		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

4 Livermore Arcade Shopping Center - Deep Well

HGCL Environmental Scientists and Engineers

Test Boring Log No: DB-1

Location of boring:



Project Name: Livermore Arcade	Total Depth: 144.0'
Project Number: 48016.18	Diameter: 10.0"
Project Manager: Bill Motzer	Logged By: SCN
Drilling Contractor: West Hazmat	Inspector: N/A
Drillers Name: Craig Chaffee	Date: Time:
Drill Rig Type: Schramm	
Start Time: 0900	Date: 9-23-93
Complete Time: 1200	Date: 10-7-93
Boring Depth: 144'	Drawn By: CPA
Casing Depth: 140'	Disk Name: 48016.18/DB-1
Water Depth:	
Backfilled Time:	Date: By:

Sample Information: Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I.D.#	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						1			Asphalt (0-3")
Drilled ahead to 6.0' due to large cobbles.						2			Gravelly Silt (ML) strong brown (7.5 YR 4/6), moist:
						3			medium soft to stiff, low plasticity, with little sand at 3'
						4			depth large cobbles to 3.5" (From cuttings) cobbles
						5			removed with hand auger
6.0' - 6.5'	18/6	SS	OVM=0 (headspace)	50	DB-1-6.0u	6			
						7			Silty Gravel (GM) light yellowish brown (10YR 6/4),
						8			dense, dry. Pebbles up to 2.5 "ø; little very fine to
						9			medium-grain sand, low plasticity fines, poorly-sorted,
10.0' - 10.5'	18/8	SS	OVM=0 (headspace)	42	DB-1-10.0u	10			(too dense to continuously core), high permeability
						11			
						12			
						13			Silty Gravel (GM) to Gravelly Silt (ML); dark
						14			yellowish brown (10YR 4/4); medium dense (stiff),
						15			moist, little fine to coarse-grained sand, low to
15.0' - 15.5'	18/10	SS		43	DB-1-15.0u	16			moderately plastic fines moderate permeability
						17			
						18			[Driller: in and out of gravelly/silty layers]
						19			
						20			

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY		GRAPHIC LEGEND	
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft		gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft		sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft		silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff		clay
		50+	very dense	15 to 30	very stiff		
				30+	hard		

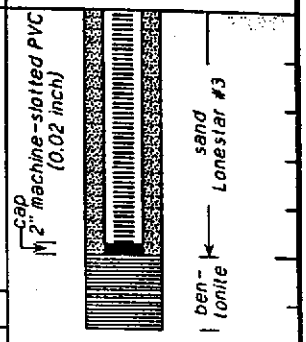
Gettler-Ryan Inc.

Log of Boring U-2

PROJECT: *Tosco (Unocal) Station No. 4186*

LOCATION: *1771 1st Street, Livermore, CA*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	WELL DIAGRAM
						CL		
	3	18	U-2-31.5				Color change to brown (10YR 5/3), becomes moist to saturated, very stiff.	
33							Becomes damp, hard.	
	5	62	U-2-34			GW GC	GRAVEL WITH CLAY AND SAND (GW-GC) - gray (5Y 5/1) to dark yellowish brown (10YR 4/6), saturated, very dense, 75% subangular to rounded fine gravel, 20% fine to coarse sand, 10% clay.	
38								
43								
48								
53								
58								



JOB NUMBER: *140175.02*

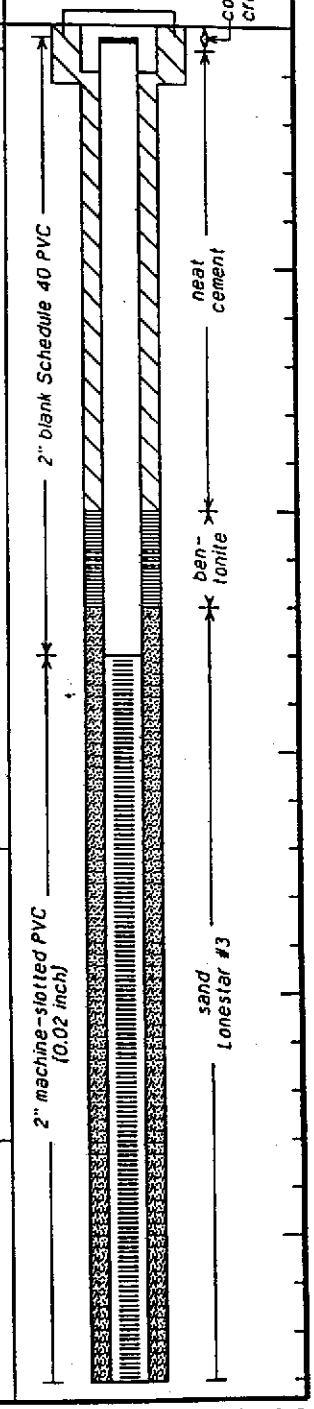
Gettler-Ryan Inc.

Log of Boring U-2

PROJECT: *Tosco (Unocal) Station No. 4186*	LOCATION: *1771 1st Street, Livermore, CA*
GSI PROJECT NO.: *140175.02*	CASING ELEVATION: *477.44 feet MSL*
DATE STARTED: *06/16/98*	WL (ft. bgs): *23.8* DATE: *06/18/98* TIME: *3:00 pm*
DATE FINISHED: *06/16/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *34.5 Feet*
DRILLING COMPANY: *Woodward Drilling*	GEOLOGIST: *Clyde Galantine*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Asphalt and fill gravel.
						GW GM	
5	-	21	U-2-5.5				GRAVEL WITH SILT AND SAND (GW-GM) - brown (10YR 5/3), damp, medium dense, 75% subangular to rounded fine gravel, 15% fine to coarse sand, 10% silt.
10	3	40	U-2-10.5				
	-	79	U-2-14				Becomes very dense.
15							
						GW GC	
20	4	51	U-2-21				GRAVEL WITH CLAY AND SAND (GW-GC) - brown (10YR 5/3), saturated, very dense, 70% subangular to rounded fine gravel, 20% fine to coarse sand, 10% clay.
						CL	
25	4	33	U-2-26.5				CLAY (CL) - brown (10YR 5/3) with dark blue gray (5B 4/1) mottling, moist to damp, hard, plastic, 90% clay, 10% silt, trace fine sand.

WELL DIAGRAM



Gettler-Ryan Inc.

Log of Boring U-1

PROJECT: *Tosco (Unocal) Station No. 4186*

LOCATION: *1771 1st Street, Livermore, CA*

DEPTH feet	PID (ppm)	BLOWS/FT. #	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	WELL DIAGRAM
	1	24	U-1-30			CL	Becomes damp to wet.	cap 2" machine-slotted PVC (0.02 inch) sand Lonestar #3
33	2	28	U-1-34.5					
38								
43								
48								
53								
58								

JOB NUMBER: *140175.02*

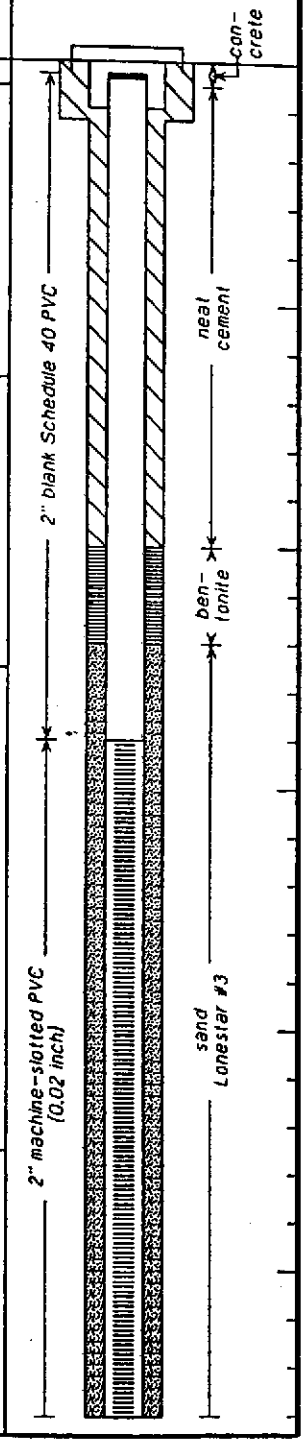
Gettler-Ryan Inc.

Log of Boring U-1

PROJECT: *Tosco (Unocal) Station No. 4186*	LOCATION: *1771 1st Street, Livermore, CA*
GSI PROJECT NO.: *140175.02*	CASING ELEVATION: *478.27 feet MSL*
DATE STARTED: *06/15/98*	WL (ft. bgs): *24.9* DATE: *06/16/98* TIME: *8:00 am*
DATE FINISHED: *06/15/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *34.5 Feet*
DRILLING COMPANY: *Woodward Drilling*	GEOLOGIST: *Clyde Galantine*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
							Asphalt and fill gravel.
						ML	GRAVELLY SILT WITH SAND (ML) – dark brown (10YR 3/3), damp, very stiff, non plastic, 60% silt, 20% fine gravel, 15% fine to coarse sand, 5% clay.
5	8	23	U-1-6				
						GW	GRAVEL WITH SAND (GW) – dark brown (10YR 4/3), damp, very dense, 75% subangular to rounded fine gravel, 20% fine to coarse sand, 5% clay.
10	2	60	U-1-11				
						GW GC	GRAVEL WITH CLAY AND SAND (GW-GC) – brown (10YR 5/3), saturated, very dense, 70% subangular to rounded fine gravel, 20% fine to coarse sand, 10% clay.
15	3	69	U-1-15.5				
	–	44	U-1-19				
20	4	78	U-1-21.5				
						CL	CLAY (CL) – yellowish brown (10YR 5/4), damp, very stiff, plastic, 75% clay, 20% silt, 5% fine to medium sand.
25	2	24	U-1-26.5				

WELL DIAGRAM



JOB NUMBER: *140175.02*

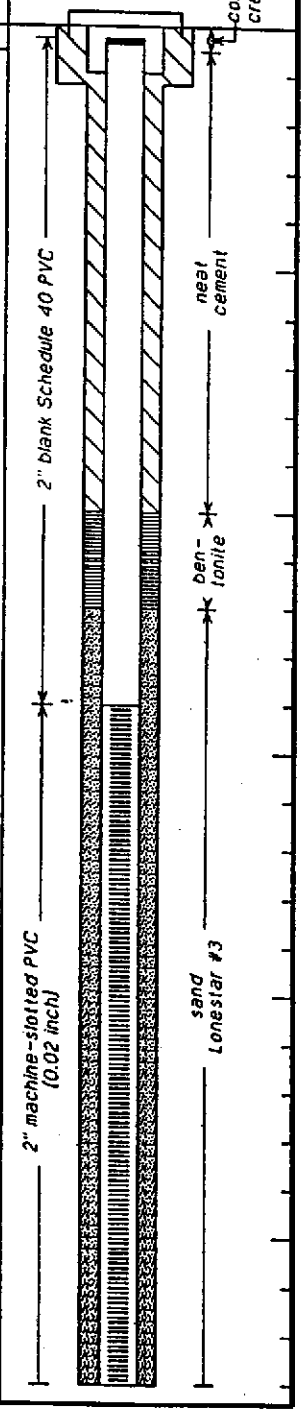
Gettler-Ryan Inc.

