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PROBLEM ASSESSMENT REPORT
JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

NOV 1989

FOR

DUPONT

Du Pont Environmental Services

PROBLEM ASSESSMENT REPORT
JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

FOR

CONOCO INC.
600 NORTH DAIRY ASHFORD
TR 3038
HOUSTON, TEXAS 77079

PREPARED BY

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NOVEMBER 22, 1989

JOB NO. 211-71-11

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DUPONT

November 22, 1989
Job No. 211-71-11

Mr. Gregory Fletcher
Conoco Inc.
600 North Dairy Ashford
TR 3038
Houston, Texas 77079

SUBJECT: Problem Assessment Report
Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Dear Mr. Fletcher:

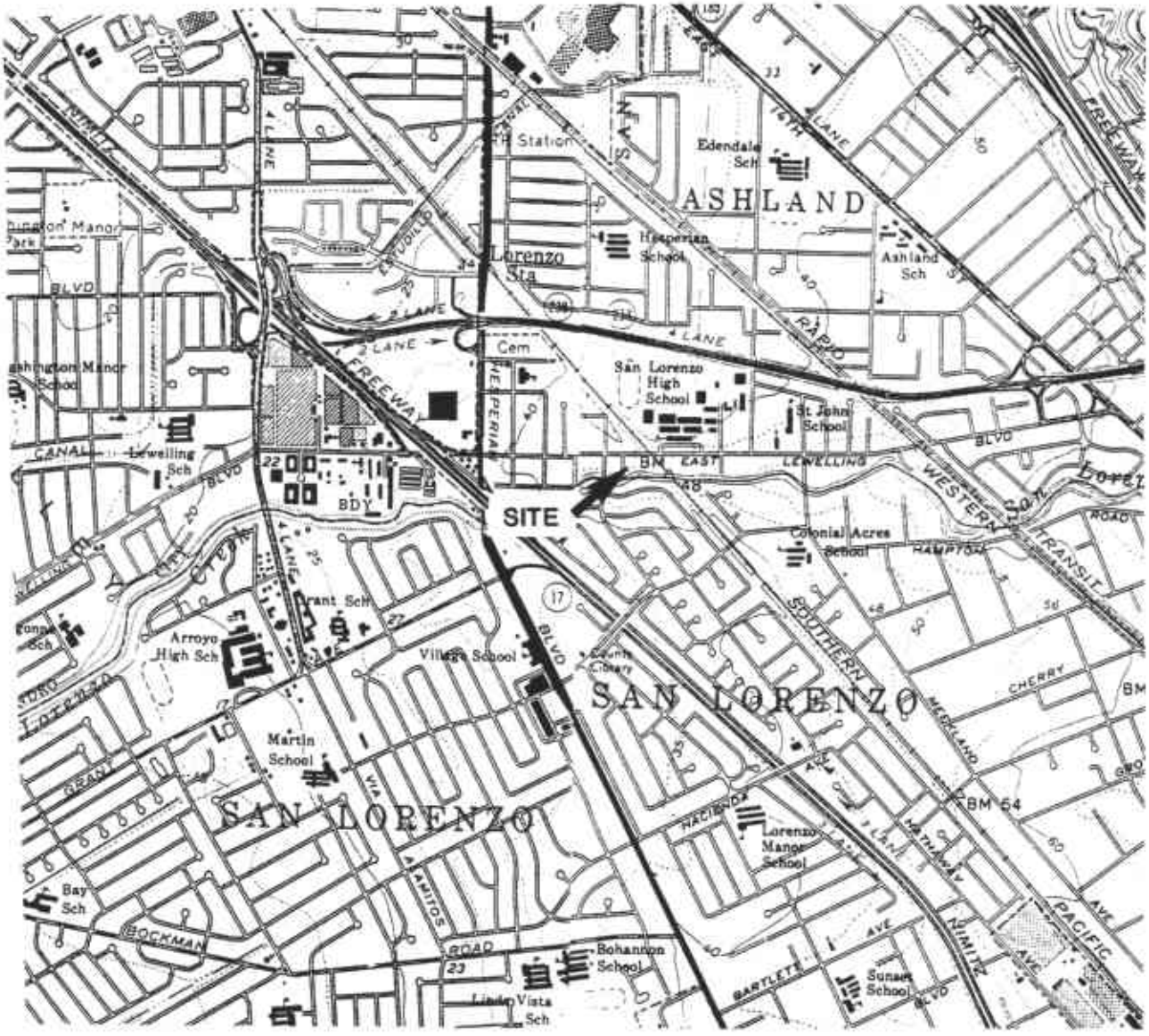
INTRODUCTION

This report presents the results of our subsurface exploration at the Jet Gas Station (formerly Econo Gas Station) in San Lorenzo, California. The facility, located at 44 Lewelling Boulevard (see the Location Map, Figure 1), is operated by Conoco, Inc. as a service station for unleaded, super-unleaded, and regular-leaded gasoline. The subsurface exploration was performed in two phases between December 1, 1988 and September 15, 1989 and was coordinated with Ms. Joyce Miley and Mr. Michael Hansen of Conoco Inc. (Houston).

The purpose of this study is to ascertain the possible presence and extent of hydrocarbon contamination in the native soils and ground water in the vicinity of the subject property. We understand that this study was performed in response to a request by the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB, letter dated July 6, 1988) for further definition of the extent of soil and ground-water contamination at the above-referenced site.

SCOPE OF SERVICE

Our scope of service included a site visit, review of pertinent geologic and hydrogeologic literature and maps, review of previous consultant reports made available to us, subsurface exploration, laboratory testing, geologic analysis, and the preparation of this report. Selected soil and ground-water samples collected from the exploratory boring and monitoring wells during our investigation were sent to a state-certified laboratory (Trace Analysis Laboratory, Hayward) for chemical analyses.



2000 0 2000 4000

scale feet

LOCATION MAP

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

BASE: A portion of the U.S.G.S. Hayward 7.5 minute quadrangle, dated 1959, photorevised 1980, scale 1:24,000.

Figure 1

SITE CONDITIONS

The Jet Gas Station is located approximately 200 feet east of the intersection of Lewelling Boulevard and Via Granada in a commercially and residentially zoned area of San Lorenzo. The site is bordered by commercial buildings to the north, and east, a restaurant to the west, and residential dwellings to the south. The Jet Gas site (lot size of approximately 95 x 100 feet) lies on nearly-flat terrain at an elevation of approximately 50 feet above mean sea level.

The Jet Gas Station is situated on a composite of artificial fill (i.e. materials placed by man), and alluvial fan and river terrace deposits associated with San Lorenzo Creek. The majority of the subject property is currently covered with several inches of asphalt or concrete. The condition of the asphalt ranges from relatively good condition to locally cracked and fragmented.

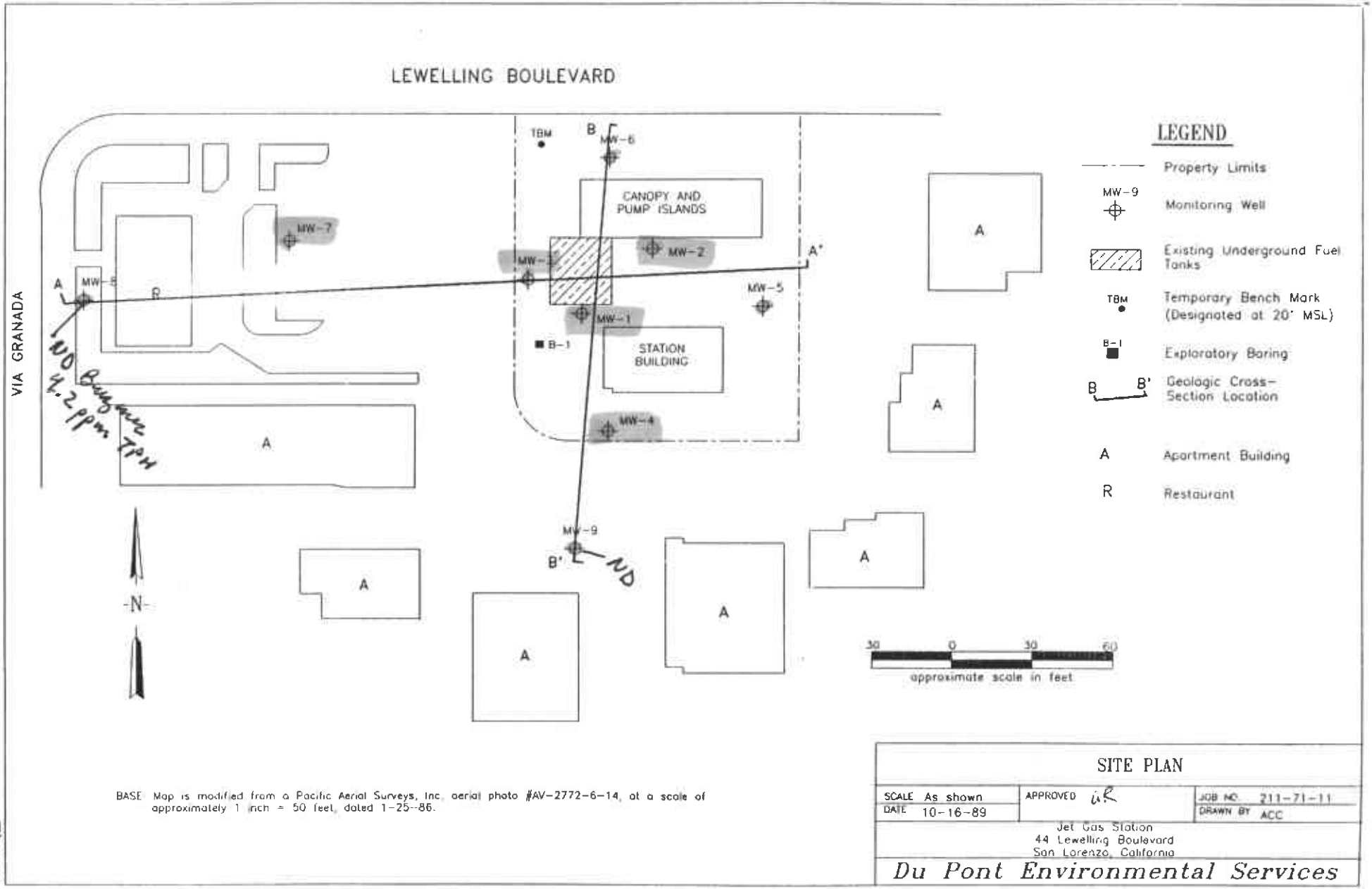
BACKGROUND

The Jet Gas site presently contains three 10,000-gallon underground storage tanks located in the west-central portion of the property (see the Site Plan, **Figure 2**). These tanks are two years old and contain unleaded, super-unleaded, and regular-leaded gasoline fuels. The following is a summary of past exploratory events at the site:

1. On April 28, 1987, two 10,000-gallon tanks and one 7,500-gallon tank were excavated and removed during a station upgrade. Subsequent soil sampling by Applied GeoSystems of the native soils beneath the former tanks found total volatile hydrocarbons (TVH) contamination to range from 1.64 ppm to 1136 ppm. One additional sample was collected from below the highest contaminated sample at the saturated zone (approximately 17 feet). This sample had a TVH value of 6.98 ppm. A summary of the Applied GeoSystems analytical results appear in Table A.

2. On May 26 and 27, 1987, Applied GeoSystems installed three 2-inch diameter ground-water monitoring wells (MW-1 through MW-3) in the vicinity of the underground fuel tanks. The three wells were advanced to a depth of 35 feet with ground water occurring at approximately 15 feet below the ground surface. Four soil samples collected during the drilling were submitted for chemical analyses and analyzed for total volatile hydrocarbons (TVH). Results ranged from 0.62 ppm in monitoring well MW-2 at 20 feet to 904 ppm in monitoring well MW-1 at 20 feet. These analytical results are included in Table A.

3. On December 1 and 2, 1988, Du Pont Biosystems (now Du Pont Environmental Services) installed four additional monitoring wells (MW-4 through MW-7). Three of the wells were located on site and the fourth was located off-site, down-gradient of the underground tanks. In addition, two more monitoring wells were installed off-site as part of the second phase on September 15, 1989. These



BASE Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25--86.

SITE PLAN

SCALE As shown	APPROVED ir	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 2

TABLE A

SUMMARY OF SOIL ANALYTICAL RESULTS FROM APPLIED GEOSYSTEMS (1987)

JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

SAMPLE I.D.	DATE SAMPLED	DEPTH (feet)	BENZENE (mg/kg)	ETHYL-BENZENE (mg/kg)	TOLUENE (mg/kg)	XYLENES (mg/kg)	TVH (mg/kg)	COMMENTS
S-1	28-APR-87	14.0	12.0	14.0	2.0	63.0	329.0	TANK PIT SAMPLE
S-2	28-APR-87	14.0	22.0	26.0	136.0	179.0	663.0	TANK PIT SAMPLE
S-3	28-APR-87	14.0	52.0	43.0	158.0	288.0	1136.0	TANK PIT SAMPLE
S-4	28-APR-87	14.0	16.0	19.0	8.0	116.0	510.0	TANK PIT SAMPLE
S-5	28-APR-87	14.0	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.05)	1.64	TANK PIT SAMPLE
S-6	28-APR-87	14.0	0.41	0.21	0.08	0.31	4.22	TANK PIT SAMPLE
S-17-NW	30-APR-87	17.0	1.37	0.40	1.06	1.18	6.98	TANK PIT SAMPLE
S-20-B1	26-MAY-87	20.0	NA	NA	NA	NA	904.0	MONITORING WELL MW-1
S-20-B2	26-MAY-87	20.0	NA	NA	NA	NA	0.62	MONITORING WELL MW-2
S-15-B3	27-MAY-87	15.0	NA	NA	NA	NA	101.39	MONITORING WELL MW-3
S-20-B3	27-MAY-87	20.0	NA	NA	NA	NA	9.40	MONITORING WELL MW-3

NOTES:
1) All results are presented in parts per million.
2) TVH = Total Volatile Hydrocarbons.
3) ND = Not detected; detection limits are shown in parentheses.
4) NA = Not analyzed.

wells were installed after obtaining permission from the current land owners. These most recent subsurface explorations are discussed in detail later in the text. Table B presents a summary of all well construction details.

4. Currently, the site is undergoing routine quarterly sampling and Table C summarizes all ground-water analytical results to date at the subject site.

REGIONAL GEOLOGIC AND HYDROGEOLOGIC SETTING

The Jet Gas Station site lies west of the Diablo Range on the eastern edge of the San Francisco Bay structural depression. An aerial geology map from the Department of Water Resources Bulletin (DWR) No. 13 (March 1963) shows that the site is immediately underlain by Late Pleistocene-age alluvium (see the Regional Geologic Map, Figure 3). The Quaternary Alluvium is interpreted as alluvial fan and river terrace deposits associated with San Lorenzo Creek. The DWR Bulletin indicates that the alluvium is approximately 500± feet thick. These Quaternary deposits are underlain by Cretaceous-age deposits that consist of marine sandstones, siltstones, shales and conglomerates. These deposits in turn are underlain by the Jurassic-age Knoxville Formation and Franciscan Complex, which are characterized as marine sandstones, shales, cherts, minor conglomerates, limestone lentils and related basalts, serpentines, and schists.

The Jet Gas Station is located in the northwestern portion of the Alameda County Ground Water Basin (OWR Bulletin 13, 1963). The Alameda County Ground Water Basin is traversed by the Alameda Creek system. This system and other minor tributaries flow into Arroyo de la Laguna which in turn discharges into Alameda Creek. The Sunol Valley unit contributes drainage from Calaveras and San Antonio Creeks, which flow into Alameda Creek upstream of its confluence with Arroyo de la Laguna. Alameda Creek then flows west across the southern Alameda Unit, through Niles Canyon, to discharge into the San Francisco Bay. San Lorenzo Creek is the principal stream draining the northern portion of the southern Alameda Unit. The nearest major source of ground-water recharge to the project site is San Lorenzo Creek which is located about 200 feet south of the site.

BENEFICIAL USES OF GROUND AND SURFACE WATER

We contacted the State Department of Water Resources regarding production wells (domestic, municipal and irrigation wells) located in the adjacent area and reviewed well data presented by other consultants. A Well Location Map is presented in **Figure 4** and **Table D** presents a Regional Well Inventory. The closest known potable domestic well to the site is located approximately 750 feet to the north (located cross-gradient). The closest irrigation well to the site is located approximately 700 feet to the north.

TABLE B

SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS

JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

MONITORING WELL	DATE INSTALLED	INSTALLED BY	TOTAL DEPTH (feet)	CASING DIAMETER (inches)	SLOTTED INTERVAL (feet)	SLOT SIZE (inches)	SAND PACK INTERVAL (feet)	BENTONITE INTERVAL (feet)	GROUT INTERVAL (feet)
MW-1	26-APR-87	AGS	35.0	2.0	35-10	0.02	35-8	8-6	6-0
MW-2	26-APR-87	AGS	35.0	2.0	35-10	0.02	35-8	8-6	6-0
MW-3	26-APR-87	AGS	35.0	2.0	35-10	0.02	35-8	8-6	6-0
MW-4	1-DEC-88	Du Pont	25.0	2.0	25-10	0.02	25-8	8-6	6-0
MW-5	1-DEC-88	Du Pont	30.0	2.0	30-12	0.02	30-10	10-8	8-0
MW-6	1-DEC-88	Du Pont	30.0	2.0	30-12	0.02	30-10	10-8	8-0
MW-7	1-DEC-88	Du Pont	25.5	2.0	25.5-12	0.02	25.5-10	10-8	8-0
MW-8	15-SEP-89	Du Pont	22.0	2.0	22-12	0.02	22-10	10-8	8-0
MW-9	15-SEP-89	Du Pont	24.0	2.0	24-10	0.02	24-8	8-6	6-0

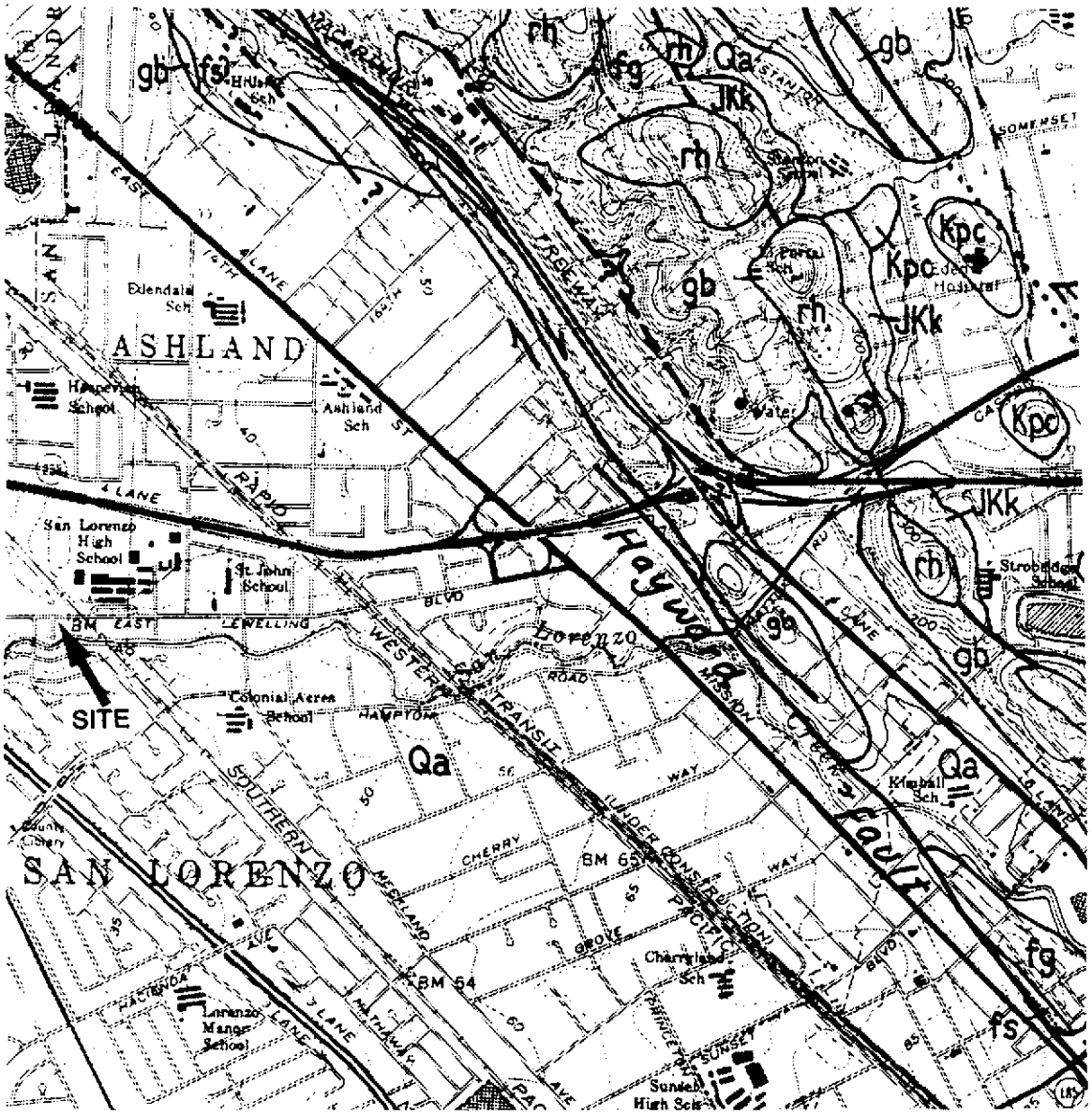
TABLE C

SUMMARY OF GROUND-WATER ANALYTICAL RESULTS

JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

WELL ID	DATE SAMPLED	BENZENE (ug/L)	ETHYLBENZENE (ug/L)	TOLUENE (ug/L)	XYLENES (ug/L)	TPHg (ug/L)	COMMENTS
MW-1	29-MAY-87	490	[illegible]	150	[illegible]	[illegible]	
	14-JUL-87	560	[illegible]	120	[illegible]	14750	
	17-AUG-87	630	[illegible]	40	1130	[illegible]	
	01-SEP-87	558	562	84	[illegible]	[illegible]	
	10-DEC-87	200	273	139	777	[illegible]	
	10-MAR-88	70	340	40	940	7300	
	14-JUN-88	290	330	ND(10)	790	[illegible]	
	05-DEC-88	100	140	16	310	[illegible]	
	08-MAR-89	670	580	20	1200	[illegible]	Odor, Sheen
	22-JUN-89	1000	[illegible]	20	[illegible]	12000	Odor, Sheen
	27-SEP-89	[illegible]	260	9	360	[illegible]	Odor
MW-2	29-MAY-87	[illegible]	46	14	58	[illegible]	
	14-JUL-87	[illegible]	34	25	48	[illegible]	
	17-AUG-87	[illegible]	8.2	10.9	11.1	[illegible]	
	01-SEP-87	[illegible]	16.4	14.2	27.6	[illegible]	
	10-DEC-87	[illegible]	38.1	40.6	100.3	[illegible]	
	10-MAR-88	[illegible]	7.3	3.1	2.6	[illegible]	
	14-JUN-88	ND(0.9)	2.2	ND(1.0)	5.7	[illegible]	
	05-DEC-88	ND(0.3)	5.6	1.3	3.6	[illegible]	
	08-MAR-89	ND(1.0)	3.5	1.3	3.7	[illegible]	
	22-JUN-89	ND(0.4)	ND(0.5)	ND(0.4)	ND(0.8)	[illegible]	
	27-SEP-89	[illegible]	2.9	0.64	54	420	
MW-3	29-MAY-87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	14-JUL-87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	17-AUG-87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	01-SEP-87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	10-DEC-87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	10-MAR-88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	14-JUN-88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	05-DEC-88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Odor
	08-MAR-89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Odor, Sheen
	22-JUN-89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Odor, Sheen
	27-SEP-89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Odor
MW-4	05-DEC-88	ND(2.0)	2.3	ND(2.0)	6.5	[illegible]	
	08-MAR-89	ND(9.0)	ND(10)	ND(8.0)	ND(10)	[illegible]	
	22-JUN-89	ND(0.4)	ND(0.5)	ND(0.4)	ND(0.8)	[illegible]	
	27-SEP-89	[illegible]	ND(1)	ND(1)	ND(4)	[illegible]	
MW-5	05-DEC-88	ND(0.2)	0.23	0.78	0.92	3.9	
	08-MAR-89	[illegible]	2.7	6.7	15	58	
	22-JUN-89	0.91	ND(0.1)	ND(0.1)	ND(0.3)	5.0	
	27-SEP-89	[illegible]	ND(0.1)	ND(0.1)	ND(0.4)	5.3	
MW-6	05-DEC-88	[illegible]	0.63	1.3	1.3	190	
	08-MAR-89	[illegible]	ND(0.5)	ND(0.4)	1.1	23	
	22-JUN-89	0 82	0.18	2.6	1.2	57	
	27-SEP-89	0 2	ND(0.1)	0.24	ND(0.4)	2.1	
MW-7	05-DEC-88	140	40	150	370	[illegible]	
	08-MAR-89	730	180	72	370	2400	
	22-JUN-89	570	180	43	220	2000	
	27-SEP-89	[illegible]	140	5.9	28	1400	
MW-8	27-SEP-89	ND(1)	16	ND(1)	ND(1)	[illegible]	
MW-9	27-SEP-89	ND(0.1)	ND(0.1)	ND(0.1)	ND(0.4)	25	

NOTES: 1) TPHg = Total Petroleum Hydrocarbons (as gasoline).
2) ND = Not Detected, detection limit shown in parentheses.
3) Odor refers to petroleum hydrocarbon odor.
4) All results are presented in parts per billion.
5) Samples prior to December 1988 taken by Applied GeoSystems.



2000 0 2000 4000

scale feet

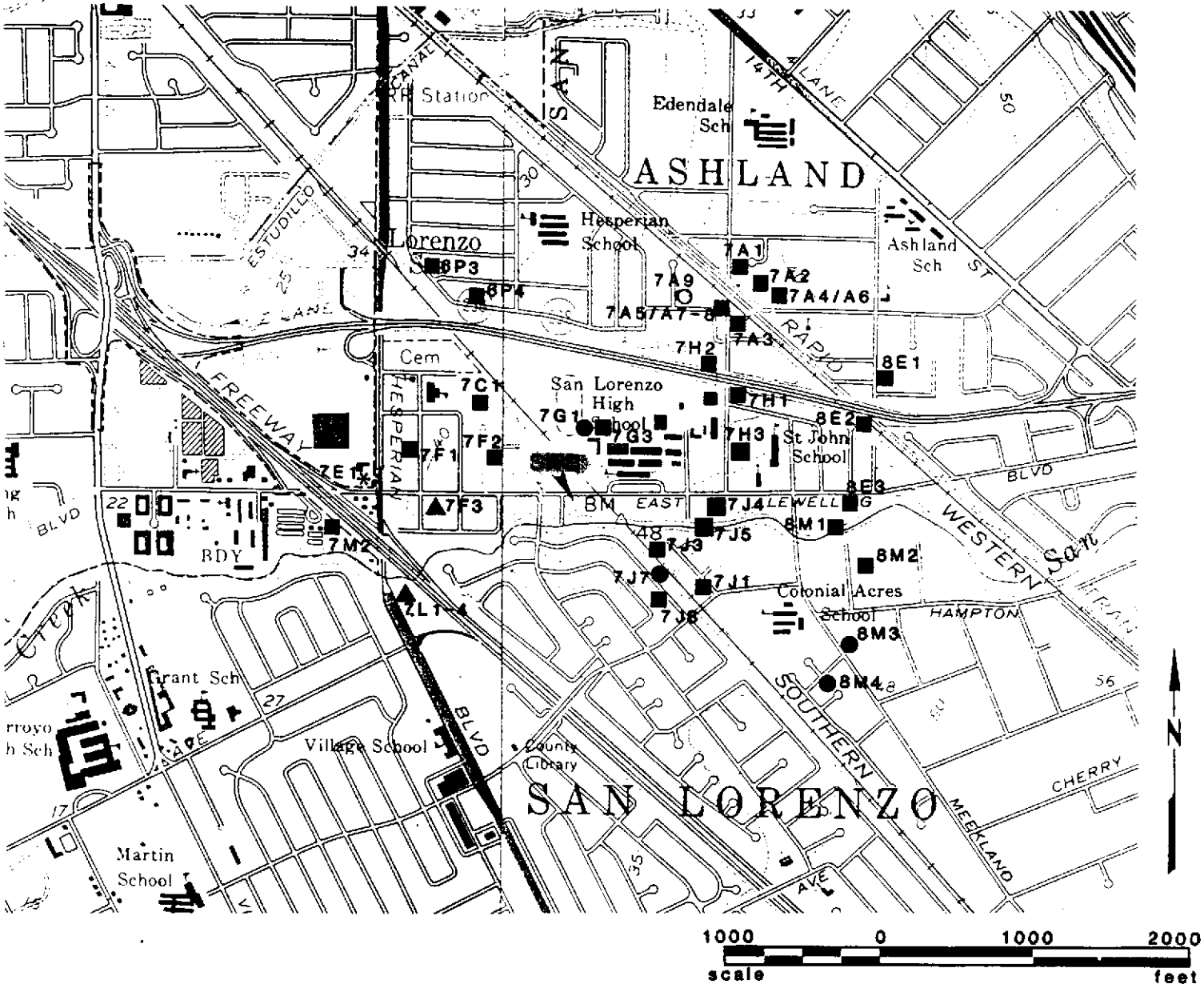
REGIONAL GEOLOGIC MAP

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Qa	Quaternary alluvium
rh	Rhyolite (Pliocene ?)
Kps	Panoche Formation - Arkosic-sandstone member, some shale interbeds and concretions (Upper Cretaceous)
Kpc	Panoche Formation - Conglomerate member (Upper Cretaceous)
JKk	Knoxville Formation - Dark micaceous shale (Jurassic-Lower Cretaceous)
gb	partially serpentinized gabbro-diabase (Jurassic ?)

BASE: A portion of U.S.G.S. map entitled Preliminary Geologic Map of the Hayward Quadrangle, Alameda and Contra Costa Counties, California, Open File Report 80-540, by Thomas W. Dibblee Jr., dated 1980, scale 1:24,000.

Figure 3



WELL LOCATION MAP

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

- ▲ Monitoring Wells
- ● Domestic Wells
- ■ Irrigation Wells
- ✳ Cathodic Protection Wells
- ○ Destroyed Wells

Wells were located using the Alameda County Well Inventory Report and a USGS Hayward 7.5 minute quadrangle base map.

BASE: Portions of the USGS Hayward and San Leandro Quadrangle, 7.5 minute topographic maps, dated 1959, photorevised in 1980. Scale is 1:24,000.