Log of Boring U-3

PROJECT: *Tosco (Unocal) Station No. 4186*	LOCATION: *1771 1st Street, Livermore, CA*
GSI PROJECT NO. : *140175.02*	CASING ELEVATION: *454.92 feet MSL*
DATE STARTED: *06/16/98*	WL (ft. bgs): *23.9* DATE: *06/16/98* TIME: *4:45 pm*
DATE FINISHED: *06/16/98*	WL (ft. bgs): DATE: TIME:
DRILLING METHOD: *8" hollow-stem auger*	TOTAL DEPTH: *38.5 Feet*
DRILLING COMPANY: *Woodward Drilling*	GEOLOGIST: *Clyde Galantine*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						GW GC	Asphalt and fill gravel.
5	2	27	U-3-6				GRAVEL WITH CLAY AND SAND (GW-GC) – brown (10YR 5/3), moist, dense, 70% subangular to rounded fine gravel, 20% fine to coarse sand, 10% clay.
10	2	51	U-3-11				Becomes very dense.
15	18	88	U-3-15.5				
20	-	70	U-3-20.5				
25	218	35	U-3-25.5			CL	CLAY (CL) – yellowish brown (10YR 5/4), damp to moist, hard, plastic, 85% clay, 15% silt, trace fine sand.

WELL DIAGRAM



JOB NUMBER: *140175.02*

Gettler-Ryan Inc.

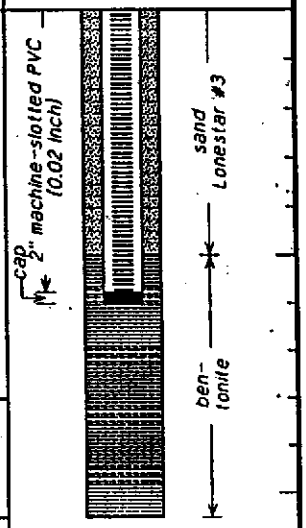
Log of Boring U-3

PROJECT: *Tosco (Unocal) Station No. 4186*

LOCATION: *1771 1st Street, Livermore, CA*

DEPTH feet	PID (ppm)	BLOWS/FT. *	SAMPLE NUMBER	SAMPLE INT.	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
	31	14	U-3-31			CL	Color change to olive brown (2.5Y 4/4), becomes saturated.
33	340	30	U-3-34.5				CLAY WITH SAND AND GRAVEL (CL) - olive brown (2.5Y 4/4), 70% clay, 10% silt, 10% fine to coarse sand, 10% fine gravel.
						GW	
38	372	44	U-3-38.5				GRAVEL (GW) - brown (10YR 4/3), saturated, very dense, 85% subangular to rounded fine gravel, 10% fine to coarse gravel, 10% clay, abundant water.
43							
48							
53							
58							

WELL DIAGRAM



JOB NUMBER: *140175.02*

Acton • Mickelson • van Dam, Inc.

Consulting Scientists, Engineers, and Geologists

Log of Soil Boring MW-3

Casing Elevation: 99.08 feet

Completion Depth: 54 feet

Project No.	Location:
19024.01	Beacon 604 1619 W. First Street Livermore, CA.

Drilling Company: Turner Exploration

Driller: Mike Barr

Drilling and Sampling Methods:

BK-81 HSA California Modified split-spoon sampler

OVM/OVA HNu PID with 10.2 eV probe

Drilling	Time	Date
Start	05-28-93	12:30
Finish	05-28-93	15:30
Water Depth	Initial	Completion 37.11 feet

Logged by: H. Hansen

Checked by: DvP

Depth (feet)	Sample Int.	Description	Graphic Log	BORING/ WELL DETAIL	Blows/6 in	Inches Driven	Inches Recov'd	Comments	Sample #	Field OVM/OVA Reading (ppm)
0		Concrete/roadbase								
1		CLAYEY GRAVEL Olive brown, 1/2 to 2 inch gravel, fine to coarse-grained sand, common plastic fines, moist, (GC)	GC		6 17 42	18	17		MW3-1	0
10					9 24 32	18	18		MW3-2	0
15					10 5 12	18	0		MW3-3	NO RECOVERY
19		SILTY CLAY brown, moderately plastic, moist, (CL)	CL		18 24 22	18	9		MW3-4	0

Acton • Mickelson • van Dam, Inc.

Consulting Scientists, Engineers, and Geologists

Log of Soil Boring MW-3 (cont)

Casing Elevation: 99.08 feet

Completion Depth: 54 feet

Project No.	Location:
19024.01	Beacon 604 1619 W. First Street Livermore, CA.

Drilling Company: Turner Exploration
Driller: Mike Barr
Drilling and Sampling Methods:
BK-81 HSA California Modified split-spoon sampler

OVM/OVA HNu PID with 10.2 eV probe

Drilling	Time	Date
Start	05-28-93	12:30
Finish	05-28-93	15:30
Water Depth	Initial	Completion 37.11 feet

Logged by: H. Hansen
Checked by: DvD

Depth (feet)	Sample Int.	Description	Graphic Log	BORING/WELL DETAIL	Blows/6 in	Inches Driven	Inches Recov'd	Comments	Sample #	Field OVM/OVA Reading (ppm)
20		(continued from above) SILTY CLAY, brown, moderately plastic, moist (CL)								
21										
22										
23										
24										
25			CL		22 28 29	18	11		MW3-5	0
26										
27										
28										
29										
30					17 19 21	18	16		MW3-6	0
31										
32										
33										
34										
35		CLAYEY GRAVEL 1/2 to 2 inch gravel, fine to coarse-grained sand, common plastic fines, saturated (GC)			9 37 42	18	11		MW3-7	0
36										
37										
38			GC							
39										
40					14 22 25	18	18		MW3-8	0
41										

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Consulting Scientists, Engineers, and Geologists

Log of Soil Boring MW-3 (cont)

Casing Elevation: 99.08 feet

Completion Depth: 54 feet

Project No.	Location:
19024.01	Beacon 504 1619 W. First Street Livermore, CA.

Drilling Company: Turner Exploration

Driller: Mike Barr

Drilling and Sampling Methods:

BK-81 HSA California Modified split-spoon sampler

OVM/OVA HNu PID with 10.2 eV probe

Drilling	Time	Date
Start	05-28-93	12:30
Finish	05-28-93	15:30
Water Depth	Initial	Completion 37.11 feet

Logged by: H. Hansen

Checked by: DvD

Depth (feet)	Sample Int.	Description	Graphic Log	BORING/ WELL DETAIL	Blows/6 in	Inches Driven	Inches Recov'd	Comments	Sample #	Field OVM/OVA Reading (ppm)
40		(continued from above) CLAYEY GRAVEL, 1/2 to 2 inch gravel, fine- to coarse-grained sand, common plastic fines, saturated (GC)	GC							
41										
42										
43										
44										
45					9 37 42	18	18		MW3-9	0
46										
47										
48										
49					7 9 24	18	12		MW3-10	0
50										
51										
52										
53		Boring terminated at 53 feet								
54										
55										
56										
57										
58										
59										
60										
61										

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STATE OF CALIFORNIA·DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

ZONE 7
WATER RESOURCES ENGINEERING

WELL LOCATION DATA

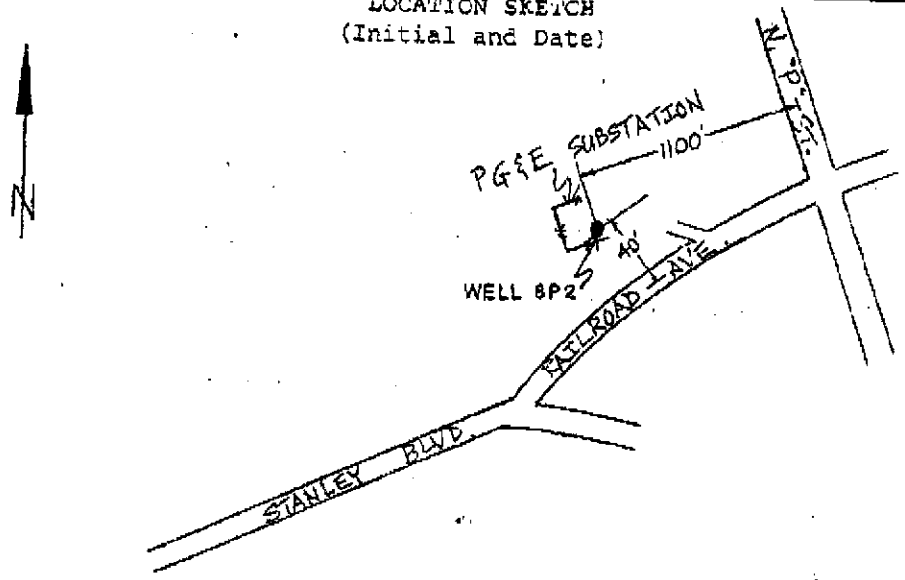
WELL NUMBER 3S / 2E - 8P2

ADDRESS Railroad Avenue between N. "P" Street & Stanley Blvd., Livermore
OWNER California Water Service Co., P.O. Box 1150, San Jose 95108
PRIMARY USE: WATER SUPPLY X
CATHODIC MONITORING
DRILLER J. M. Ough
DATE COMPLETED 11-18-24
DEPTH: COMPLETED 415 FT
DRILLED 420 FT
DIAMETER 12 IN.