Figure 4

TABLE D

REGIONAL WELL INVENTORY

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Well Number	Distance From Site (miles)	Well Usage	Well Depth (feet)	Year Drilled/ Destroyed
7A1	0.36	Irrigation	120	1948
7A2	0.36	Irrigation	40	1938
7A3	0.30	Irrigation	42	Unknown
7A4	0.36	Irrigation	125	Unknown
7A5	0.30	Domestic	50	1909
7A6	0.36	Irrigation	49	1949
7A7	0.30	Domestic	60	Unknown
7A8	0.30	Domestic	68	1918
7A9	0.29	Destroyed	NA	1988
7C1	0.17	Irrigation	270	1935
7E1	0.27	Cathodic Projection	50	1977
7F1	0.21	Irrigation	25	Unknown
7F2	0.11	Irrigation	27	1955
7F3	0.17	Monitoring	30	1988
7G1	0.09	Irrigation	75	1937
7G3	0.10	Monitoring	616	1951
7H1	0.25	Irrigation	72	1941
7H2	0.25	Irrigation	75	1929
7H3	0.22	Irrigation	65	1988
7J1	0.26	Irrigation	130	1938
7J3	0.11	Irrigation	110	1920
7J4	0.17	Irrigation	65	1946
7J5	0.17	Irrigation	80	1947
7J7	0.13	Irrigation	30	1977
7J8	0.15	Irrigation	37	1977
7L1	0.24	Monitoring	25	1986
7L2	0.24	Monitoring	25	1986
7L3	0.24	Monitoring	25	1986
7L4	0.24	Monitoring	25	1986
7M2	0.30	Irrigation	150	1920
8E1	0.42	Irrigation	90	1918
8E2	0.34	Irrigation	104	Unknown
8E3	0.34	Irrigation	60	1980
8M1	0.32	Irrigation	70	1941
8M2	0.37	Irrigation	58	Unknown
8M3	0.38	Domestic	85	1968
8M4	0.38	Domestic	40	1956

Notes: *1) Screened intervals and depths to seals were not available.*

2) NA = Not available.

Source: Alameda County Well Inventory Report

FIELD EXPLORATION

The Jet Gas Station ground-water monitoring system was installed and completed as proposed in our Workplan (dated August 30, 1988) and letter to Alameda County (dated February 14, 1989). Well locations for the ground-water monitoring system were based on providing additional information for determination of the "practical zero-line" level of contamination. The screened intervals of the wells were situated to accommodate expected seasonal variations in ground-water elevation. A total of nine functional monitoring wells were installed as part of the investigation in the immediate vicinity of the Jet Gas Station as shown on the Site Plan, Figure 2. As requested by the RWQCB, soil samples were collected from all monitoring well boreholes and the one exploratory boring. All monitoring wells installed by Du Pont Environmental Services were located farther from the tanks than the three previously existing wells and were designed for delineation of the lateral limits for both soil and ground-water contamination. Exploratory boring B-1 was drilled near the underground fuel tanks to provide additional information on stratigraphy, aquifer thickness and to determine the vertical extent of hydrocarbon contamination in the soils underlying the site.

Borehole Advancement and Soil Sampling

The exploratory boring and ground-water monitoring wells were drilled during two separate phases of our subsurface exploration of the site. Exploratory boring B-1 and monitoring wells MW-4 through MW-7 were drilled December 1st and 2nd, 1988 using a Mobile B-61 truck-mounted drill rig which is owned and operated by Aqua Science Engineers. Review of the chemical analytical results from the soil and water samples collected during this phase of drilling necessitated the installation of two additional monitoring wells to more clearly delineate the lateral limits of ground-water contamination. Monitoring wells MW-8 and MW-9 were drilled on September 15, 1989 using Exploration Geoservices' (Redwood City) truck-mounted Mobile B-47 drill rig.

The boreholes were drilled using 8-inch O.D. hollow-stem augers. All bits, drill rods, and augers were steam-cleaned before use and between borings. The exploratory boring was backfilled with cement grout containing 5 percent bentonite. Soil samples were collected from the borings using a 2¼-inch I.D. split barrel sampler, containing three 2½-inch X 6-inch brass tube liners, and a standard penetration sampler. The sampler was driven into the undisturbed soil beyond the tip of the auger using a 140-pound safety hammer with a 30-inch drop. The sampling interval ranged from continuous to 5 feet. The boreholes were logged and all soil samples were visually classified (ASTM D-2487-85). The boring logs and well logs are attached in Appendix A.

To avoid cross-contamination of the samples, the samplers and brass tube liners were thoroughly washed with a trisodium phosphate solution and then carefully rinsed before each sampling event took place. Soil samples were retained in the brass liners, labeled, covered with aluminum foil, capped with polyethylene lids, sealed with adhesive tape, and placed on ice. Selected samples were delivered to the State of California certified Trace Analysis Laboratory (Hayward) for chemical analyses. Routine chain-of-custody procedures were employed.

Monitoring Well Installation

The six monitoring wells installed at the Jet Gas Station site by Du Pont Environmental Services are similar in detail of construction (see Well Logs presented in Appendix A). The monitoring wells (MW-4 through MW-9) were constructed using 2-inch diameter PVC well screen and casing. The boreholes for each well were sampled and advanced as discussed in the previous section. Information regarding all monitoring wells installed at the Jet Gas Station site is presented in Table B, Summary of Monitoring Well Construction.

The proper lengths of screened and solid PVC well casing were steam-cleaned and then threaded together above ground and lowered inside the hollow-stem augers. The length of the slotted portion was designed to intersect the water table and account for seasonal variations; no glue was used in this assembly. The well screen consists of schedule 40 PVC with four 0.01 and 0.02-inch-wide horizontal slots per inch. The annular space between the PVC casing and the borehole was then backfilled to approximately two feet above the screened interval with Lone Star #2/16 or 2/12 Monterey filter sand (the sand size depended on which screen size was used.) The sand was slowly poured down the hollow-stem augers while the augers were gradually withdrawn. This method minimized the possibility of bridging and helped assure that the filter sand would surround the well casing before the native material could collapse into the borehole.

After the screened portion of the well casing was backfilled with filter sand, the hole was sealed from possible surface water contamination with a 2-foot thick bentonite plug. The hole was then backfilled with sand/cement grout to within a few inches of the surface. The monitoring wells were finished with watertight, traffic boxes or locking steel stove pipe and all contained locking watertight well caps. The traffic boxes were installed slightly above the existing ground surface to help divert surface water away from the well.

Well Development and Water Sampling

The monitoring wells were developed using a 1.7-inch O.D. stainless steel bailer to surge the water around the screened interval and remove fine particles from the vicinity of the screened casing. Water was purged from the wells until the water was relatively free of turbidity. All well development equipment was steam-cleaned between wells. The water generated during well development was placed in labeled 55-gallon drums and stored on-site until analytical test results were available.

Prior to purging, each well was sampled with a clear teflon bailer in order to observe the possible presence of floating hydrocarbons. The wells were purged using a 1.7-inch O.D. stainless steel bailer until pH and conductivity measurements stabilized. This typically resulted in the removal of 3 to 5 well volumes of water. Before each sampling the bailer was washed with methanol, and then a trisodium phosphate solution, and finally rinsed with potable water. New bailer line was used for each sampling. Samples recovered from each well were decanted into two appropriately prepared 40-ml volatile organic analysis (VOA) bottles. Care was taken to avoid the presence of a headspace in any of the sample bottles. The sample bottles were immediately placed in an ice chest for delivery to Trace Analysis Laboratory (Hayward). Routine chain-of-custody procedures were employed.

Ground-Water Gradient Determination

The most recent static water level elevations from the monitoring wells were obtained on September 27, 1989 and appear in Table E. Top of casing elevations were surveyed (to the nearest 0.01 foot) for MW-1 through MW-9 by Du Pont Environmental Services. The survey datum used was a temporary bench mark located on the northwest corner of the property. The bench mark was assigned an arbitrary elevation of 50 feet above mean sea level. The depth to water was measured using a Solinist electronic immersion probe.

LABORATORY TESTING

Chemical Analyses of Soil and Water

Chemical laboratory tests were performed on both soil and water samples. As part of the current investigation, soil and ground-water samples were tested for total petroleum hydrocarbons (as gasoline), benzene, toluene, xylenes and ethylbenzene by Trace Analysis Laboratory in Hayward.

RESULTS AND DISCUSSION

Subsurface Soils

The exploratory boring and monitoring well boreholes revealed that the alluvial sediments in the area of the Jet Gas Station are highly interbedded and consist of variable amounts of clay, silt, silty sand, sand and gravel. Silty sand is predominant to depths of approximately 11 to 14 feet. This unit is underlain by a sequence of interbedded clays and silty sands. The aquifer (encountered at a depth of approximately 20-22 feet) consists primarily of poorly graded sands and gravels. For more detail see the Boring Logs and Well Logs in Appendix A.

POTENTIOMETRIC ELEVATIONS

Geologic cross sections made through the site (see Plate 1) show the highly interbedded and interfingered nature of the sediments. In general, it appears that the soils contain more sand and silty sand interbeds to the northwest and thicker interbeds of silt to the southeast. The subsurface soils generally increase in moisture content and consistency with depth.

Ground Water

The most recent static ground-water levels were measured from the monitoring wells at the Jet Gas Station site on September 29, 1989. Elevations of the monitoring wells (i.e. ground surface and top of casing) and potentiometric levels are shown in Table E. Ground water was encountered at a depth of approximately 20-22 feet below the existing grade at the site. Elevations of the potentiometric levels measured on September 27, 1989 range from a high of 1.73 feet in well MW-6 to a low of 0.24 feet in well MW-8. The Ground-Water Gradient

TABLE E

GROUND-WATER POTENTIOMETRIC ELEVATIONS

JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

WELL ID	TOP OF CASING ELEVATION	GROUND-WATER ELEVATION Sep 1989	DEPTH TO GROUND-WATER Dec 1987	Mar 1988	Jun 1988	Dec 1988	Mar 1989	Jun 1989	Sep 1989
MW-1	21.54	1.56	17.54	17.12	18.05	19.48	18.07	18.60	19.98
MW-2	20.91	1.64	16.71	16.43	17.35	18.79	17.31	17.92	19.27
MW-3	20.96	1.49	16.90	16.68	17.59	18.96	17.60	18.11	19.47
MW-4	22.52	1.54	---	---	---	20.47	19.03	19.57	20.98
MW-5	21.66	1.66	---	---	---	19.48	18.00	18.60	20.00
MW-6	20.37	1.73	---	---	---	17.99	16.75	17.30	18.64
MW-7	19.40	1.41	---	---	---	17.61	16.27	16.72	17.99
MW-8	19.13	0.24	---	---	---	---	---	---	18.89
MW-9	22.82	1.44	---	---	---	---	---	---	21.38

NOTES:
1) All elevations surveyed to a temporary bench mark designated 20 feet.
2) Elevations and depths given in feet.
3) Data prior to December 1988 collected by Applied GeoSystems.
4) Monitoring wells MW-4, MW-5, MW-6, and MW-7 installed in December 1988.
5) Monitoring wells MW-8 and MW-9 installed on September 15, 1989.

Map (**Figure 5**) shows potentiometric elevations and contours for the site. The Ground-Water Gradient Map indicates that ground water generally flows towards the southeast with a gradient of 0.002.

Analytical Results-Soils

Soil samples collected during this phase of exploration from exploratory borings B-1 and monitoring wells MW-4 through MW-9 were analyzed for Total Petroleum Hydrocarbons as gasoline (TPHg), Benzene, Ethylbenzene, Toluene, and Xylenes (BETX). TPHg concentrations ranged from not detected to a high of 250 ppm in boring B-1 (16.0 feet). Benzene concentrations ranged from not detected to a high of 0.55 ppm in boring B-1 (at 21.5 feet). **Table F** and Appendix B present the analytical results of all the soil samples submitted for chemical analyses along with detection limits. **Figures 6 and 7** presents an isopleth map of TPHg concentrations in the shallow soils (from 10 feet to ground water).

Analytical Results-Ground Water

Ground-water samples collected from new monitoring wells MW-4 through MW-7 on December 5, 1988 showed TPHg concentrations to range from 3.9 ppb in monitoring well MW-5 to 4,500 ppb in monitoring well MW-4. Benzene concentrations ranged from not detected (DL <2.0 ppb) in monitoring wells MW-4 and MW-5 to 140 ppb in monitoring well MW-7.

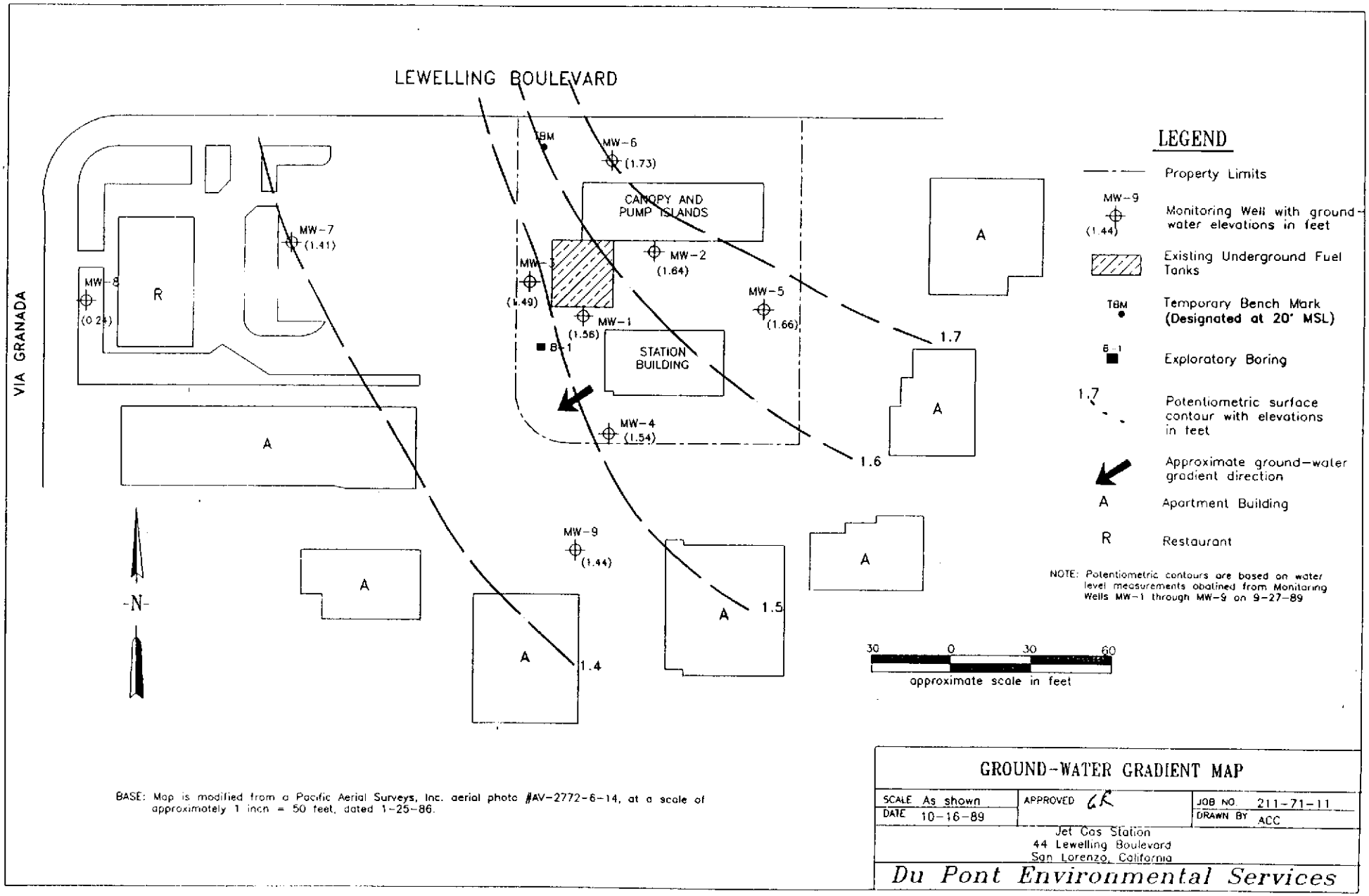
Ground-water samples collected on September 29, 1989 from all monitoring wells showed TPHg concentrations ranging from 2.1 ppb in well MW-6 to 34,000 ppb in monitoring well MW-3. Benzene concentrations ranged from not detected (DL <0.1 ppb) in monitoring well MW-9 to 8,100 ppb in well MW-3. The two new wells MW-8 and MW-9 showed TPHg concentrations of 4,200 and 25 ppb respectively and benzene concentrations of <1.0 and <0.1 ppb respectively. **Figures 8 and 9** present isopleths of benzene and TPHg concentrations in the ground water. All laboratory analytical results for ground water are presented in Appendix C and **Table C.**

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. Soils encountered in the subsurface (i.e. within approximately 36 feet of the existing grade) consist primarily of clays and silts to 18 feet; a gravelly silty sand layer is present from 18 to 23 feet below the ground surface and is the shallow water-bearing formation. Sieve results of soil samples from above and below the ground water are presented in Appendix D. Below this unit the soils consist of fat clays with thin silt interbeds.

2. At the time of the most recent ground-water sampling (September 29, 1989) the ground-water flow direction was directed to the west-southwest with a gradient of approximately 0.002.



BASE: Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25-86.

GROUND-WATER GRADIENT MAP

SCALE As shown	APPROVED GR	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 5

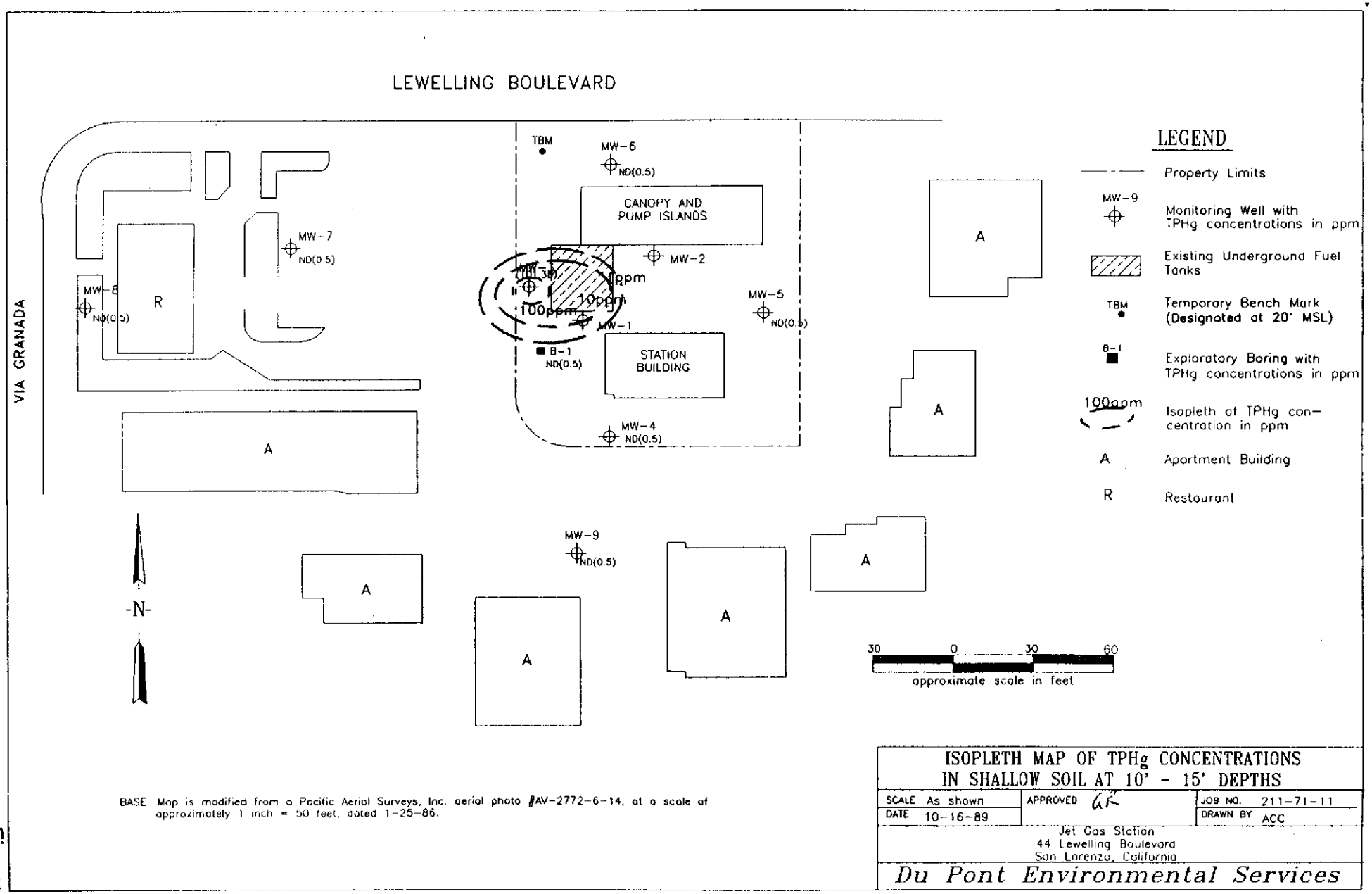
TABLE F

SUMMARY OF ANALYTICAL RESULTS – SOIL

JET GAS STATION
44 LEWELLING BOULEVARD
SAN LORENZO, CALIFORNIA

SAMPLE I.D.	DATE SAMPLED	DEPTH (feet)	BENZENE (mg/kg)	ETHYL-BENZENE (mg/kg)	TOLUENE (mg/kg)	XYLENES (mg/kg)	TPHg (mg/kg)	COMMENTS
B-1	2-DEC-88	11.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
B-1	2-DEC-88	16.0	ND(2.0)	7.8	ND(3.0)	39.0	250.0	No Odor
B-1	2-DEC-88	21.5	0.55	0.25	0.1	0.9	7.1	Slight Odor
B-1	2-DEC-88	33.0	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-4	1-DEC-88	11.5	ND(0.09)	ND(0.2)	ND(0.2)	ND(0.7)	ND(0.5)	No Odor
MW-4	1-DEC-88	21.0	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-4	1-DEC-88	26.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	0.64	No Odor
MW-5	1-DEC-88	11.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-5	1-DEC-88	21.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-5	1-DEC-88	26.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-6	1-DEC-88	11.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-6	1-DEC-88	21.0	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	5.5	No Odor
MW-6	1-DEC-88	26.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-7	2-DEC-88	11.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-7	2-DEC-88	21.5	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-7	2-DEC-88	26.0	ND(0.09)	ND(0.2)	ND(0.1)	ND(0.7)	ND(0.5)	No Odor
MW-8C	5-SEP-8	15.0	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.06)	ND(0.5)	No Odor
MW-8D	5-SEP-8	20.0	ND(0.01)	0.16	0.84	ND(0.06)	43.0	Slight Odor
MW-9C	5-SEP-8	15.0	ND(0.01)	ND(0.02)	ND(0.04)	ND(0.06)	ND(0.5)	No Odor
MW-9E	5-SEP-8	19.0	ND(0.01)	ND(0.02)	ND(0.01)	ND(0.06)	ND(0.5)	No Odor

Notes:
1) All results are presented in parts per million.
2) TPHg = Total petroleum hydrocarbon as gasoline.
3) ND = Not detected; detection limits are in parentheses.
4) Odor refers to petroleum hydrocarbon odor.



BASE. Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25-86.

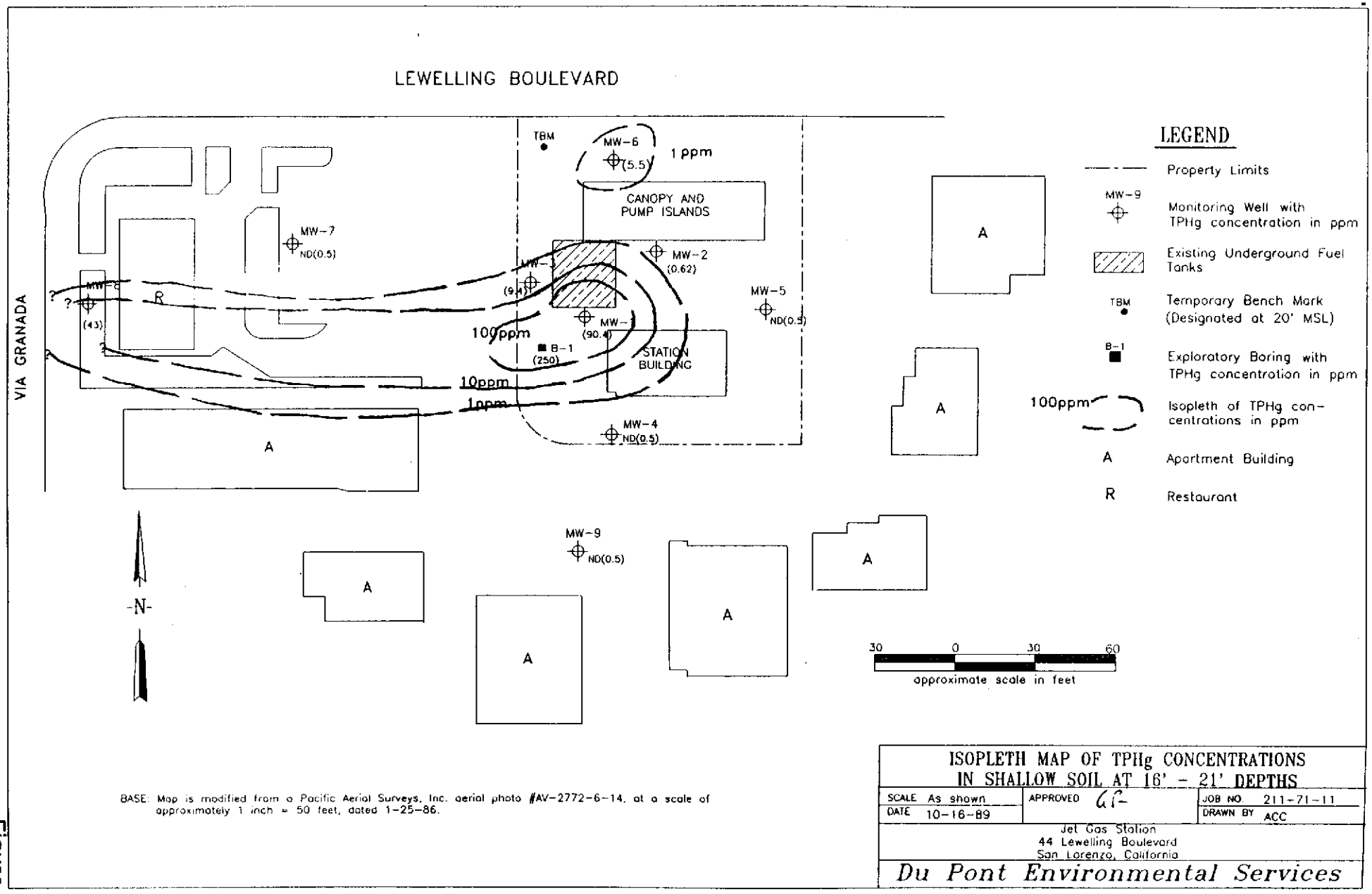
ISOPLETH MAP OF TPHg CONCENTRATIONS IN SHALLOW SOIL AT 10' - 15' DEPTHS

SCALE As shown	APPROVED GR	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 6



BASE: Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25-86.

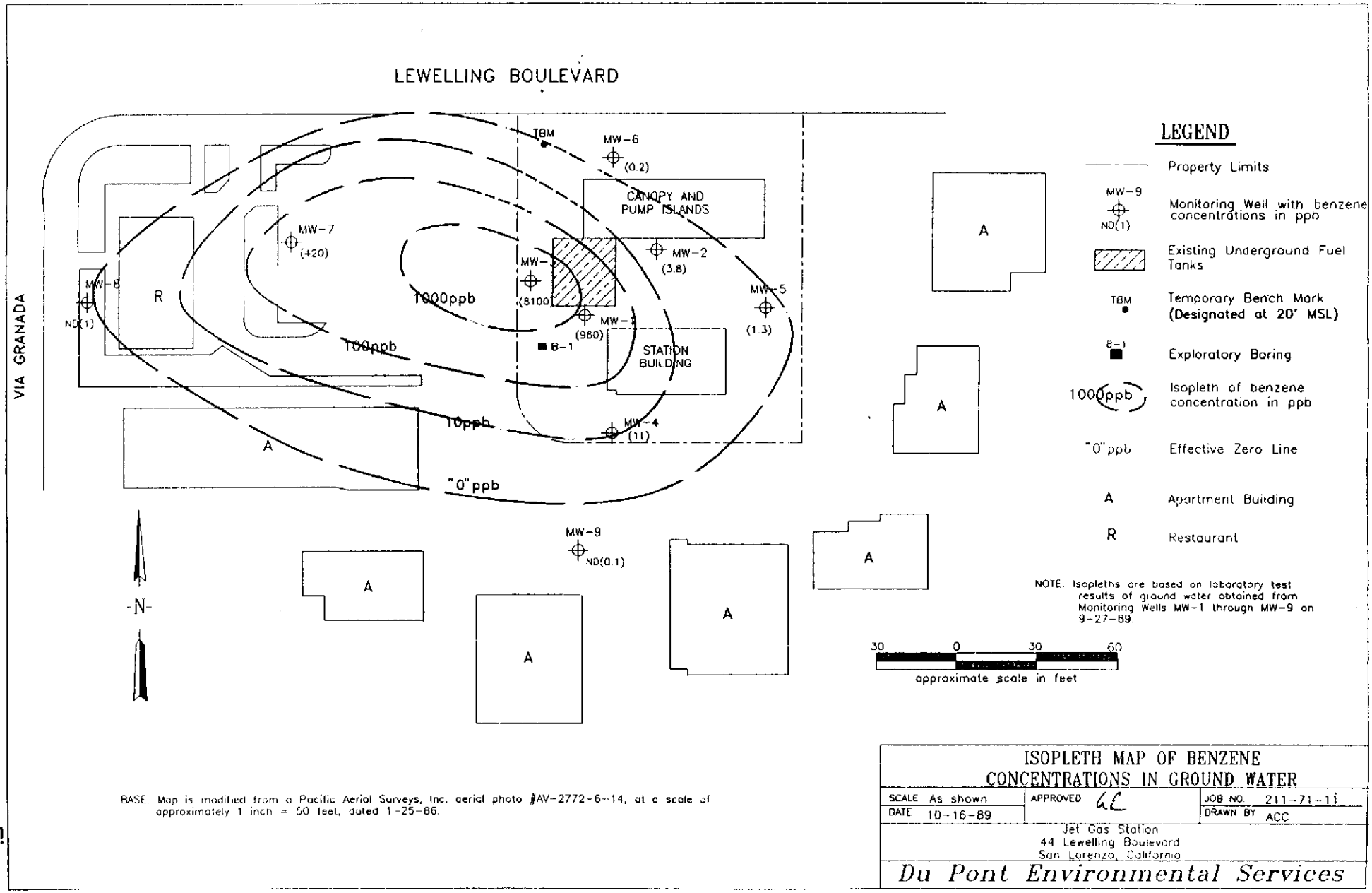
ISOPLETH MAP OF TPHg CONCENTRATIONS IN SHALLOW SOIL AT 16' - 21' DEPTHS

SCALE As shown	APPROVED GF	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 7



BASE. Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25-86.