OTHER DESIGNATION CWS #3
PUMP: TYPE deep well turbine
MAKE Byron-Jackson
HP 60
METER NUMBER
SOUNDED DEPTH 397 FT
DATE SOUNDED 10-78
DATE DESTROYED
DATE UNLOCATABLE

REMARKS (Initial and date entry)

LOCATION SKETCH
(Initial and Date)



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1# 12JAN 87

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STATE OF CALIFORNIA·DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

ZONE 7
WATER RESOURCES ENGINEERING

WELL LOCATION DATA

WELL NUMBER 3S / 2E - 8P1

ADDRESS 1493 Olivina Avenue, Livermore

OWNER California Water Service Co., 195 South N Street, Livermore 94550

PRIMARY USE: WATER SUPPLY X
CATHODIC MONITORING

DRILLER

DATE COMPLETED Fall 1948

DEPTH: COMPLETED FT
DRILLED 273 FT

DIAMETER 10 IN

OTHER

DESIGNATION CWS #8

PUMP: TYPE turbine
MAKE Layne-Bowler
HP 25

METER NUMBER 224466

SOUNDED DEPTH FT

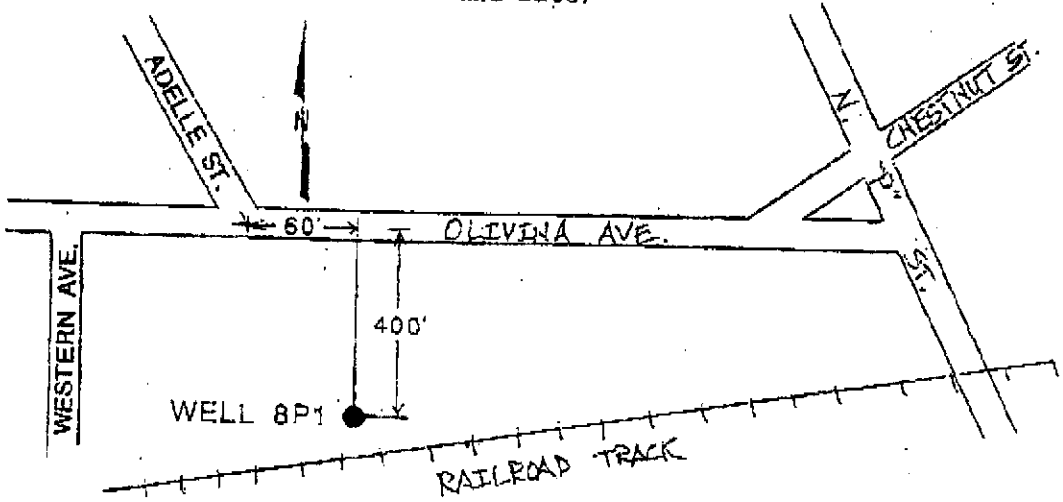
DATE SOUNDED

DATE DESTROYED

DATE UNLOCATABLE

REMARKS (Initial and date entry)

LOCATION SKETCH
(Initial and Date)



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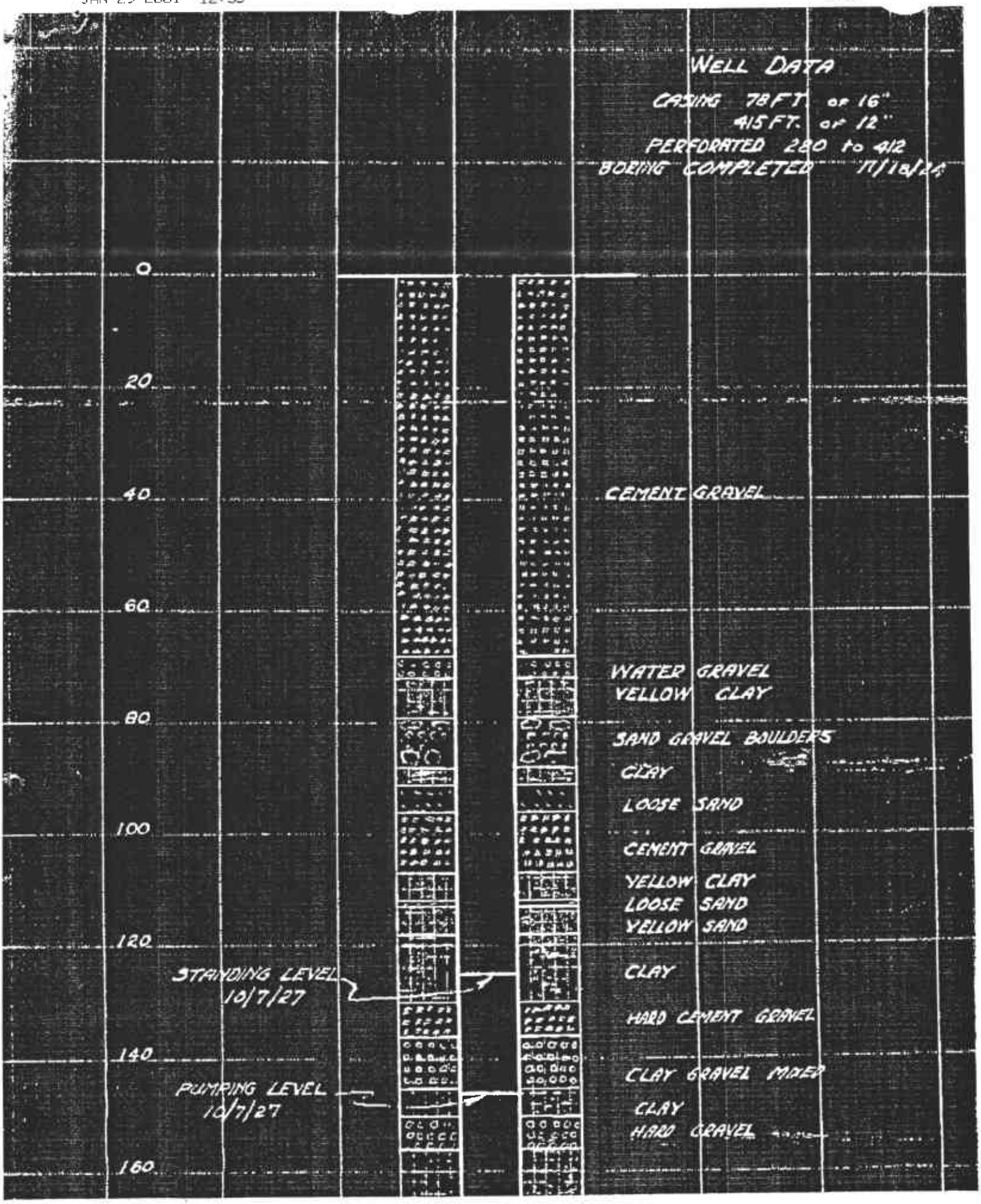
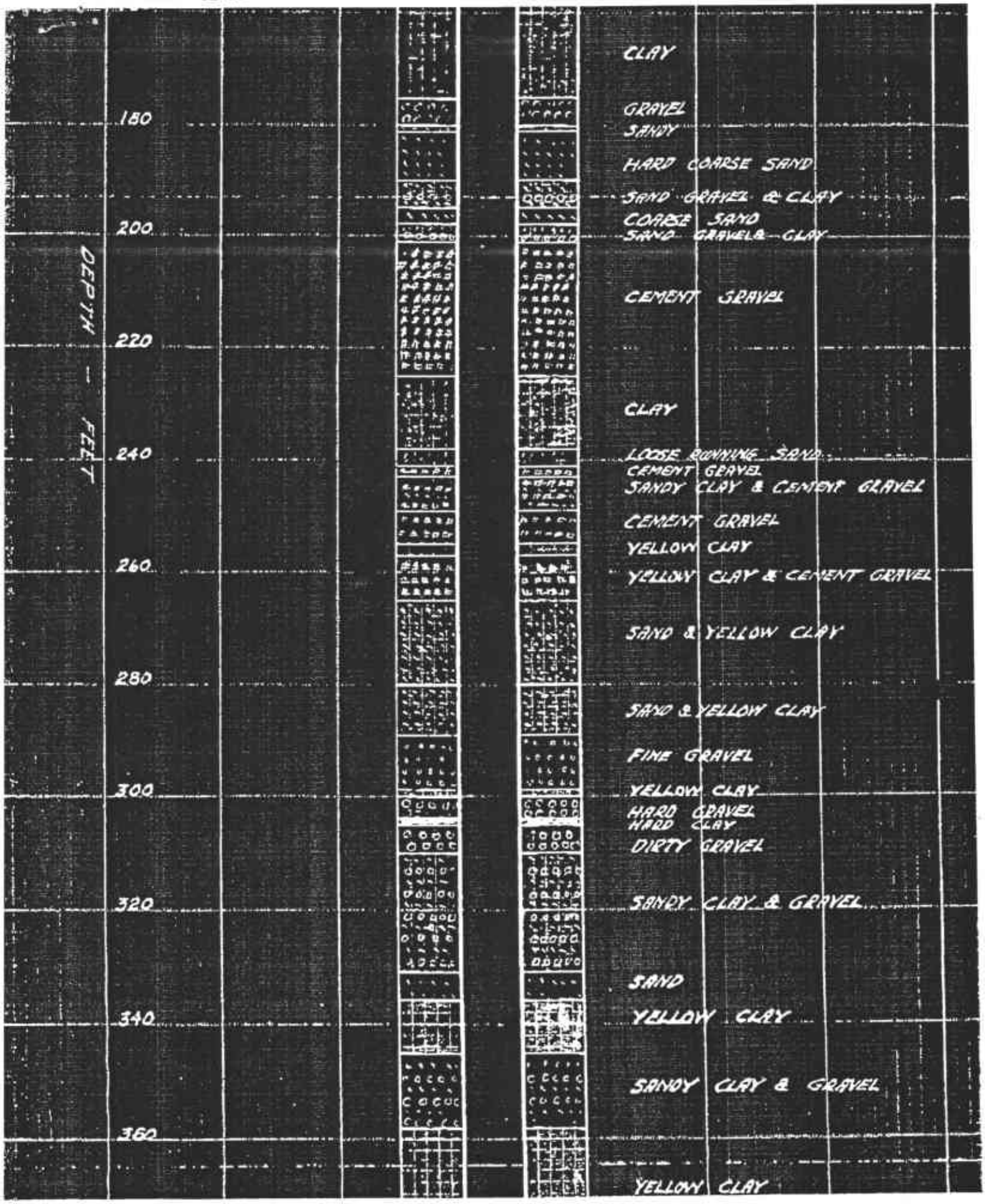
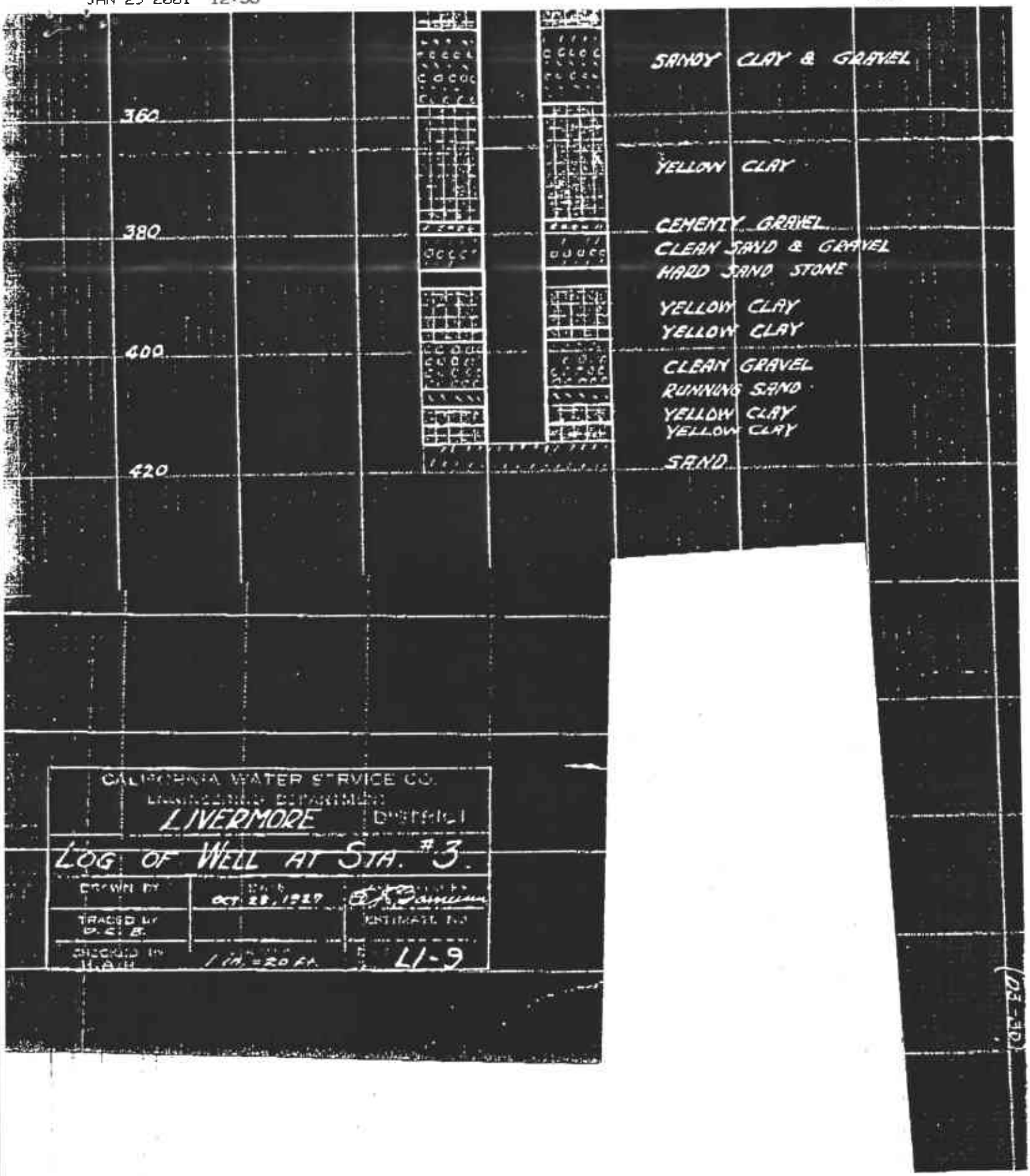

WELL DATA
CASING 78 FT. of 16"
415 FT. of 12"
PERFORATED 280 to 412
BORING COMPLETED 11/18/26
0
20
40
60
80
100
120
140
160
CEMENT GRAVEL
WATER GRAVEL
YELLOW CLAY
SAND GRAVEL BOULDERS
CLAY
LOOSE SAND
CEMENT GRAVEL
YELLOW CLAY
LOOSE SAND
YELLOW SAND
CLAY
HARD CEMENT GRAVEL
CLAY GRAVEL MIXED
CLAY
HARD GRAVEL
STANDING LEVEL
10/7/27
PUMPING LEVEL
10/7/27


DEPTH — FEET
180
200
220
240
260
280
300
320
340
360
CLAY
GRAVEL
SANDY
HARD COARSE SAND
SAND GRAVEL & CLAY
COARSE SAND
SAND GRAVEL & CLAY
CEMENT GRAVEL
CLAY
LOOSE RUNNING SAND
CEMENT GRAVEL
SANDY CLAY & CEMENT GRAVEL
CEMENT GRAVEL
YELLOW CLAY
YELLOW CLAY & CEMENT GRAVEL
SAND & YELLOW CLAY
SAND & YELLOW CLAY
FINE GRAVEL
YELLOW CLAY
HARD GRAVEL
HARD CLAY
DIRTY GRAVEL
SANDY CLAY & GRAVEL
SAND
YELLOW CLAY
SANDY CLAY & GRAVEL
YELLOW CLAY


SANDY CLAY & GRAVEL
360
YELLOW CLAY
CEMENTY GRAVEL
380
CLEAN SAND & GRAVEL
HARD SAND STONE
YELLOW CLAY
YELLOW CLAY
400
CLEAN GRAVEL
RUNNING SAND
YELLOW CLAY
YELLOW CLAY
SAND
420
CALIFORNIA WATER SERVICE CO.
LIVERMORE
LOG OF WELL AT STA. #3
DRAWN BY
DATE
Oct 28, 1929
TRACED BY
D.C.B.
ENTERED BY
CHECKED BY
1 IN. = 20 FT.
41-9

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STATE OF CALIFORNIA·DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

CONFIDENTIAL

STATE OF CALIFORNIA·DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

LOG OF SOIL BORING:

MW1

COORDINATES:

ELEVATION RIM: 465.68' MSL

ELEVATION TOP OF CASING: 465.04' MSL

CLIENT	SITE NUMBER	LOCATION
Livermore Gas and Mini Mart	TMMNW T3 3	160 Holmes St Livermore, CA

DRILLING AND SAMPLING METHODS: 8" HOLLOW STEM AUGERS

				DRILLING START	DRILLING FINISH
WATER LEVEL	19.67	20.49			
TIME	1400	0900		TIME 1220	TIME 1330
DATE	7/26/00	8/11/00		DATE 7/26/00	DATE 7/26/00
REFERENCE	TOC	TOC			

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	WELL DETAIL	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION
				0	CL	SURFACE CONDITIONS: Planter, wood chips and black sandy loam DESCRIPTION BY: R. F. Flory Black sandy loam
				1	CL	
				2		SANDY SILTY CLAY, dark brown, occasional gravel, slightly moist, moderately firm
				3		
18	18	10		4	GP	SANDY GRAVEL, brown-grayish brown-yellowish brown, locally clayey, matrix supported, 2" max clasts, dry, firm
		10		5		
		8		6		
				7		
				8	SW	
18	16	12		9		SILTY SAND, brown, gravelly, slightly moist, firm
		40		10	GP	SANDY GRAVEL, grayish brown-yellowish brown, locally clayey, matrix supported, 2" max clasts, dry, firm
		50/5'		11		
				12	CL	SANDY SILTY CLAY, yellow brown, moist, moderately firm
				13		grading downward into CLAYEY SILT
18	18	9		14	ML	
		9		15		CLAYEY SILT, yellow brown - light olive mottling, slightly moist, moderately firm, slight DIESEL? ODOR becoming increasingly light olive, increasing ODOR downward
		9		16		
				17	CL	SILTY CLAY, light olive, slightly moist, moderately firm, DIESEL? ODOR
				18		
18	17.5	9		19	GC	SANDY CLAYEY GRAVEL, grayish brown, matrix supported, 1 1/2" max clasts, moist, firm
		9				
		9		20		Wet @ 19.5'

Continued on page 2

RECOVER							CLIENT	LOCATION
							Livermore Gas and Mini Mart	160 Holmes Livermore, CA

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	OVA READING	WELL DETAIL	DEPTH (feet)	GRAPHIC LOG	LOG OF SOIL BORING: MW1 — page 2 of 2
					21	GC	SANDY CLAYEY GRAVEL, grayish brown, matrix supported, 1 1/2" max clasts, moist, firm
					22		
					23	CL	CLAY, light olive - olive brown, moist, firm grading downward into
18	18	6			24	CL	
		8					
		9			25	ML	
					26	CL	SILTY CLAY, light olive - light olive brown, moist, firm locally becoming CLAYEY SILT
						ML	
					27	CL	
						ML	
					28	CL	
18	17.75	6			29		
		7					
		7			30	CL	SILTY CLAY, light brown, moist, firm, slight odor
						Total Depth 30 feet	
					31		
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		
					41		
					42		
					43		
					44		
					45		

Registered Geologist
Robert F. Ivey
No. 5825
10/31/02
State of California

LOG OF SOIL BORING:

MW2

COORDINATES:

ELEVATION RIM: 465.32' MSL

ELEVATION TOP OF CASING: 464.96' MSL

CLIENT	SITE NUMBER	LOCATION
Livermore Gas and Mini Mart	**TMMNW T3 3**	**160 Holmes St Livermore, CA**

DRILLING AND SAMPLING METHODS: 8" HOLLOW STEM AUGERS

				DRILLING START	DRILLING FINISH
WATER LEVEL	19.65	20.35			
TIME	1130	0930		TIME 1045	TIME 1200
DATE	7/26/00	8/11/00		DATE 7/26/00	DATE 7/26/00
REFERENCE	TOC	TOC			

SURFACE CONDITIONS: Planter, wood chips and black sandy loam

DESCRIPTION BY: R. F. Flory

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	WELL DETAIL	DEPTH (feet)	GRAPHIC LOG	
				0	CL	Black sandy loam
				1		SANDY SILTY CLAY, dark brown, slightly moist, moderately firm
				2		
				3		
18	17	9		4	CL	SANDY SILTY CLAY, brown, slightly moist, firm
		10				
		10		5		
				6		
				7		SANDY SILTY CLAY, brown - yellowish brown, slightly moist, in auger returns
				8		
18	18	8		9		
		9				
		10		10	CL	SANDY SILTY CLAY, yellowish brown, slightly moist, firm
				11		grading downward into brown-dark brown moist, firm
				12		
				13		
18	18	8		14		SANDY SILTY CLAY, brown- dark brown grading downward to black, moist, firm, slightly plastic
		10				
		13		15	CL	
				16		
				17		
				18	GP	CLAYEY GRAVEL, light brown, sandy, matrix supported, 1 1/2" max clasts, moist, firm
18	16.5	25		19		
		28	▽ 19.65'			CLAYEY SANDY GRAVEL, light brown-olive brown, matrix supported, 1 1/2" max clasts, wet @19.5', firm, diesel? odor Wet @ 19.5'
		29		20		

Continued on page 2

RECOVER

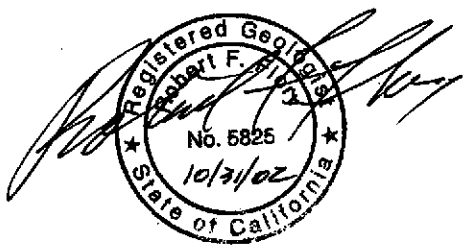
CLIENT: **Livermore Gas and Mini Mart**

LOCATION: **160 Holmes Livermore, CA**

LOG OF SOIL BORING:

MW2

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	OVA READING	WELL DETAIL	DEPTH (feet)	GRAPHIC LOG	
					21	GC	CLAYEY SANDY GRAVEL, light brown-olive brown, matrix supported, 1 1/2" max clasts, wet @19.5', firm, diesel? odor
					22		
					23	CL	SANDY GRAVELY CLAY, light brown - occassionally olive gray mottling, moist, firm
18	18	11			24	SC	SANDY GRAVELY CLAY, light brown, moist, firm, locally becoming CLAYEY SAND
		11				CL	
		12			25	SC	
						CL	SANDY CLAY, light brown, moist, firm, locally becoming CLAYEY SAND
					26	SC	
					27	CL	
						SC	
					28		
18	17.5	6				CL	SANDY CLAY, light brown, moist, firm, locally becoming CLAYEY SAND
		6			29	SC	
		7				CL	
					30		Total Depth 30 feet
					31		
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		
					41		
					42		
					43		
					44		
					45		



LOG OF SOIL BORING:

MW3

COORDINATES:

ELEVATION RIM: 466.24' MSL

ELEVATION TOP OF CASING: 465.86' MSL

CLIENT	SITE NUMBER	LOCATION
Livermore Gas and Mini Mart	**TMMNW T3 3**	**160 Holmes St Livermore, CA**