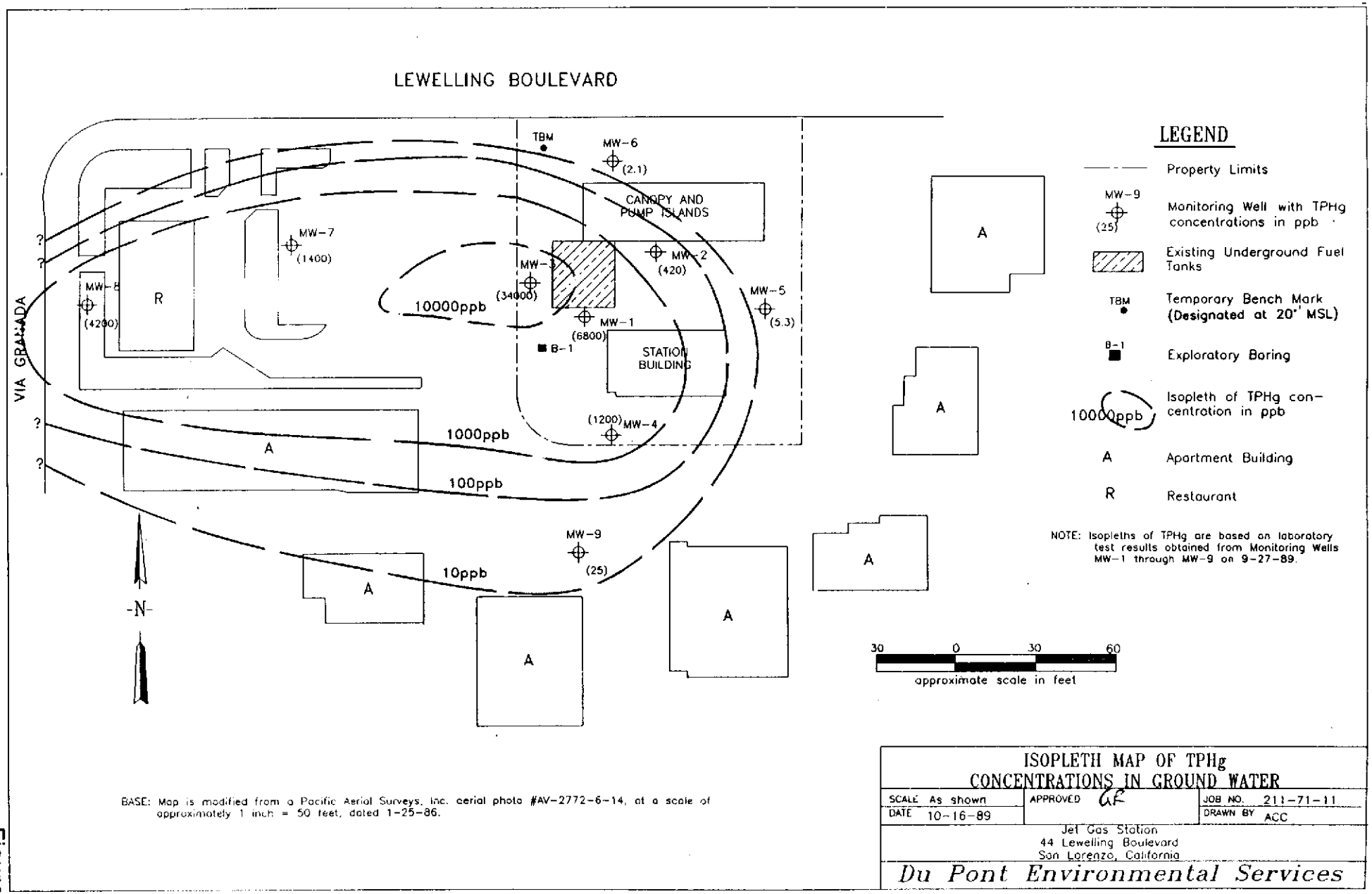
ISOPLETH MAP OF BENZENE CONCENTRATIONS IN GROUND WATER

SCALE As shown	APPROVED GC	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 8



BASE: Map is modified from a Pacific Aerial Surveys, Inc. aerial photo #AV-2772-6-14, at a scale of approximately 1 inch = 50 feet, dated 1-25-86.

ISOPLETH MAP OF TPHg CONCENTRATIONS IN GROUND WATER

SCALE As shown	APPROVED GF	JOB NO. 211-71-11
DATE 10-16-89		DRAWN BY ACC

Jet Gas Station
44 Lewelling Boulevard
San Lorenzo, California

Du Pont Environmental Services

Figure 9

3. Gasoline constituents were detected in soil samples from boring B-1 and monitoring wells MW-4, MW-6, and MW-8. The deepest soil contamination noted was at 26.5 feet in well MW-4. The TPHg concentration in MW-4 was found to be 0.64 ppm; no other gasoline constituents were detected.

4. Petroleum hydrocarbons of varying concentrations were detected in ground-water samples in all the monitoring wells both on and off-site. No free-product has been noted at any time during these investigations.

5. TPHg concentrations have been noted in off-site monitoring wells MW-7 (1,400 ppb) and MW-8 (4,200 ppb). Benzene concentrations for these two wells were 420 ppb and not detected (detection limit of 1 ppb).

6. TPHg (gasoline) concentrations ranging from not detected to 250 ppm have been noted in the area of the site limited to the tank area. Lesser concentrations have been noted at other wells just above ground water. This may be due to a fluctuation of the water table during the last few years.

Recommendations:

1. Continue with quarterly monitoring of the ground water.

2. Since the benzene plume has been defined by the two additional wells (MW-8 and MW-9) we feel no other exploration is necessary to characterize the plume.

3. Develop a remedial action plan that would include a ground-water recovery system as well as a ground-water treatment system.

LIMITATIONS

Our study for Jet Gas Station site is based on a surface reconnaissance, review of pertinent geologic and hydrogeologic references, review of available previous consultant reports, subsurface exploration (exploratory borings and monitoring wells), laboratory analyses of soil and ground-water samples, and subsurface geologic correlations and analyses. The chemical analytical results for soil and ground-water samples are considered only applicable to that boring or monitoring well from which they were collected. The soils encountered in the borings and monitoring wells are believed to be representative of the site; however, the soils may vary in character between observation points. The conclusions contained herein are based on the analytical results and professional judgement which is in accordance with current standards of professional practice; no other warranty is expressed or implied. Du Pont Environmental Services assumes no liability for exploratory borings, the construction of monitoring wells, and report data by other consultants or contractors.

Respectfully submitted,

DU PONT ENVIRONMENTAL SERVICES

Mark Vetter
Project Geologist

George Reid
CEG 1068

APPENDIX A

BORING AND
WELL LOGS

BORING LOG B-1

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

DATE DRILLED: 12-2-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2' SPLIT SPOON ‖ 5 FOOT CONTINUOUS

* Laboratory Analysis: S - Soil Properties, C - Chemical Analysis

DEPTH FEET	BLOWS/ FOOT	LAB * ANALYSIS	USCS SYSTEM	DESCRIPTION
				Asphalt
2			SM	SILTY SAND - Light brown, dry, loose, (Fill).
				SILTY SAND - Dark brown, moist, medium dense, (Fill).
4				SILTY SAND - Light brown, moist, medium dense, no hydrocarbon odor.
	12		SM	
6			SP-SM	SAND with silt - Light brown, moist, medium dense, no hydrocarbon odor.
8	13			
10				SILTY SAND - Grayish-black, moist, medium stiff, slight hydrocarbon odor.
	8	C		
12	7		SM	
14				
	10			As above.
16		C		SANDY SILT - Mixed brown & tan, moist, medium stiff, moderate hydrocarbon odor.
18	5		ML	
20				SILTY SAND - Grayish-olive, wet, loose, no hydrocarbon odor.
	7	C	SM	
22			CH	FAT CLAY - Dark grey, wet, very stiff, slight hydrocarbon odor.
	21			
24			SM	SILTY SAND - Mixed gray & tan, wet, dense, no hydrocarbon odor.
26	21			

Du Pont Environmental Services

Logged by: _____ Approved by: _____

BORING LOG B-1

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

DATE DRILLED: 12-2-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2" SPLIT SPOON ‖ 5 FOOT CONTINUOUS █

* Laboratory Analysis: S - Soil Properties, C - Chemical Analysis

DEPTH FEET	BLOWS/ FOOT	LAB * ANALYSIS	USCS SYSTEM	DESCRIPTION
	36		SM	SILTY SAND - Mixed gray & tan, wet, no hydrocarbon odor.
30	17			
	7		CL	LEAN CLAY - Tan, wet, medium stiff, no hydrocarbon odor.
32			SM	SILTY SAND - Tan, saturated, loose, no hydrocarbon odor.
				POORLY GRADED SAND with silt - Tan, saturated, very stiff, no hydrocarbon odor.
	23	C	SP-SM	POORLY GRADED SAND - Mixed gray & tan, saturated, medium dense, no hydrocarbon odor.
34			SP	SILTY SAND - Tan, saturated, medium dense, no hydrocarbon odor.
			SM	
36	27			
38				Boring terminated at 37 feet. Ground water encountered at approximately 21.5 feet.
40				
42				
44				
46				
48				
50				
52				
54				

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WELL LOG MW-4

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

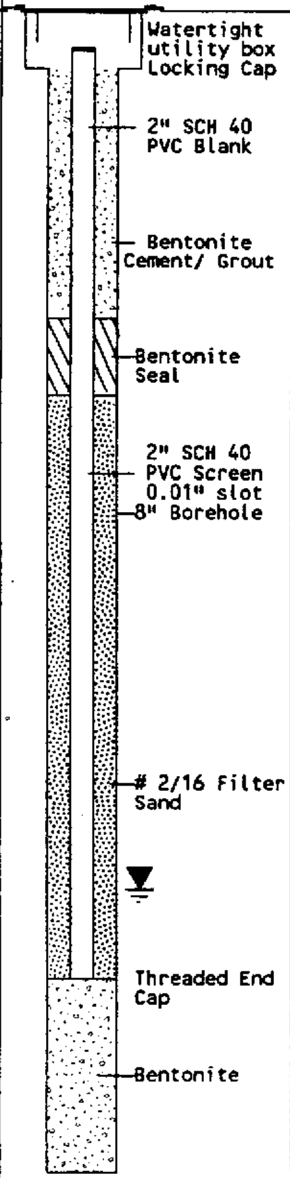
DATE DRILLED: 12-1-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2" SPLIT SPOON
5' CONTINUOUS

DRIVE WEIGHT - LB: 140

HEIGHT OF FALL-IN: 30

* Laboratory Analysis: S-Soil Properties C-Chemical Properties



Depth feet	Lab * Analysis	Blows Per Foot	USCS Symbol	Description
0–1				Asphalt
1–3			CL	SILTY CALY - Mottled brown and tan, moist, medium stiff, (Fill).
3–11		9, 6	SM	SILTY SAND - Light brown, moist, loose, no hydrocarbon odor. SILTY SAND - Tan, moist, loose, no hydrocarbon odor.
11–13	C	7, 5	CL-ML	SANDY SILTY CLAY - Light brown, moist, medium stiff, no hydrocarbon odor.
13–15		8	CL	SILTY CLAY - Light brown, moist, medium stiff, no hydrocarbon odor.
15–17			SM	SILTY SAND - Tan, moist, medium stiff, no hydrocarbon odor.
17–19		6	CL-ML	SANDY SILTY CLAY - Mixed light brown and tan, moist, medium stiff, water lense encountered at 17.5'.
19–22		18	SM	SILTY SAND - Tan, wet, medium dense, no hydrocarbon odor.
22–24	C	29	GP	POORLY GRADED GRAVEL with sand - Grayish tan, saturated, medium dense, slight hydrocarbon odor.
24–28	C	17	CH	FAT CLAY - Grayish black, moist, medium stiff, no hydrocarbon odor.
28–29.5		9	CL-ML	SILTY CLAY - Grayish-brown, wet, medium stiff, no hydrocarbon odor.
29.5–30		25	CL	SANDY LEAN CLAY - Light tannish-brown, wet, medium stiff, no hydrocarbon odor.
				Boring terminated at 30 feet. Ground water encountered at 22.5'.

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Approved by: [signature]

WELL LOG MW-5

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

DATE DRILLED: 12-1-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2" SPLIT SPOON
5' CONTINUOUS

DRIVE WEIGHT - LB:
140

HEIGHT OF FALL-IN:
30

* Laboratory Analysis: S-Soil Properties C-Chemical Properties

Depth feet	Well Construction	Lab * Analysis	Blows Per Foot	Sample Depth	Sample Type	USCS Symbol	Description
	Watertight utility box Locking Cap						Asphalt
2				2		SM	SILTY SAND - Dark brown, moist, medium dense, (Fill). SILTY SAND - Light brown, moist, loose, no hydrocarbon odor.
4	Bentonite Cement/Grout			4		SM	
6	2" SCH 40 PVC Losing		9	6			
8			12	8			As above, increasing sand content.
10	Bentonite		9	10			
12	8" Borehole	C	6	12			As above, increasing fines content.
14				14			POORLY GRADED GRAVEL with sand - Tan, moist, loose, no hydrocarbon odor.
16	2" SCH 40 PVC Screen 0.01" Slot		6	16		GP	
18			5	18		CL	LEAN CLAY - Light tannish-brown, moist, medium stiff, no hydrocarbon odor.
						SP-SM	POORLY GRADED SAND with silt - Tan, moist, loose, no hydrocarbon odor.
20			11	20		CL-ML	SILTY CLAY - Light tannish-brown, moist, medium stiff, no hydrocarbon odor.
22		C	13	22		SM	SILTY SAND - Tan, saturated, loose, no hydrocarbon odor.
24	#2/16 Filter Sand			24		CH	FAT CLAY - Dark grey, saturated, stiff, no hydrocarbon odor.
26			9	26		CL-ML	SILTY CLAY - Tannish-gray, saturated, medium stiff, no hydrocarbon odor.
28		C	21	28		CL	SANDY LEAN CLAY - Mixed tan & light brown, wet, very stiff, no hydrocarbon odor.
30	Threaded End Cap		19	30			Boring terminated at 30 feet. Ground water encountered at approximately 21.5 feet.