DRILLING AND SAMPLING METHODS: 8" HOLLOW STEM AUGERS

				DRILLING START	DRILLING FINISH
WATER LEVEL	20.50	20.97			
TIME	0832	1000		TIME 0745	TIME 1000
DATE	7/26/00	8/11/00		DATE 7/26/00	DATE 7/26/00
REFERENCE	TOC	TOC			

SURFACE CONDITIONS: Driveway, 3" asphalt

DESCRIPTION BY: R. F. Flory

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION
			0		3" Asphalt concrete
			1	CL	SANDY GRAVELY CLAY, dark brown, very slightly moist, hard
			2		becoming slightly moist, firm - hard
					SANDY GRAVELY CLAY, dark brown, silty, slightly moist, firm
			3	CL	SANDY GRAVELY CLAY, dark brown, slightly moist, firm
18	17.75	12	4		Becoming red brown
		33		GC	
		28	5		SANDY CLAYEY GRAVEL,yellowish brown, locally silty, slightly moist, firm, locally interbedded with/grading to GRAVELLY CLAY
			6		
			7	CL	SANDY CLAY, yellowish brown, slightly moist, in auger returns
			8		
			9		SILTY CLAY, medium brown - dark brown, abundant black carbonaceous material, slightly moist, firm
18	18	12	10		becoming sandy
		12			grading downward into
		15	11		SANDY SILTY CLAY, medium brown, decreasing black
18	18	12	12	CL	carbonaceous material, slightly moist, firm
		20			
		23	13		locally becoming CLAYEY SILT
18	18	10			
		12	14		
		14			
18	18	8	15		
		11		CL	GRAVELY CLAY, light brown - brown, sandy, moist, firm
		14	16	GC	CLAYEY GRAVEL, light brown - brown, sandy, matrix supported, 1 1/2" max clasts, moist, firm
18	18	12		GP	GRAVEL, light brown - brown - gray brown, sandy, matrix supported, 1 1/2" max clasts, moist, firm
		15	17		
		25			
18	16.5	11	18	CL	GRAVELY CLAY, light brown - brown - yellowish brown, 1 1/2" max clasts, moist, firm
		20			
		16	19		
18	17	23		CL	SANDY CLAY, olive brown - brown , locally gravelly 1" max clasts, moist, firm, slight ? odor
		30	20		

Continued on page 2

RECOVER

CLIENT: **Livermore Gas and Mini Mart**

LOCATION: **160 Holmes Livermore, CA**

LOG OF SOIL BORING: **MW3**

INCHES DRIVEN	INCHES RECOVER	BLOWS/6" SAMPLER	OVA READING	WELL DETAIL	DEPTH (feet)	GRAPHIC LOG	
		30			▽ 20.50	CL	SANDY CLAY, olive brown - brown , locally gravelly 1" max clasts, moist, firm, slight ? odor
18	18	12			21	CL	SILTY CLAY, yellowish brown - reddish brown mottling, moist, firm
		18					
		8			22		
18	18	6				CL	SILTY CLAY, yellowish brown - light brown, very silty firmm, wet
		6			23		
		7					
18	18	6			24		
		7				CL	SILTY SANDY CLAY, yellowish brown - light brown, moist, firm, locally becoming SANDY CLAY
		8			25		
					26		
						SC	CLAYEY SILTY SAND, light brown, moist, firm, locally becoming SILTY SANDY CLAYEY
					27		
					28		
18	18	5				CL	SANDY CLAY, light brown, moist, firm, locally becoming CLAYEY SAND
		6			29		
		7					
					30		Total Depth 30 feet
					31		
					32		
					33		
					34		
					35		
					36		
					37		
					38		
					39		
					40		
					41		
					42		
					43		
					44		
					45		

Registered Geologist
Robert F. Flory
No. 5825
10/31/07
State of California

GET

3275 Stevens Creek Blvd. # 208
San Jose, CA 95117

CLIENT	SITE NUMBER	LOCATION
Livermore Gas and Mini Mart	Manwel	160 Holmes St Livermore, CA

DRILLING AND SAMPLING METHODS: 10" HOLLOW STEM AUGERS

LOG OF SOIL BORING:

EX1

ELEVATION RIM: 465.68' MSL

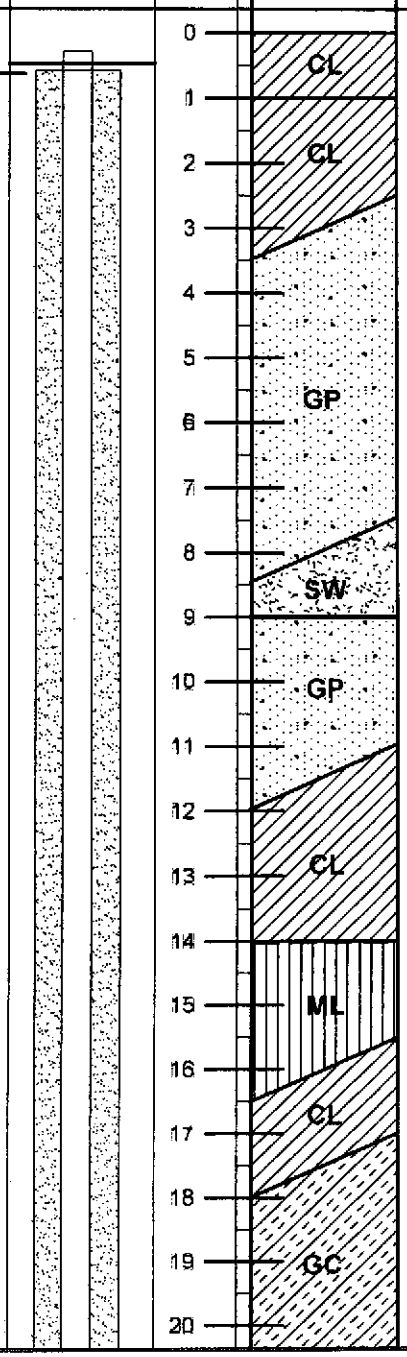
ELEVATION TOP OF CASING: 465.39' MSL

WATER LEVEL	33.41
TIME	1200
DATE	11/14/01
REFERENCE	TOC

DRILLING START DATE	DRILLING FINISH DATE
10/29/01	10/30/01

SURFACE CONDITIONS: Planter, wood chips and black sandy loam

DESCRIPTION BY: Costas Orountiotis



Black sandy loam

SANDY SILTY CLAY, dark brown, occasional gravel, slightly moist, moderately firm

SANDY GRAVEL, brown-grayish brown-yellowish brown, locally clayey, matrix supported, 2" max clasts, dry, firm

SILTY SAND, brown, gravelly, slightly moist, firm

SANDY GRAVEL, grayish brown-yellowish brown, locally clayey, matrix supported, 2" max clasts, dry, firm

SANDY SILTY CLAY, yellow brown, moist, moderately firm

grading downward into CLAYEY SILT

CLAYEY SILT, yellow brown - light olive mottling, slightly moist, moderately firm, slight DIESEL? ODOR
becoming increasingly light olive, increasing ODOR downward

SILTY CLAY, light olive, slightly moist, moderately firm, DIESEL? ODOR

SANDY CLAYEY GRAVEL, grayish brown, matrix supported, 1 1/2" max clasts, moist, firm

Wet @ 19.5'

Continued on page 2,

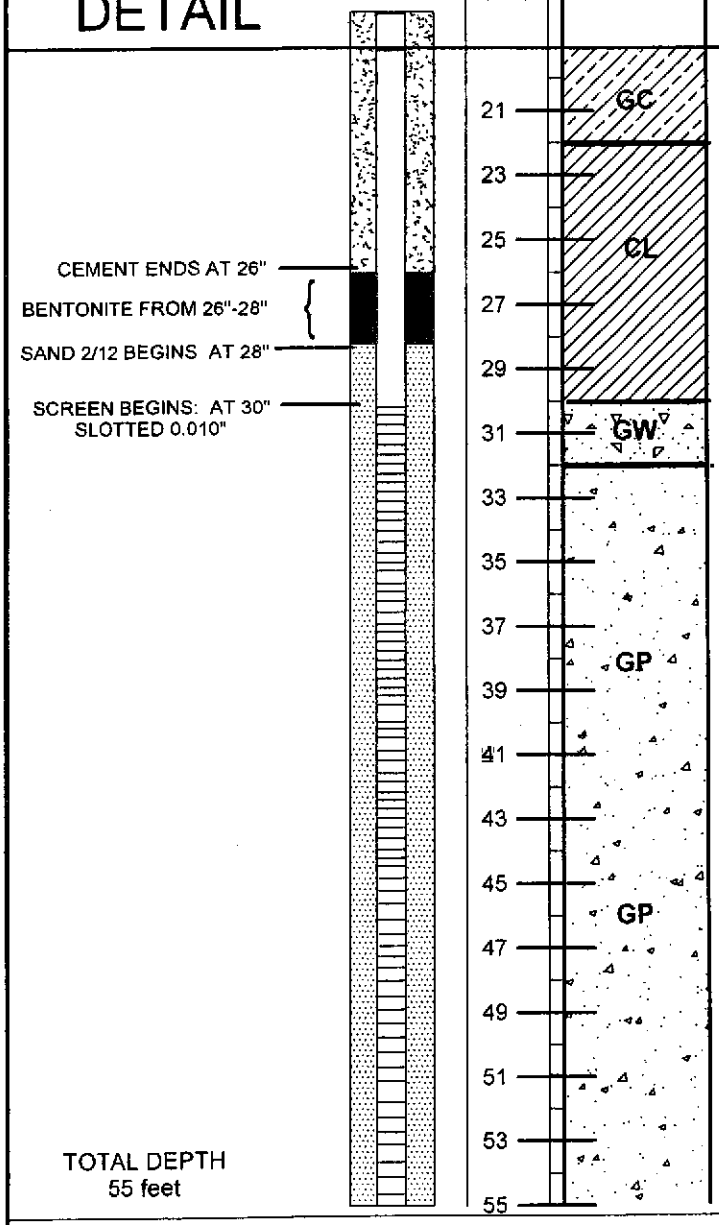
GET
3275 Stevens Creek Blvd. # 208
San Jose, CA 95117

CLIENT
Livermore Gas and Mini Mart

LOCATION
160 Holmes
Livermore, CA

WELL DETAIL

LOG OF SOIL BORING:
EX1



SANDY CLAYEY GRAVEL, grayish brown, matrix supported, 1 1/2" max clasts, moist, firm

SANDY SILTY CLAY, yellowish brown, moist, moderately firm

GRAVEL, (cement gravel), firm

SANDS AND GRAVEL, grayish brown, matrix supported, 1 1/2" max clasts, moist, firm (cement gravel)

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job #	392-001
Client	ETIC
Project/Location	Monwell/TMMNNT3
Date	8/9/00

Boring #	MW2	MW2			
Depth (ft)	12.5'	17'			
Soil Type	brown CLAY with sand (very silty)	brown clayey GRAVEL with sand			
Specific Gravity	2.82	2.75			
Volume Total cc	95.286	95.882			
Volume of Solids	59.239	65.134			
Volume of Voids	36.047	30.748			
Void Ratio	0.609	0.472			
Porosity %	37.8%	32.1%			
Saturation %	93.6%	78.6%			
Moisture %	20.2%	13.5%			
Dry Density (pcf)	109.4	116.6			

Remarks

Specific Gravity
ASTM D-854

Cooper Testing Lab

Job#: 392-001 Date: 08/10/00
Client: ETIC By: DC
Project: TMMNN-T3

Boring:	MW-2	MW-3				
Sample:						
Depth, ft.:	12.5	17				
Soil Classification: (visual)	brown CLAY w/sand	brown clayey GRAVEL w/sand				
Wt. of Pycnometer Soil & Water, gm:	719.9	721.62				
Temp. centigrade:	23	23				
Wt. of Pycnometer & Water, gm:	662.85	671.24				
Wt. Dry Soil, gm:	88.44	79.09				
Temp. Correction Factor:	1	1				
Specific Gravity:	2.82	2.75	ERR	ERR	ERR	ERR

Remarks: The temperature correction factor is shown as 1 if the weight of the pycnometer is taken from the lab temperature correction curve.

TABLE 2 - Soil Analytical Results

Livermore Gas and Minimart, 160 Holmes, Livermore, California

Well No.	Sampling Date	TPHg (mg/Kg	Benzene (mg/Kg	Toluene (mg/Kg	Ethyl-Benzene (mg/Kg	Xylene (mg/Kg	MtBE (mg/Kg
MW-1-15	07/26/00	< 10	< 0.62	< 0.62	< 0.62	< 0.62	0.93
MW-1-19	07/26/00	800	< 6.2	36	18	100	21
MW-2-15	07/26/00	< 1.0	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
MW-2-20	07/26/00	1.1	0.0092	0.013	0.053	0.13	0.11
MW-3-15	07/26/00	< 1.0	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
MW-3-20	07/26/00	< 1.0	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

TABLE 3 - Fuel Oxygenates

Livermore Gas and Minimart, 160 Holmes, Livermore, California

Well ID.	Date sampled	Diisopropyl Ether (µg/L)	Ethyl-t-butyl Ether (µg/L)	Methyl-t-butyl Ether (µg/L)	Tert-Amyl Methyl Ether (µg/L)	Tert-Butanol (µg/L)
MW1	10/19/00	< 2000	< 2000	180,000	< 2000	< 2000
MW2	10/19/00	< 40	< 40	1,800	< 40	< 40
MW3	10/19/00	< 1	< 1	< 1	< 1	< 1
MW4	11/14/01	<10	<5.0	14	<5.0	6.7
MW5	11/14/01	<10	<5.0	8.2	<5.0	<5.0
MW6	11/14/01	<10	<5.0	<5.0	<5.0	<5.0
EX1	11/14/01	<250	<250	2,200	<250	<250

Note: µg/L = Micrograms per liter

TABLE 2 - Groundwater Analytical Results

Livermore Gas and Minimart, 160 Holmes, Livermore, California

Well ID.	Date	DTW (feet)	TPHd (µg/L)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
MW1	08/11/00		57,000	170,000	6,400	7,600	4,200	9,700	320,000
	10/19/00	21.94	17,000	170,000	8,400	3,200	2,700	10,000	200,000
	02/22/01	22.91	11,000	82,000	5,100	1,000	13,000	8,700	190,000
	05/30/01	Dry							
	11/14/01	Dry							
	05/07/02	Dry							
	09/11/02	26.16	NA	130,000	7,700	1,100	4,500	1,500	<5000
	12/01/02	27.55	NS	NS	NS	NS	NS	NS	NS
	03/14/03	22.63	3,800	180,000	7,100	3,200	4,300	6,000	220,000
MW2	08/11/00		1,900	4,500	220	52	160	170	3,000
	10/19/00	21.80	1,300	3,400	150	21	100	70	1,900
	02/22/01	22.87	880	7,600	25	< 10	69	25	2,200
	05/30/01	Dry	not sampled						
	11/14/01	Dry	not sampled						
	05/07/02	26.70	86	400	5.4	<0.50	1.9	2.3	230
	09/11/02	25.96	NA	260	1.3	<0.50	0.57	0.77	200
	12/11/02	27.56	120	250	7.9	1.6	13	9.9	180
	03/14/03	22.41	110	830	56	<0.50	<0.50	<1.0	1,200
MW3	08/11/00		260	59	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	10/19/00	22.45	< 65	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	02/22/01	23.51	100	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	05/30/01	Dry	not sampled						
	11/14/01	Dry	not sampled						
	05/07/02	Dry	not sampled						
	09/11/02	26.61	NA	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	12/11/02	28.18	not sampled						
	03/14/03	23.04	<50	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
MW-4	11/14/01	33.84	90	510	4	< 0.50	< 0.50	< 0.50	14
	05/07/02	26.75	< 50	150	3.5	0.5	< 0.50	< 0.50	48
	09/11/02	26.66	NA	< 50	< 0.50	< 0.50	< 0.50	< 0.50	15
	12/11/02	28.39	< 50	< 50	< 0.50	< 0.50	< 0.50	< 0.50	24
	03/14/03	23.14	< 50	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 1.0
MW-5	11/14/01	34.94	< 66	< 50	< 0.50	< 0.50	< 0.50	< 0.50	8.2
	05/07/02	27.90	< 50	140	< 0.50	< 0.50	< 0.50	< 0.50	110
	09/11/02	27.99	NA	< 50	< 0.50	< 0.50	< 0.50	< 0.50	6.3
	12/11/02	29.50	< 50	73	< 0.50	< 0.50	< 0.50	< 0.50	160
	03/14/03	24.26	< 50	110	< 0.50	< 0.50	< 0.50	< 0.50	170
MW-6	11/14/01	33.88	< 50	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	05/07/02	27.01	< 67	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	09/11/02	27.03	NA	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 5.0
	12/11/02	28.77	< 50	< 50	< 0.50	< 0.50	< 0.50	< 0.50	< 1.0
	03/14/03	23.46	< 50	< 50	< 0.50	< 0.50	< 0.50	< 1.0	< 1.0

Entech Analytical Labs, Inc.

3334 Victor Court (408) 588-0200
Santa Clara. CA 95054 (408) 588-0201 - Fax

Chain of Custody / Analysis Request

Attention to: COSTAS	Phone No.:	Purchase Order No (Reqd).: VES TEST	Send Invoice to (if Different) / Phone
Company Name: GET	Fax No.:	Project Number:	Company
Mailing Address:	email:	Project Name: MANWEL	Billing Address (if Different)
City:	State: / Zip:	Project Location: Liver More.	City: / State / Zip

Sampler: GN — Field Org. Code:

Global ID:

Turn Around Time

- ☐ Same Day ☐ 1 Day
- ☐ 2 Day ☐ 3 Day
- ☐ 4 Day ☐ 5 Day
- ☒ Standard (10 Day)

Order ID:

Client ID:	Field PT	Lab. No.	Sampling: Date	Sampling: Time	Matrix	Composite	Grab	Containers	Preservative
MW-1#	34185-001		042403	0725	A		X	1	
MW-1#2		002	042403	1400	A		X	1	

Preservative / Remarks:

- Volatile Organics by GCMS: 601/602 ☐ 624 ☐ 8260B ☐
- Fuel Oxygenates by 8260 ☐ 8010 by 8260B ☐
- MTBE by 8260B ☐
- Pesticides-8081 ☐
- PCBs - 8082 ☐
- TPH as Gas/BTEX ☐
- TPH as Gas/BTEX/MTBE ☐
- Base/Neutral/Acid Organics 8270 ☐ 8270-SIM ☐
- PNA ☐
- Fuel Scan Extractable ☐ Purgeable ☐
- Diesel ☐ w/ Si-gel Standard Cleanup ☐
- Motor Oil ☐ w/ Si-gel Column Cleanup ☐
- pH
- CN
- TRPH ☐ Oil & Grease ☐
- Metals - Circle Below Total ☐ Dissolved ☐
- STLC
- TTLC
- Remarks

Relinquished by:	Received by:	Date:	Time:
[signature]	[signature]	4/24	1502
Relinquished by:	Received by:	Date:	Time:
Relinquished by:	Received by:	Date:	Time:
Relinquished by:	Received by:	Date:	Time:

Special Instructions or Comments

- ☐ NPDES Detection Limits
- ☐ EDD Report Required
- ☐ EDF Report Required
- ☐ PDF File Required

Metals:
Al, As, Sb, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Si, Ag, Na, Se, Sr, Tl, Sn, Ti, V, Zn, W : RCRA-8 ☐ CAM-17 ☐ Plating ☐ PPM-13 ☐ LUFT-5 ☐

TABLE 2 - Groundwater Analytical Results

Livermore Gas and Minimart, 160 Holmes, Livermore, California

Well ID.	Date	DTW (feet)	TPHd (µg/L)	TPHg (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-Benzene (µg/L)	Xylenes (µg/L)	MTBE (µg/L)
EX1	11/14/01	33.41	2,000	13,000	180	1,000	330	3,200	2,200
	05/07/02	27.58	560	7,700	320	< 25	66	150	6,200
	09/11/02	NM	NA	2,800	32	< 13	14	< 13	2,500
	12/11/02	27.98	100	3,000	81	< 0.50	44	< 1	4,800
	03/14/03	23.02	50	750	< 0.50	< 0.50	7.7	13	1,200

Notes:

DTW: Depth to Groundwater
NM: Not Measured
NA: Not Analyzed
TPHg: Total Petroleum Hydrocarbons as gasoline
TPHd: Total Petroleum Hydrocarbons as diesel
MTBE: Methyl tertiary Butyl Ether
µg/L: Micrograms per liter

APPENDIX D

Manuel

SVE test

SVE Equipment used: 4/24/03

Abatement device:

Time	Observation well	Applied Vacuum	Flow Rate	Induced Vacuum	Gastech readings	Other/Remarks
0723	~~0~~ 0.00	60"	1.42	0.00	80	DTW
0735	0.01	55"	1.40	0.01	197	MW-1 21.47 EX-1 21.92
0745	0.02	55"	1.40	0.02	100	MW-2 21.32
0807	0.02	55"	1.40	~~0.02~~	118	
0821	0.02	55"	1.40	0.02	94	
0836	0.02	50"	1.36	0.02	44	
0900	0.02	50"	1.40	0.02	11	
0930	0.02	50"	1.40	0.02	~~8~~ 7	
0946	0.02	45"	0.70	0.02	16	Began reducing vac to expose slots collected sample
1006	0.02	45"	0.80	0.02	90	
1030	0.02	40"	~~0.70~~ 0.70	0.02	112	
1100	0.02	35"	~~0.7~~ ~~0.7~~ 0.7	0.02	140	
1130	0.02	30"	0.68	0.02	169	
1200	0.02	25"	0.65	0.02	147	
1230	0.02	20"	0.56	0.02	287	
1300	0.02	~~15~~ 15"	0.56	0.02	310	
1330	0.02	10"	0.45	0.02	324	collect sample #2
1400	0.02	15"	0.56	0.02	466	end test

APPENDIX E

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

4/30/03\

Costas Orountiotis
Geo Environmental Tech
343 Soquel Ave, #33
Santa Cruz, CA 95062

Order: 34185
Project Name: Manwel
Project Number:
Project Notes:

Date Collected: 4/24/2003
Date Received: 4/24/2003
P.O. Number: VES TEST

On April 24, 2003, samples were received under documentented chain of custody. Results for the following analyses are attached:

Matrix	Test	Method
Air	Gas/BTEX/MTBE	EPA 8015 MOD. (Purgeable) EPA 8020

Chemical analysis of these samples has been completed. Summaries of the data are contained on the following pages. USEPA protocols for sample storage and preservation were followed.