Du Pont Environmental Services

Logged by:

Approved by:

WELL LOG MW-6

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

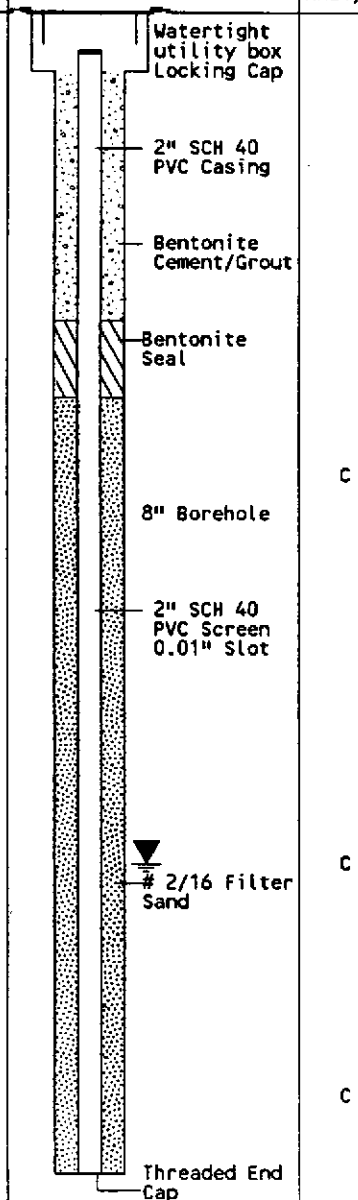
DATE DRILLED: 12-1-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2" SPLIT SPOON
5' CONTINUOUS

DRIVE WEIGHT - LB: 140

HEIGHT OF FALL-IN: 30

* Laboratory Analysis: S-Soil Properties C-Chemical Properties



Depth feet	Lab * Analysis	Blows Per Foot	Sample Depth	USCS Symbol	Description
					Asphalt
2			2	CH	FAT CLAY - Black, moist, medium stiff, (Fill).
4			4	SM	SILTY SAND - Grayish-olive, moist, loose, slight organic hydrocarbon odor.
6		7	6		
8		8	8		
10		11	10		
12	C		12		As above, medium dense, slight organic odor.
14		10	14	CL	LEAN CLAY - Grayish-olive, moist, soft, no hydrocarbon odor.
16		11	16		
18		6	18	SM	SILTY SAND - Grayish-olive, moist, loose, no hydrocarbon odor.
20		14	20	SP-SM	POORLY GRADED SAND with silt - mixed tan and olive, wet, medium dense, no hydrocarbon odor.
22	C	15	22	CH	FAT CLAY - Grayish-black, wet, stiff, no hydrocarbon odor.
24			24	CL	LEAN CLAY - Mixed grayish-black, tan & light brown, wet, stiff, no hydrocarbon odor.
26		55	26	CL-ML	SILTY CLAY with sand - Mixed tan & light brown, wet, hard, no hydrocarbon odor.
28	C	35	28		
30		43	30	CL	SANDY LEAN CLAY - Tan, wet, hard, no hydrocarbon odor.
					Boring terminated at 30 feet. Ground water encountered at 22 feet.

Du Pont Environmental Services

Logged by:

Approved by:

WELL LOG MW-7

JOB NUMBER: 211-71-11
JOB NAME: SAN LORENZO
DRILL RIG: MOBILE B-61

DATE DRILLED: 12-2-88
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE: 2 1/2" SPLIT SPOON 5' CONTINUOUS

DRIVE WEIGHT - LB: 140

HEIGHT OF FALL-IN: 30

* Laboratory Analysis: S-Soil Properties C-Chemical Properties

Depth feet	Well Construction	Lab * Analysis	Blows Per Foot	Sample Depth	Sample Type	USCS Symbol	Description
	Watertight utility box Locking Cap						Asphalt.
2				2		SM	SILTY SAND - Mottled bluish-gray & brown moist, medium dense, (fill).
4	2" SCH 40 PVC Casing			4		SM	SILTY SAND - Light brown, moist, medium dense, no hydrocarbon odor.
6	Bentonite Cement/Grout		18	6			As above, grayish-olive, increasing sand content.
8			10	8			
10	Bentonite Seal		9	10		ML	SANDY SILT - Grayish-olive, moist, stiff, no hydrocarbon odor.
12		C	9	12			As above, slight organic odor.
14	8" Borehole			14		SP-SM	POORLY GRADED SAND with silt - Bluish-olive, moist, medium stiff.
16	2" SCH 40 PVC Casing 0.01" Slot		8	16		CL	LEAN CLAY - Light brown, moist, medium stiff, no hydrocarbon odor. As above, dark brown, moderate hydrocarbon odor @ 18 feet.
18			6	18		SM	SILTY SAND - Dark brown, wet, loose, moderate hydrocarbon odor.
20	#2/16 Filter Sand		23	20			
22		C	15	22		CH	FAT CLAY - Grayish-black, wet, stiff, no hydrocarbon odor.
24				24		CL	SANDY LEAN CLAY - Mixed tan & light brown, wet, stiff, no hydrocarbon odor.
26	Threaded End Cap Bentonite	C	27	26		CH	FAT CLAY - Grayish-black, moist, very stiff, no hydrocarbon odor.
28				28			Boring terminated at 27 feet. Ground water encountered at 21 feet.
30				30			

Du Pont Environmental Services

Logged by:

Approved by:

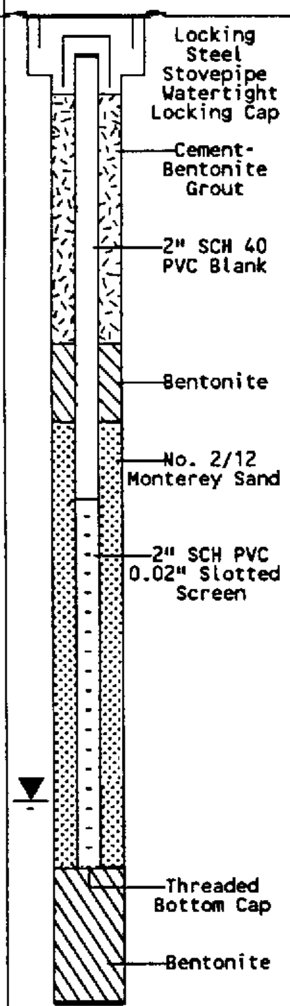
WELL LOG MW-8

JOB NUMBER: 211-71-11
JOB NAME: San Lorenzo
DRILL RIG: B-40

DATE DRILLED: 9/15/89
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:	DRIVE WEIGHT-LB:	HEIGHT OF FALL-IN:
2 1/2" SPLIT SPOON ■	140	30
1" STANDARD PENETROMETER		

* Laboratory Analysis: S-Soil Properties C-Chemical Properties



Depth feet	Lab * Analysis	Blows Per Foot	USCS Symbol	Description
0–2			ML	SILT - Dark brown, moist, slightly sandy, pebbly. No hydrocarbon odor. Fill.
6		15	CH	CLAY with silt and minor sand - Medium brown, moist, stiff, high plasticity; sand is fine-grained. No hydrocarbon odor.
10		20		CLAY - Medium brown, moist, very stiff, high plasticity, silt. No hydrocarbon odor.
14			ML	SANDY SILT - Medium brown, very moist, medium dense. No hydrocarbon odor.
16	C	12	SM	SILTY SAND with clay - Medium brown, orange mottling, moist, medium dense; sand is fine-grained. No hydrocarbon odor.
18		13	ML	SANDY SILT with clay - Dark brown to black, moist; sand is fine to coarse-grained, some pebbles. No hydrocarbon odor.
20	C	35	SP	POORLY GRADED SAND with silt - Grey, saturated, dense; sand is coarse to medium-grained. Degraded hydrocarbon odor.
22		36	CH	FAT CLAY - Medium brown, moist, hard, high plasticity. No hydrocarbon odor.
24		49		As above.
25		27		
26				Boring terminated at 25.5 feet. Free ground water encountered at 20.0 feet.

Du Pont Environmental Services

Logged by:

Approved by:

WELL LOG MW-9

JOB NUMBER: 211-71-11
JOB NAME: San Lorenzo
DRILL RIG: B-40

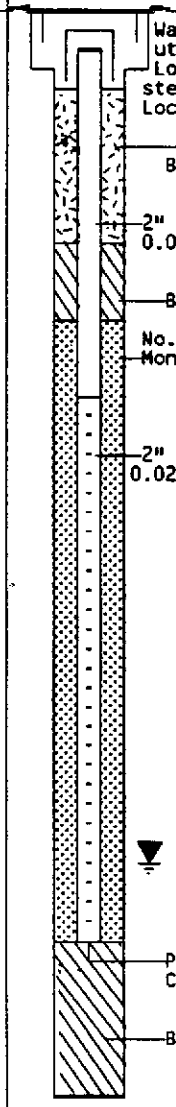
DATE DRILLED: 9/15/89
SURFACE ELEVATION:
DATUM:

SAMPLER TYPE:
2 1/2" SPLIT SPOON
1" STANDARD PENETROMETER

DRIVE WEIGHT-LB: 140

HEIGHT OF FALL-IN: 30

* Laboratory Analysis: S-Soil Properties C-Chemical Properties



Depth feet	Lab * Analysis	Blows Per Foot	Sample Depth	Sample Type	USCS Symbol	Description
0					ML	SILT - Medium brown, moist, broken wood, glass, etc. No hydrocarbon odor. Fill.
2			2			
4			4			
6		10	6		ML	SILT with clay and minor sand - Medium brown, moist, stiff. No hydrocarbon odor.
8			8			
10			10			As above.
		14			SM/ML	SILTY SAND/SANDY SILT - Medium brown, moist, medium dense; sand is fine-grained. No hydrocarbon odor.
12			12			
14			14			
	C	21			ML	SILT with clay and minor sand - Medium brown, orange mottling, moist, very stiff; sand is fine grained. No hydrocarbon odor.
16			16			
18			18			
		17				SILT with sand and clay - Medium brown, very moist, very stiff; sand is fine to coarse-grained. No hydrocarbon odor.
20			20			
	C	22			SC/SM	SILTY CLAYEY SAND with minor gravel - Medium brown, very moist, medium dense; sand is fine to coarse-grained. No hydrocarbon odor.
22			22			
		54			GP	POORLY GRADED GRAVEL - Medium brown, saturated, very dense; gravel is medium to coarse-grained. No hydrocarbon odor.
24			24			
		26			CH	FAT CLAY - Grey to brown, moist, very stiff, high plasticity. No hydrocarbon odor.
26			26			As above - Minor sand.
		29			CL	
28			28			SANDY CLAY - Brown, moist, very stiff, high plasticity. No hydrocarbon odor.
		31				
30			30			Boring terminated at 28.0 feet. Free ground water encountered at 22.0'.

Du Pont Environmental Services

Logged by: _____ Approved by: _____

APPENDIX B

LABORATORY ANALYTICAL REPORTS
AND
CHAIN-OF-CUSTODY FORMS
FOR SOIL

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545 *(415) 783-6960*

TAL

DATE: 12/30/88

LOG NO.: 6773

DATE SAMPLED: 12/1/88 and 12/2/88

DATE RECEIVED: 12/9/88

CUSTOMER: DuPont Biosystems

REQUESTER: Michael Reese

PROJECT: No. 211-71-11, San Lorenzo

		Sample Type: Soil					
		B-1 11.5'		B-1 16.0'		B-1 21.5'	
Method and Constituent	Units	Concentration	Detection Limit	Concentration	Detection Limit	Concentration	Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	< 500	500	250,000	8,000	7,100	500
Modified EPA Method 8020:							
Benzene	ug/kg	< 90	90	< 2,000	2,000	550	90
Toluene	ug/kg	< 100	100	< 3,000	3,000	100	100
Xylenes	ug/kg	< 700	700	39,000	20,000	900	700
Ethyl Benzene	ug/kg	< 200	200	7,800	5,000	250	200

DATE: 12/30/88
LOG NO.: 6773
DATE SAMPLED: 12/1/88 and 12/2/88
DATE RECEIVED: 12/9/88
PAGE: Two

Sample Type: Soil

Method and Constituent	Units	B-1 33.0' Concentration	B-1 33.0' Detection Limit	MW-4 11.5' Concentration	MW-4 11.5' Detection Limit	MW-4 21.0' Concentration	MW-4 21.0' Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	< 500	500	< 500	500	< 500	500
Modified EPA Method 8020:							
Benzene	ug/kg	< 90	90	< 90	90	< 90	90
Toluene	ug/kg	< 100	100	< 200	200	< 100	100
Xylenes	ug/kg	< 700	700	< 700	700	< 700	700
Ethyl Benzene	ug/kg	< 200	200	< 200	200	< 200	200

		MW-4 26.5'		MW-5 11.5'		MW-5 21.5'	
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	640	500	< 500	500	< 500	500
Modified EPA Method 8020:							
Benzene	ug/kg	< 90	90	< 90	90	< 90	90
Toluene	ug/kg	< 100	100	< 100	100	< 100	100
Xylenes	ug/kg	< 700	700	< 700	700	< 700	700
Ethyl Benzene	ug/kg	< 200	200	< 200	200	< 200	200

		MW-5 26.5'		MW-6 11.5'		MW-6 21.0'	
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	< 500	500	< 500	500	5,500	500
Modified EPA Method 8020:							
Benzene	ug/kg	< 90	90	< 90	90	< 90	90
Toluene	ug/kg	< 100	100	< 100	100	< 100	100
Xylenes	ug/kg	< 700	700	< 700	700	< 700	700
Ethyl Benzene	ug/kg	< 200	200	< 200	200	< 200	200

DATE: 12/30/88
LOG NO.: 6773
DATE SAMPLED: 12/1/88 and 12/2/88
DATE RECEIVED: 12/9/88
PAGE: Three

Sample Type: Soil

Method and Constituent	Units	MW-6 26.5' Concentration	MW-6 26.5' Detection Limit	MW-7 11.5' Concentration	MW-7 11.5' Detection Limit	MW-7 21.5' Concentration	MW-7 21.5' Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/kg	< 500	500	< 500	500	< 500	500
Modified EPA Method 8020:							
Benzene	ug/kg	< 90	90	< 90	90	< 90	90
Toluene	ug/kg	< 100	100	< 100	100	< 100	100
Xylenes	ug/kg	< 700	700	< 700	700	< 700	700
Ethyl Benzene	ug/kg	< 200	200	< 200	200	< 200	200

Method and Constituent	Units	MW-7 26.0' Concentration	MW-7 26.0' Detection Limit
DHS Method:			
Total Petroleum Hydrocarbons as Gasoline	ug/kg	< 500	500
Modified EPA Method 8020:			
Benzene	ug/kg	< 90	90
Toluene	ug/kg	< 100	100
Xylenes	ug/kg	< 700	700
Ethyl Benzene	ug/kg	< 200	200

Hugh R. McLean

Hugh R. McLean
Supervisory Chemist

HRM:mln

Alpha Environmental Services, Inc.

310 Main Street, Suite F • Pleasanton, California 94566 • (415) 462-7772

CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD UNIT 10

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Mark Reese

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2"½" Brass Liners	Collected & Sealed	Iced & Transported	Test for TPH & BTXE				REMARKS
													Bill to Kayo
SW-4	12/1	8:55		✓	6 ft.	1	✓	✓					
"	12/1	8:55		✓	6.5 ft	1	✓	✓					
"	12/1	9:05		✓	11 ft	1	✓	✓					
"	12/1	9:15		✓	11.5 ft	1	✓	✓	✓				
"	12/1	9:15		✓	16 ft	1	✓	✓					
"	12/1	9:30		✓	16.5 ft	1	✓	✓					
"	12/1	9:30		✓	21 ft	1	✓	✓	✓				
"	12/1	9:50		✓	21.5 ft	1	✓	✓					
"	12/1	10:00		✓	26 ft	1	✓	✓					
"	12/1	10:00		✓	26.5 ft	1	✓	✓	✓				

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Mark Reese	12/9	10:00	Alexis DRUSH	12/9	10:00
REPRESENTING: DuPont Biosystems			REPRESENTING: TRACE ANALYSIS		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

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CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Michael Reese

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2½" Brass Liners	Collected & Sealed	Iced & Transported					REMARKS
MW5	12/1/08	12:20		✓	6ft	1	✓	✓					Bill to Kayo
"	"	12:20		✓	6.5ft	1	✓	✓					
"	"	12:40		✓	11ft	1	✓	✓					
"	"	12:40		✓	11.5ft	1	✓	✓	✓				
"	"	1:00		✓	16ft	1	✓	✓					
"	"	1:00		✓	16.5ft	1	✓	✓					
"	"	1:20		✓	21ft	1	✓	✓					
"	"	1:20		✓	21.5ft	1	✓	✓	✓				
"	"	1:30		✓	26.5ft	1	✓	✓	✓				
"	"			✓									

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Michael Reese	12/9	10:00	Alexis DRUSH	12/9	10:00
REPRESENTING: DuPont Biosystems			REPRESENTING: Trace Analysis		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

Alpha Environmental Services, Inc.