Entech Analytical Labs, Inc. is certified by the State of California (#2346). If you have any questions regarding procedures or results, please call me at 408-588-0200.

Sincerely,

Patti Sandrock
QA/QC Manager

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Geo Environmental Tech
343 Soquel Ave, #33
Santa Cruz, CA 95062
Attn: Costas Orountiotis

Date: 4/30/03
Date Received: 4/24/2003
Project Name: Manwel
Project Number:
P.O. Number: VES TEST
Sampled By: GN

Certified Analytical Report

Order ID: 34185 **Lab Sample ID:** 34185-001 **Client Sample ID:** MW-1 #1

Sample Time: 7:25 AM **Sample Date:** 4/24/2003 **Matrix:** Air

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
Benzene	23		50	0.1	5	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020
Toluene	280		50	0.1	5	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020
Ethyl Benzene	60		50	0.1	5	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020
Xylene, m+p	160		50	0.2	10	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020
Xylene, o	47		50	0.1	5	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	75.5	65 - 135

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
Methyl-t-butyl Ether	210		50	1	50	mg/m3	N/A	4/26/2003	WGC62822	EPA 8020

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	75.5	65 - 135

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
TPH as Gasoline	4000		50	10	500	mg/m3	N/A	4/26/2003	WGC62822	EPA 8015 MOD. (Purgeable)

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	103.2	65 - 135

DF = Dilution Factor ND = Not Detected DLR = Detection Limit Reported PQL = Practical Quantitation Limit

Analysis performed by Entech Analytical Labs, Inc. (CA ELAP #2346)

Patti Sandrock, QA/QC Manager

Environmental Analysis Since 1983

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Geo Environmental Tech
343 Soquel Ave, #33
Santa Cruz, CA 95062
Attn: Costas Orountiotis

Date: 4/30/03
Date Received: 4/24/2003
Project Name: Manwel
Project Number:
P.O. Number: VES TEST
Sampled By: GN

Certified Analytical Report

Order ID: 34185 **Lab Sample ID:** 34185-002 **Client Sample ID:** MW-1 #2

Sample Time: 2:00 PM **Sample Date:** 4/24/2003 **Matrix:** Air

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
Benzene	39		50	0.1	5	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020
Toluene	480		50	0.1	5	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020
Ethyl Benzene	120		50	0.1	5	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020
Xylene, m+p	360		50	0.2	10	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020
Xylene, o	120		50	0.1	5	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	77.2	65 - 135

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
Methyl-t-butyl Ether	440		50	1	50	mg/m3	N/A	4/25/2003	WGC62822	EPA 8020

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	77.2	65 - 135

Parameter	Result	Flag	DF	PQL	DLR	Units	Extraction Date	Analysis Date	QC Batch ID	Method
TPH as Gasoline	5100		50	10	500	mg/m3	N/A	4/25/2003	WGC62822	EPA 8015 MOD. (Purgeable)

Surrogate	Surrogate Recovery	Control Limits (%)
4-Bromofluorobenzene	111.8	65 - 135

DF = Dilution Factor ND = Not Detected DLR = Detection Limit Reported PQL = Practical Quantitation Limit

Analysis performed by Entech Analytical Labs, Inc. (CA ELAP #2346)

Patti Sandrock, QA/QC Manager

Environmental Analysis Since 1983

Entech Analytical Labs, Inc.

3334 Victor Court • Santa Clara, CA 95054 • (408) 588-0200 • Fax (408) 588-0201

Quality Control Results Summary

QC Batch #: WGC62822
Matrix: Liquid
Units: µg/L
Date Analyzed: 4/25/2003

Parameter	Method	Blank Result	Spike Sample ID	Spike Amount	Sample Result	Spike Result	QC Type	% Recovery	RPD	RPD Limits	Recovery Limits
Test: TPH as Gasoline											
TPH as Gasoline	EPA 8015 M	ND		250		246.	LCS	98.4			65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			82.7			65 - 135					
Test: BTEX											
Benzene	EPA 8020	ND		8		7.9	LCS	98.8			65.0 - 135.0
Ethyl Benzene	EPA 8020	ND		8		8.5	LCS	106.3			65.0 - 135.0
Toluene	EPA 8020	ND		8		8.3	LCS	103.8			65.0 - 135.0
Xylenes, total	EPA 8020	ND		24		26.1	LCS	108.8			65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			95.6			65 - 135					
Test: MTBE by EPA 8020											
Methyl-t-butyl Ether	EPA 8020	ND		8		8.1	LCS	101.3			65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			95.6			65 - 135					
Test: TPH as Gasoline											
TPH as Gasoline	EPA 8015 M	ND		250		238.	LCSD	95.2	3.31	25.00	65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			80.2			65 - 135					
Test: BTEX											
Benzene	EPA 8020	ND		8		7.7	LCSD	96.3	2.56	25.00	65.0 - 135.0
Ethyl Benzene	EPA 8020	ND		8		8.	LCSD	100.0	6.06	25.00	65.0 - 135.0
Toluene	EPA 8020	ND		8		7.8	LCSD	97.5	6.21	25.00	65.0 - 135.0
Xylenes, total	EPA 8020	ND		24		24.6	LCSD	102.5	5.92	25.00	65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			87.7			65 - 135					
Test: MTBE by EPA 8020											
Methyl-t-butyl Ether	EPA 8020	ND		8		7.2	LCSD	90.0	11.76	25.00	65.0 - 135.0
Surrogate			**Surrogate Recovery**			**Control Limits (%)**					
4-Bromofluorobenzene			87.7			65 - 135					

APPENDIX F

Manwel Calculations

Per Entech Labs:

TPHg	= 95	$^{lbs}/_{lb\text{-}mole}$
B	= 78	$^{lbs}/_{lb\text{-}mole}$
T	= 92	$^{lbs}/_{lb\text{-}mole}$
E	= 106	$^{lbs}/_{lb\text{-}mole}$
X	= 106	$^{lbs}/_{lb\text{-}mole}$
MTBE	= 88	$^{lbs}/_{lb\text{-}mole}$

To convert from mg/m^3 for TPHg (again per Entech):

$$Ppmv = {}^{mg}/_{m^3} * {}^{1000}/_{mole} * 0.0224 = {}^{5100mg}/_{m^3} * {}^{1000}/_{95} * 0.0224 = \mathbf{1202\ ppmv}$$

To obtain TPHg extraction rate:

$$ER = {}^{1202ppm}/_{1,000,000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{95lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

TPHg extraction rate = **0.6** $^{\mathbf{lbs}}/_{\mathbf{day}}$

To obtain MTBE extraction rate:

$$ER = {}^{53}/_{1,000,000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{88lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

MTBE extraction rate = **0.051** $^{\mathbf{lbs}}/_{\mathbf{day}}$

To obtain Benzene extraction rate:

$$ER = {}^{11}/_{1,000,000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{78lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

Benzene extraction rate = **0.005** $^{\mathbf{lbs}}/_{\mathbf{day}}$

To obtain Toluene extraction rate:

$$ER = {}^{117}/_{1{,}000{,}000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{92lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

$$\text{Toluene extraction rate} = \mathbf{0.056}\ {}^{\mathbf{lbs}}/_{\mathbf{day}}$$

To obtain Ethyl-Benzene extraction rate:

$$ER = {}^{25}/_{1{,}000{,}000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{106lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

$$\text{Ethyl-Benzene extraction rate} = \mathbf{0.014}\ {}^{\mathbf{lbs}}/_{\mathbf{day}}$$

To obtain Total Xylenes extraction rate:

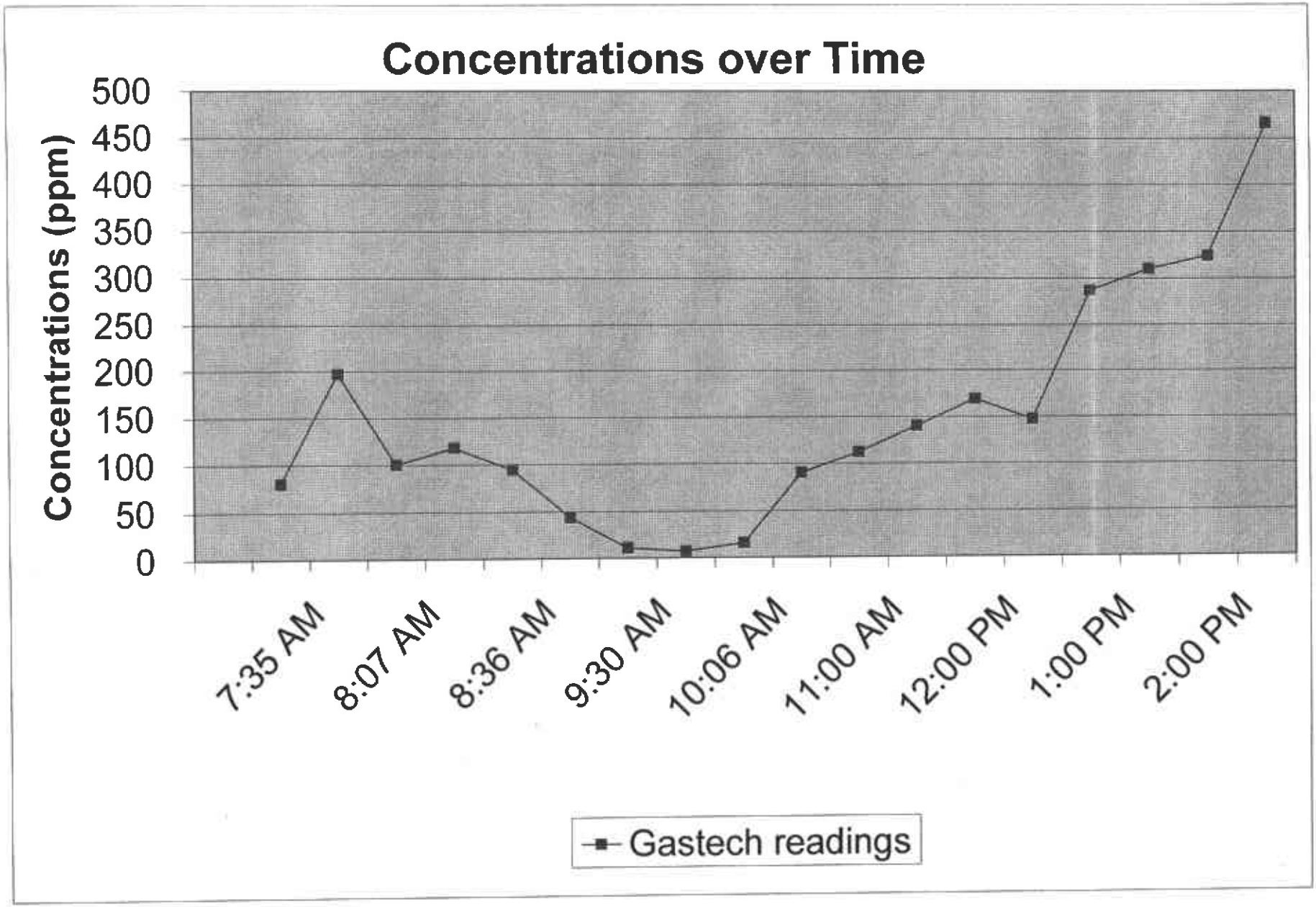
$$ER = {}^{101}/_{1{,}000{,}000} * {}^{1.4cf}/_{minutes} * {}^{1440min}/_{day} * {}^{106lbs}/_{lb\text{-}mole} * {}^{1lb\text{-}mole}/_{386cf}$$