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CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Michael Rossi

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2½" Brass Liners	Collected & Sealed	Iced & Transported	Test for TPH & BTEX	REMARKS
MW-6	12/1/88	3:20		✓	6 ft	1	✓	✓		Bill to Kaypo
"	"	3:20		✓	6.5 ft	1	✓	✓		
"	"	3:30		✓	11 ft	1	✓	✓		
"	"	3:30		✓	11.5 ft	1	✓	✓	✓	
"	"	3:40		✓	16.5 ft	1	✓	✓		
"	"	3:50		✓	21 ft	1	✓	✓	✓	
"	"	4:00		✓	26 ft	1	✓	✓		
"	"	4:00		✓	26.5 ft	1	✓	✓	✓	
"	"	4:10		✓	29 ft	1	✓	✓		
"	"	4:10		✓	29.5 ft	1	✓	✓		

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Michael Rossi	12/9	10:00	Alexis DRUSH	12/9	10:00
REPRESENTING: DuPont Biosystems			REPRESENTING: Trace Analysis		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

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CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Michael Reese

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2½" Brass Liner	Collected & Sealed	Iced & Transported	Test for TPH & BTXE	REMARKS
MW-7	12/2 88			✓	6.5 ft.	1	✓	✓		Bill to Kaya
				✓	11.0 ft	1	✓	✓		
				✓	11.5 ft	1	✓	✓	✓	
				✓	16 ft	1	✓	✓		
				✓	16.5 ft	1	✓	✓		
				✓	21 ft	1	✓	✓		
				✓	21.5 ft	1	✓	✓	✓	
				✓	26.0 ft	1	✓	—	✓	
↓	↓			✓	26.5 ft	1	✓	—		

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Michael Reese	12/9	10:00	Alexis Drush	12/9	10:00
REPRESENTING: DuPont Biosystems			REPRESENTING: Trace Analysis		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

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CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Michael Reese

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2½" Brass Liners	Collected & Sealed	Iced & Transported	Test for TPH + BTXE				REMARKS
B-1	12/2	12:40			6.0 ft.	1	✓	✓					Bill to Kaya
		12:40			6.5 ft.	1	✓	✓					
		1:25			11.0 ft	1	✓	✓					
		1:25			11.5 ft	1	✓	✓	✓				
		2:00			16.0 ft	1	✓	✓	✓				
		2:00			16.5 ft	1	✓	✓					
		2:30			21.0 ft	1	✓	✓					
		2:30			21.5 ft	1	✓	✓	✓				
		2:45			26.0 ft	1	✓	✓					
↓	↓	2:45			26.5 ft.	1	✓	✓					

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Michael Reese	12/9	10:00	Alex B DRUSH	12/9	10:00
REPRESENTING: Pacific Biosystems			REPRESENTING: Trace Analysis		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

Alpha Environmental Services, Inc.

310 Main Street, Suite F • Pleasanton, California 94566 • (415) 462-7772

CHAIN OF CUSTODY/WORK ORDER

Testing Laboratory TRACE ANALYSIS LABORATORY Phone 783-6960

Address 3423 INVESTMENT BOULEVARD

City, State, Zip HAYWARD, CALIFORNIA 94545

PROJECT NAME: SAN LORENZO

JOB NUMBER: 211-71-11

SAMPLERS (Signature): Michael Reese

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS 2½" Brass Liners	Collected & Sealed	Iced & Transported	Test for TPH & BTXE	REMARKS
B-1	12/2	2:45			29.0 ft	1	✓	✓		
		3:25			29.5 ft	1	✓	✓		
		3:25			33.0 ft	1	✓	✓	✓	
		3:35			36.0 ft	1	✓	✓		
↓	↓	3:35			36.5 ft.	1	✓	✓		

RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
Michael Reese	12/2	10:00	Alex B Drust	12/9	10:00
REPRESENTING: D-Port Biosystems			REPRESENTING: Trace Analysis		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		
RELINQUISHED BY (Signature)	DATE	TIME	RECEIVED BY (Signature)	DATE	TIME
REPRESENTING:			REPRESENTING:		

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545 *(415) 783-6960*

DATE: 10/2/89

LOG NO.: 7858

DATE SAMPLED: 9/15/89

DATE RECEIVED: 9/19/89

CUSTOMER: DuPont Biosystems

REQUESTER: Mark Vetter

PROJECT: No. 211-71-11, Jet Gas-San Lorenzo

		Sample Type: Soil			
		MW 8 C		MW 8 D	
Method and Constituent	Units	Concentration	Detection Limit	Concentration	Detection Limit
DHS Method:					
Total Petroleum Hydrocarbons as Gasoline	mg/kg	< 0.5	0.5	43	0.5
Modified EPA Method 8020:					
Benzene	mg/kg	< 0.01	0.01	< 0.01	< 0.01
Toluene	mg/kg	< 0.02	0.02	0.84	0.01
Xylenes	mg/kg	< 0.06	0.06	< 0.06	0.06
Ethyl Benzene	mg/kg	< 0.02	0.02	0.16	0.02

DATE: 10/2/89
LOG NO.: 7858
DATE SAMPLED: 9/15/89
DATE RECEIVED: 9/19/89
PAGE: Two

Sample Type: Soil

Method and Constituent	Units	MW 9 C Concentration	MW 9 C Detection Limit	MW 9 F Concentration	MW 9 F Detection Limit
DHS Method:					
Total Petroleum Hydrocarbons as Gasoline	mg/kg	< 0.5	0.5	< 0.5	0.5
Modified EPA Method 8020:					
Benzene	mg/kg	< 0.01	0.01	< 0.01	0.01
Toluene	mg/kg	< 0.04	0.04	< 0.01	0.01
Xylenes	mg/kg	< 0.06	0.06	< 0.06	0.06
Ethyl Benzene	mg/kg	< 0.02	0.02	< 0.02	0.02

Dan Farah

Dan Farah, Ph.D.
Supervisory Chemist

DF:sam

DU PONT ENVIRONMENTAL SERVICES

7068 Koll Center Parkway * Suite 401 * Pleasanton, California * (415) 462-7772

CHAIN-OF-CUSTODY/WORK ORDER

Testing Laboratory: Trace Analysis Laboratory — Phone: (415) 783-6960

Address: 3423 Investment Boulevard, Unit 8

City, State, Zip: Hayward, California 94545

PROJECT NAME: JET GAS - SAN LORENZO

JOB NUMBER: 211-71-11

REQUESTOR: MARK VETTER

SAMPLERS (Signature): Mark Vetter

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION	NO. OF CONTAINERS	TPHg	BTEX					REMARKS
MW8A	9/5/89			✓	Monitor Well 8 5'	1							Hold
MW8B				✓	" 10'	1							Hold
MW8C				✓	" 15'	1	x	x					Run - Normal TA
MW8D				✓	20'	1	x	x					Run - Normal TA
MW8E				✓	23'	1							Hold
MW9A				✓	5'	1							Hold
MW9B				✓	10'	1							Hold
MW9C				✓	15'	1	x	x					Run - Normal TA
MW9D				✓	19'	1							Hold
MW9E				✓	20.5'	1							Hold
MW9F				✓	22'	1	x	x					Run - Normal TA
MW9G				✓	25'	1							Hold
MW9H				✓	26.5'	1							Hold

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature): Mark Vetter — REPRESENTING: Du Pont	9/15/89		RECEIVED BY (Signature): — REPRESENTING:		
RELINQUISHED BY (Signature): — REPRESENTING:			RECEIVED BY (Signature): — REPRESENTING:		
RELINQUISHED BY (Signature): — REPRESENTING:			RECEIVED BY (Signature): Catherine Deller — REPRESENTING: TAL	9/19/89	2:30 P.M.

APPENDIX C

GROUND-WATER SAMPLING PROCEDURES
LABORATORY ANALYTICAL REPORTS
AND
CHAIN-OF-CUSTODY FORMS

GROUND-WATER SAMPLING PROCEDURES

All monitoring wells were sampled during a routine quarterly sampling event on September 29, 1989. Prior to purging, each well was sampled with a clear teflon bailer in order to observe the possible presence of floating hydrocarbons. Purging was accomplished using a stainless steel bailer. The bailer was thoroughly cleaned prior to each sampling using a trisodium phosphate solution and then a 10% solution of methyl alcohol and finally rinsed with water. The wells were purged prior to sampling until pH conductivity values stabilized. Generally, this was accomplished by removing three to five well volumes of ground water from each well during the purging process. The water obtained from purging was placed in labeled 55-gallon drums and stored on-site. The bailer line was replaced after each sampling. Samples recovered from each well were decanted into two 40-ml appropriately labeled volatile organic analysis (VOA) bottles. Care was taken to avoid the presence of headspace in any of the sample bottles. The sample bottles were immediately placed in an ice chest for delivery to the State of California licensed Trace Analysis Laboratory in Hayward, California. Routine chain-of-custody procedures were employed.

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545 *(415) 783-6960*

TAL

DATE: 10/11/89

LOG NO.: 7892

DATE SAMPLED: 9/27/89

DATE RECEIVED: 9/28/89

CUSTOMER: DuPont Biosystems

REQUESTER: Bill Bassett

PROJECT: No. 211-Q9-11, San Lorenzo

Sample Type: Water

Method and Constituent	Units	MW-A Concentration	MW-A Detection Limit	MW-B Concentration	MW-B Detection Limit	MW-1 Concentration	MW-1 Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	4,200	20	25	2	6,800	100
Modified EPA Method 8020:							
Benzene	ug/l	< 1	1	< 0.1	0.1	960	6
Toluene	ug/l	< 1	1	< 0.1	0.1	9.0	5
Xylenes	ug/l	< 1	4	< 0.4	0.4	360	20
Ethyl Benzene	ug/l	16	1	< 0.1	0.1	260	7

DATE: 10/11/89
LOG NO.: 7892
DATE SAMPLED: 9/27/89
DATE RECEIVED: 9/28/89
PAGE: Two

Sample Type: Water

Method and Constituent	Units	MW-2 Concentration	MW-2 Detection Limit	MW-3 Concentration	MW-3 Detection Limit	MW-4 Concentration	MW-4 Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	420	10	34,000	500	1,200	20
Modified EPA Method 8020:							
Benzene	ug/l	3.8	0.6	8,100	30	11	1
Toluene	ug/l	0.64	0.5	2,800	20	< 1	1
Xylenes	ug/l	54	2	4,300	100	< 4	4
Ethyl Benzene	ug/l	2.9	0.7	1,200	30	< 1	1

Method and Constituent	Units	MW-5 Concentration	MW-5 Detection Limit	MW-6 Concentration	MW-6 Detection Limit	MW-7 Concentration	MW-7 Detection Limit
DHS Method:							
Total Petroleum Hydrocarbons as Gasoline	ug/l	5.3	2	2.1	2	1,400	100
Modified EPA Method 8020:							
Benzene	ug/l	1.3	0.1	0.20	0.1	420	6
Toluene	ug/l	< 0.1	0.1	0.24	0.1	5.9	5
Xylenes	ug/l	< 0.4	0.4	< 0.4	0.4	28	20
Ethyl Benzene	ug/l	< 0.1	0.1	< 0.1	0.1	140	7

DATE: 10/11/89
LOG NO.: 7892
DATE SAMPLED: 9/27/89
DATE RECEIVED: 9/28/89
PAGE: Three

Sample Type: Water

Method and Constituent	Units	MW-10 Concentration	MW-10 Detection Limit	Duplicate Concentration	Duplicate Detection Limit
DHS Method:					
Total Petroleum Hydrocarbons as Gasoline	ug/l	< 2	2	2.8	2
Modified EPA Method 8020:					
Benzene	ug/l	< 0.1	0.1	< 0.1	0.1
Toluene	ug/l	< 0.2	0.2	< 0.1	0.1
Xylenes	ug/l	< 0.4	0.4	< 0.5	0.5
Ethyl Benzene	ug/l	< 0.1	0.1	< 0.2	0.2

Stephen D. Boyle
Supervisory Chemist

SDB:vls

DU PONT ENVIRONMENTAL SERVICES

7068 Koll Center Parkway * Suite 401 * Pleasanton, California * (415) 462-7772

CHAIN-OF-CUSTODY/WORK ORDER

Testing Laboratory: Trace Analysis Laboratory — Phone: (415) 783-6960

Address: 3423 Investment Boulevard, Unit 8

City, State, Zip: Hayward, California 94545

PROJECT NAME: San Lorenzo

JOB NUMBER: 211-89-11

REQUESTOR: Bill Bassett

SAMPLERS (Signature): Bill Bassett

SAMPLE I.D.	DATE	TIME	COMP	GRAB	LOCATION (MW=Monitoring Well)	NO. OF CONTAINERS	Collected, iced at 4°C, Transported to Pleasanton, TPH g + BTEX	REMARKS
MW-1	9/27/89				MW-1	2	✓✓✓	Normal TAT
MW-2					MW-2	2	✓✓✓	
MW-3					MW-3	2	✓✓✓	
MW-4					MW-4	2	✓✓✓	
MW-5					MW-5	2	✓✓✓	
MW-6					MW-6	2	✓✓✓	
MW-7					MW-7	2	✓✓✓	
MW-A					MW 100' west of MW 7	2	✓✓✓	
MW-B					MW 60' South of MW 4	2	✓✓✓	
MW-10					MW-10	2	✓✓✓	
Duplicate					Duplicate	2	✓✓✓	

	DATE	TIME		DATE	TIME
RELINQUISHED BY (Signature): Bill Bassett REPRESENTING: DPES	9/27/89	5:00 PM	RECEIVED BY (Signature): Laura K. Frost REPRESENTING:	09/27/89	5:00 PM
RELINQUISHED BY (Signature): Laura K. Frost REPRESENTING:	09/28/89	10:25 AM	RECEIVED BY (Signature): Allasson REPRESENTING:	9/28/89	10:25 AM
RELINQUISHED BY (Signature): Allasson REPRESENTING:	9/28/89	2:25	RECEIVED BY (Signature): REPRESENTING:	9/28/89	2:25