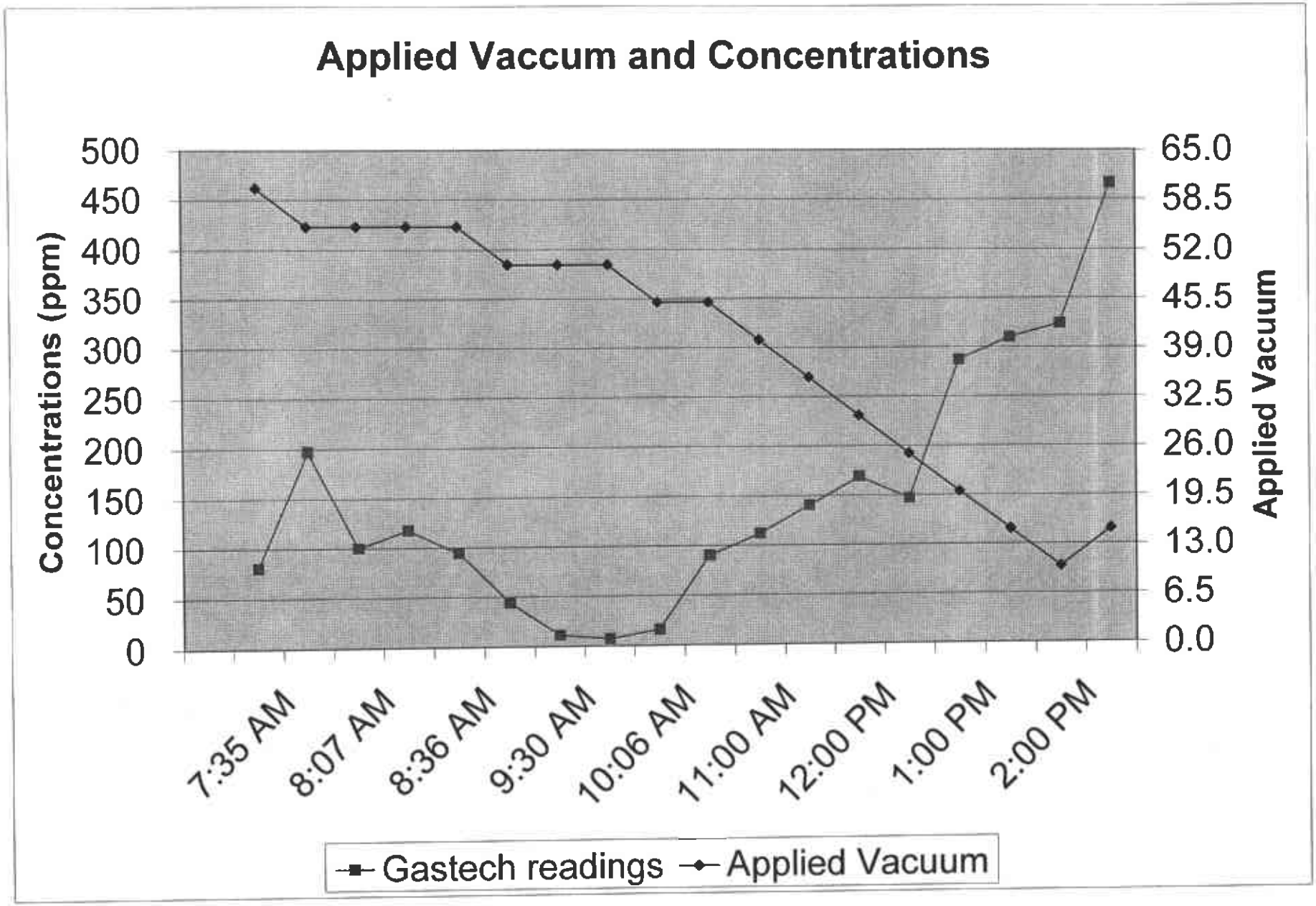
$$\text{Total Xylenes extraction rate} = \mathbf{0.056}\ {}^{\mathbf{lbs}}/_{\mathbf{day}}$$

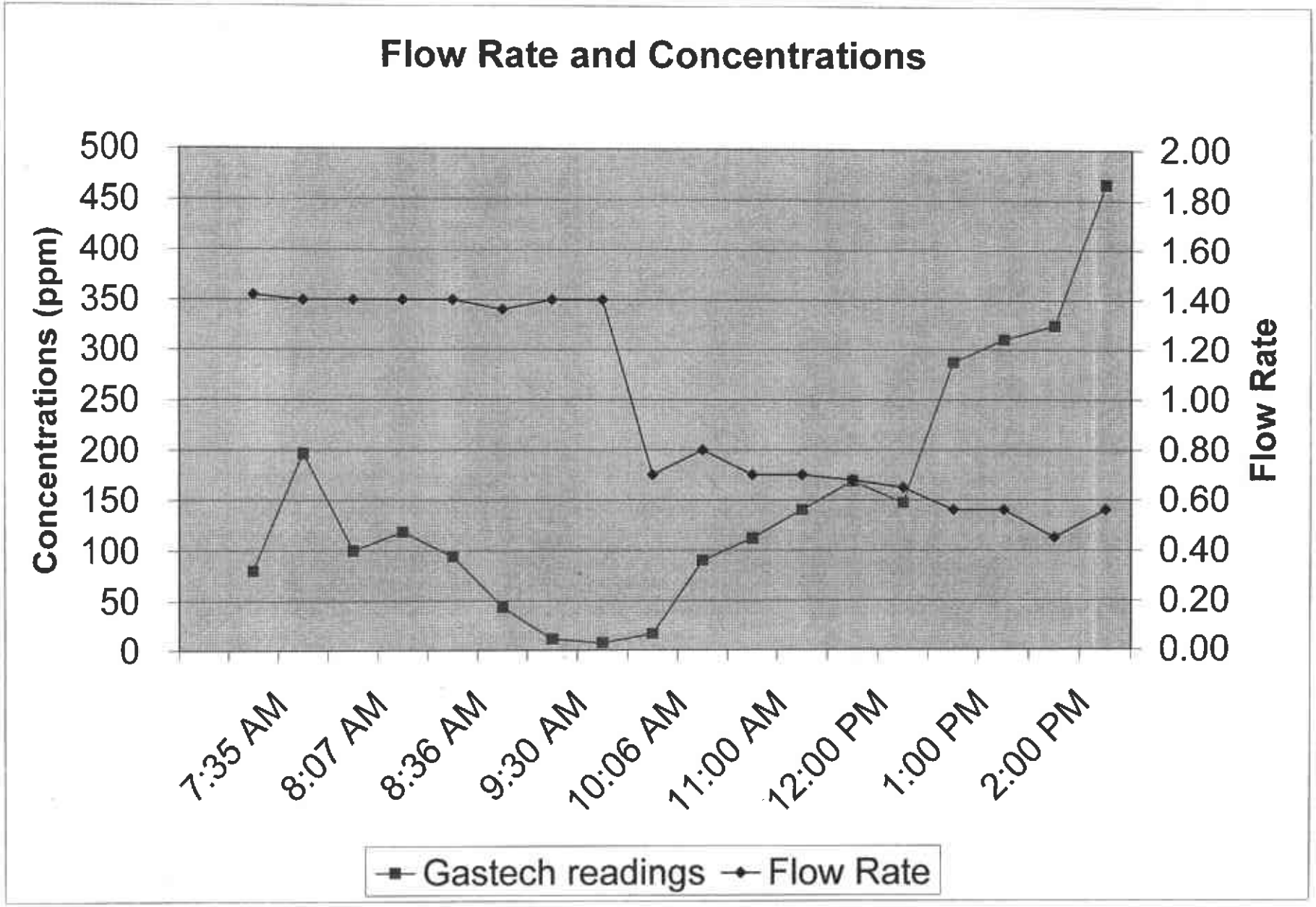
Manuel 4/24/03

TABLE FOR CALCULATING SVE EXTRACTION RATE

	mg/m3	conversion formula	ppmv	formula for Extraction rate	extraction rate lbs/day
MW1#1					
TPHg	4000	0.235789474	943.158	0.000496166	0.468
Benzene	23	0.287179487	6.60513	0.000407378	0.003
Toluene	280	0.243478261	68.1739	0.000480497	0.033
E.Benzene	60	0.211320755	12.6792	0.000553617	0.007
Xylenes	207	0.211320755	43.7434	0.000553617	0.024
MTBE	210	0.254545455	53.4545	0.000459606	0.025
MW1#2					
TPHg	5100	0.235789474	1202.53	0.000496166	0.597
Benzene	39	0.287179487	11.2	0.000407378	0.005
Toluene	480	0.243478261	116.87	0.000480497	0.056
E.Benzene	120	0.211320755	25.3585	0.000553617	0.014
Xylenes	480	0.211320755	101.434	0.000553617	0.056
MTBE	440	0.254545455	112	0.000459606	0.051


Concentrations over Time
Concentrations (ppm)
500
450
400
350
300
250
200
150
100
50
0
7:35 AM
8:07 AM
8:36 AM
9:30 AM
10:06 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
Gastech readings


Applied Vaccum and Concentrations
Concentrations (ppm)
500
450
400
350
300
250
200
150
100
50
0
65.0
58.5
52.0
45.5
39.0
32.5
26.0
19.5
13.0
6.5
0.0
Applied Vacuum
7:35 AM
8:07 AM
8:36 AM
9:30 AM
10:06 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
Gastech readings
Applied Vacuum


Flow Rate and Concentrations
Concentrations (ppm)
500
450
400
350
300
250
200
150
100
50
0
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Flow Rate
7:35 AM
8:07 AM
8:36 AM
9:30 AM
10:06 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
Gastech readings
Flow Rate