APPENDIX D

SOIL SIEVE ANALYSIS RESULTS

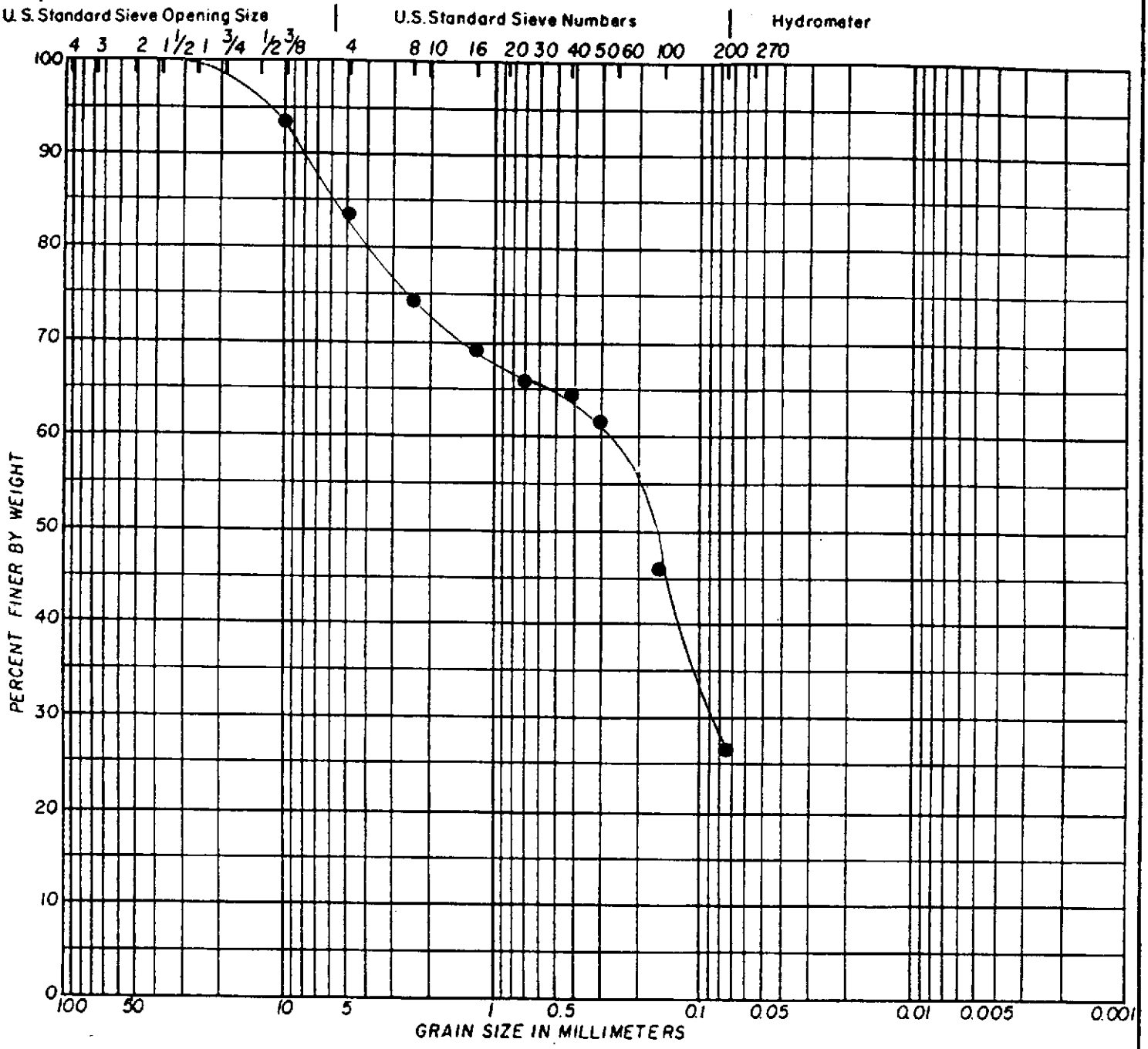
GRAIN SIZE DISTRIBUTION

JOB NO: 211-71-11
NAME: JET GAS STATION

DATE: 8-NOV-89
SAMPLE # MW-8D
DEPTH 20 FEET

MOISTURE CONTENT		#200 WASH	
PAN NUMBER	65	PAN NUMBER	65
PAN + WET SOIL	605.6	PAN + DRY SOIL	515.71
PAN + DRY SOIL	515.71	(before wash)	
MOISTURE LOSS	89.89	PAN + DRY SOIL	388.30
PAN TARE	9.93	(after wash)	
DRY SOIL	505.78	PAN TARE	9.93
MOISTURE CONTENT	17.8		

SIEVE	PARTICLE DIAMETER (mm)	WEIGHT RETAINED (gm)	PERCENT PASSING	
2"	50.00	0.00	100.0	
1"	25.00	0.00	100.0	
3/4"	18.85	0.00	100.0	
3/8"	9.42	32.27	93.6	
#4	4.699	51.28	83.5	
#8	2.362	47.87	74.0	
#16	1.168	25.25	69.0	
#30	0.589	15.42	66.0	
#40	0.425	8.47	64.3	
#50	0.295	11.47	62.0	
#100	0.147	78.10	46.6	
#200	0.074	99.77	26.9	
PAN		6.57		
TOTAL PASSING #200 SIEVE		133.98	26.5	
TOTAL SAMPLE WEIGHT		503.88		505.8



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Sample Source	Classification
SM	Monitoring Well 8 Sample D 20.0 Feet	Silty Sand with Gravel

Du Pont Environmental Services

PARTICLE SIZE ANALYSIS

PLATE D-2

Job No. 211-71-11 Appr: GK Date

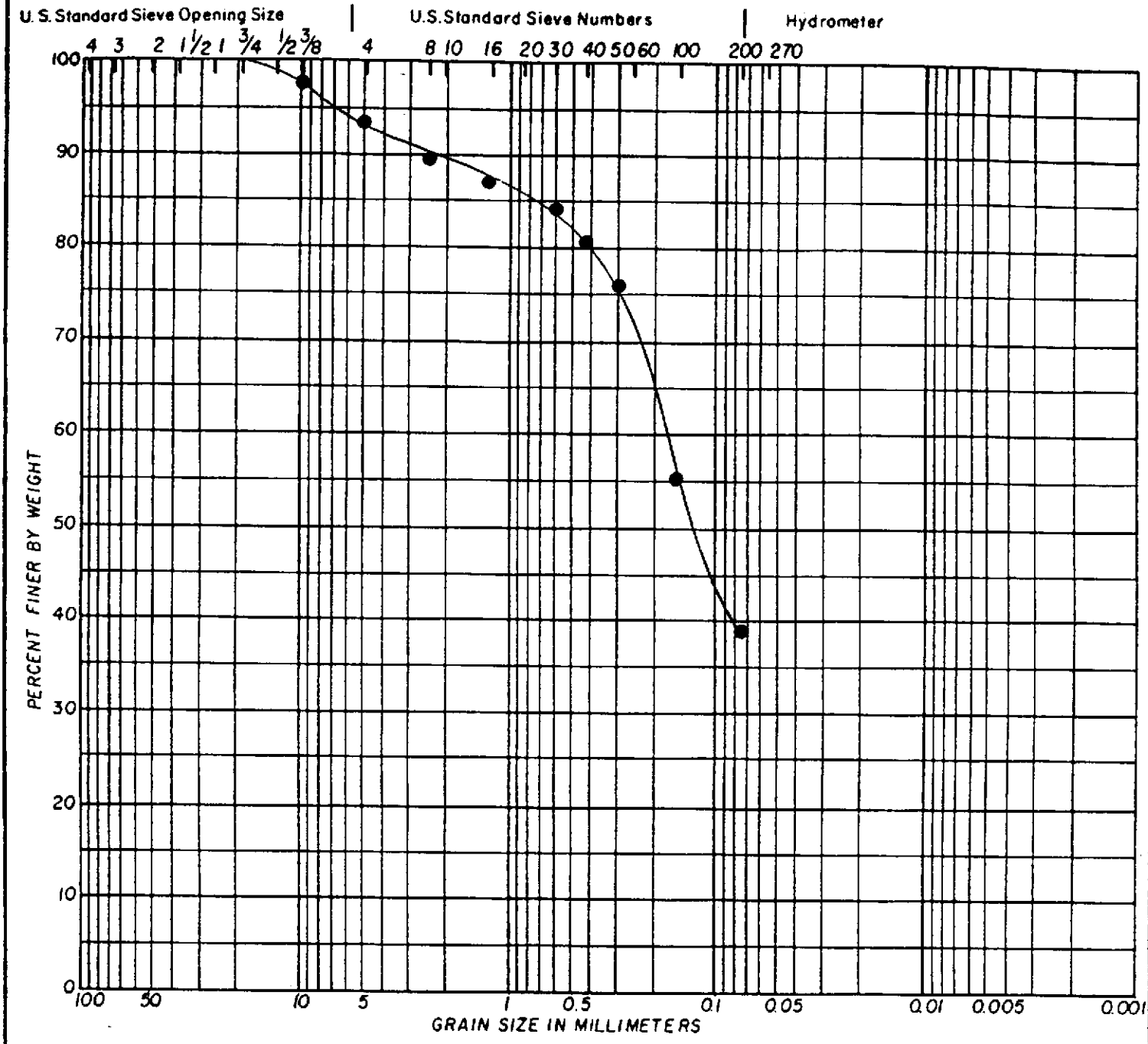
GRAIN SIZE DISTRIBUTION

JOB NO: 211-71-11
NAME: JET GAS STATION

DATE: 8-NOV-89
SAMPLE # MW-8E
DEPTH 20.5 FEET

MOISTURE CONTENT		#200 WASH	
PAN NUMBER	32	PAN NUMBER	32
PAN + WET SOIL	601.55	PAN + DRY SOIL	500.04
PAN + DRY SOIL	500.04	(before wash)	
MOISTURE LOSS	101.51	PAN + DRY SOIL	323.60
PAN TARE	9.81	(after wash)	
DRY SOIL	490.23	PAN TARE	9.81
MOISTURE CONTENT	20.7		

SIEVE	PARTICLE DIAMETER (mm)	WEIGHT RETAINED (gm)	PERCENT PASSING	
2"	50.00	0.00	100.0	
1"	25.00	0.00	100.0	
3/4"	18.85	0.00	100.0	
3/8"	9.42	10.80	97.8	
#4	4.699	21.04	93.5	
#8	2.362	17.95	89.8	
#16	1.168	14.08	87.0	
#30	0.589	13.04	84.3	
#40	0.425	14.62	81.3	
#50	0.295	25.19	76.2	
#100	0.147	101.06	55.6	
#200	0.074	81.67	38.9	
PAN		10.28		
TOTAL PASSING #200 SIEVE		186.72	38.1	
TOTAL SAMPLE WEIGHT		486.17		490.2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Sample Source	Classification
SM	Monitoring Well 8 Sample E 20.5 Feet	Silty Sand

Du Pont Environmental Services

PARTICLE SIZE ANALYSIS

PLATE D-4

Job No. 211-71-11 Appr: WR Date

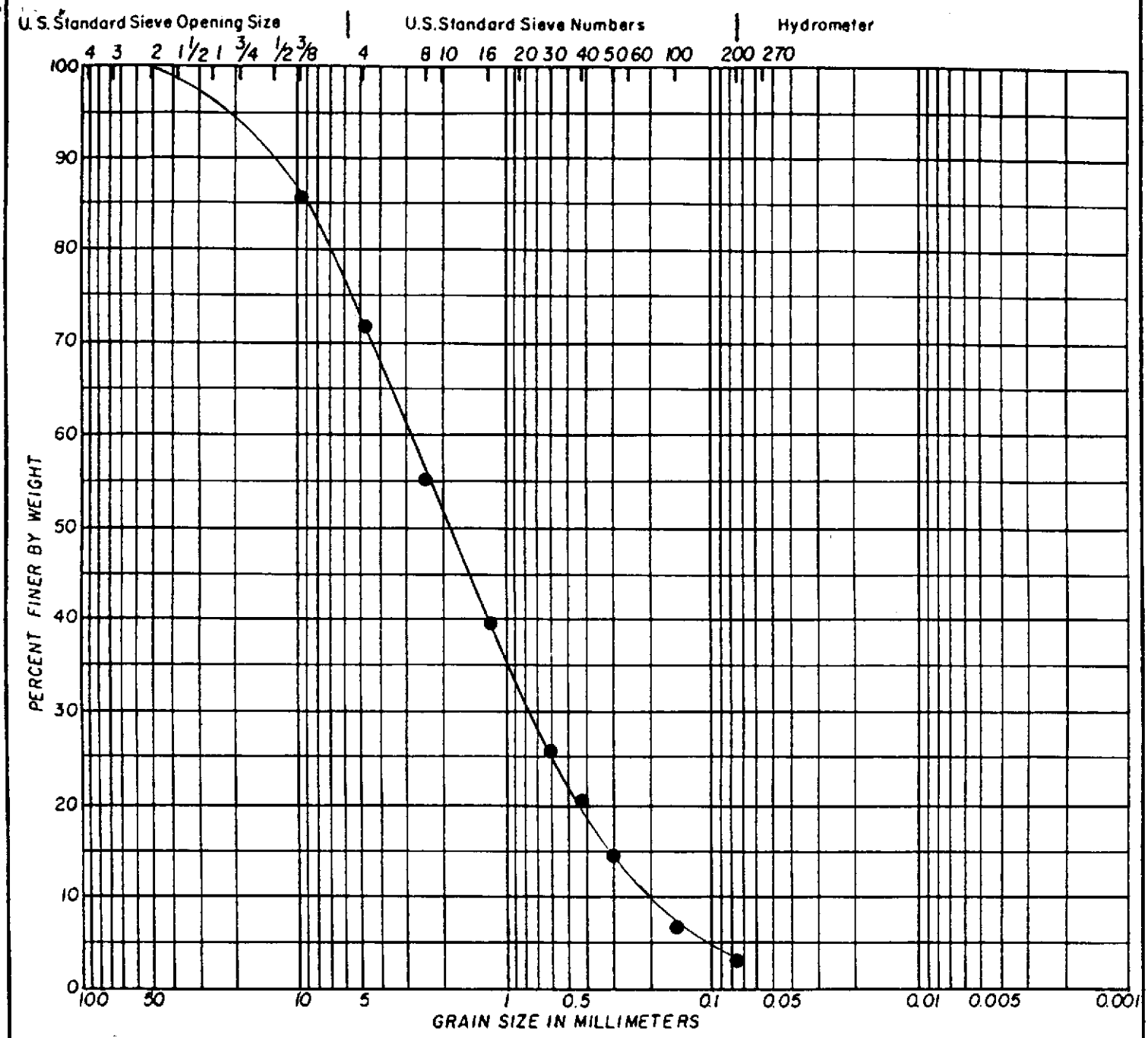
GRAIN SIZE DISTRIBUTION

JOB NO: 211-71-11
NAME: JET GAS STATION

DATE: 8-NOV-89
SAMPLE # MW-9F
DEPTH 22 FEET

MOISTURE CONTENT		#200 WASH	
PAN NUMBER	88	PAN NUMBER	88
PAN + WET SOIL	605.6	PAN + DRY SOIL	522.55
PAN + DRY SOIL	522.55	(before wash)	
MOISTURE LOSS	83.05	PAN + DRY SOIL	506.73
PAN TARE	9.29	(after wash)	
DRY SOIL	513.26	PAN TARE	9.29
MOISTURE CONTENT	16.2		

SIEVE	PARTICLE DIAMETER (mm)	WEIGHT RETAINED (gm)	PERCENT PASSING	
2"	50.00	0.00	100.0	
1"	25.00	0.00	100.0	
3/4"	18.85	0.00	100.0	
3/8"	9.42	71.41	86.1	
#4	4.699	71.41	72.2	
#8	2.362	87.71	55.1	
#16	1.168	78.92	39.7	
#30	0.589	67.76	26.5	
#40	0.425	30.77	20.5	
#50	0.295	28.92	14.9	
#100	0.147	40.86	6.9	
#200	0.074	20.41	2.9	
PAN		1.30		
TOTAL PASSING #200 SIEVE		17.12	3.3	
TOTAL SAMPLE WEIGHT		515.29		513.3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Sample Source	Classification
SP	Monitoring Well 9 Sample F 22.0 Feet	Poorly Graded Sand

Du Pont Environmental Services

PARTICLE SIZE ANALYSIS

PLATE D-6

Job No. 211-71-11 Appr: GR Date