



PACIFIC
ENVIRONMENTAL
GROUP INC.

Catalytic unit -
Start June 6, 1991

- February 16, 1990
Project Number 330-40.03

500 cfm ^{at} 3500 ppm

Mr. Kyle Christie
ARCO Petroleum Products Company
P.O. Box 5811
San Mateo, California 94402

440 60
1" 3/4"
(1) 2" vapor

Re: ARCO Service Station No. 0276
10600 MacArthur Boulevard at 106th Street
Oakland, California

Dear Mr. Christie:

Pacific Environmental Group, Inc. (PACIFIC) is pleased to submit this report concerning ongoing environmental services in an area adjacent to the ARCO station referenced above. At the request of ARCO, PACIFIC has developed a design for the installation and operation of an in-situ soil venting system at this site. The following is a description of the project site and background, the performance testing, and the soil venting system.

SITE DESCRIPTION AND BACKGROUND

The project site is a parking lot adjacent to southern boundary of the ARCO station located at 10600 MacArthur Boulevard, Oakland, California (Figure 1). The soil venting system has been designed to remediate an area of approximately 90 feet by 100 feet with soils containing petroleum hydrocarbons. The parking lot is part of a commercial development known as Foothill Square Shopping Center.

The presence of petroleum hydrocarbons in the soil in varying concentrations was previously noted in the Preliminary Report of Environmental Investigation, ARCO Station Number 276, May 12, 1989, prepared by Applied Geosystems, and a soil vapor investigation performed by PACIFIC on June 21 and 22, 1989, and reported to ARCO in PACIFIC's letter report of July 17, 1989.

During the PACIFIC investigation a total of sixteen soil gas probes were installed, both at the ARCO station and in the adjacent parking lot. Probes installed in the parking lot were sampled at two depth intervals: 17 to 19 feet and 22 to 24 feet deep. As previously reported by PACIFIC, total hydrocarbon concentrations in the upper sample elevations ranged from 5 parts per million (ppm) to 31,900 ppm; total petroleum concentrations in the lower sample elevations ranged from 20 ppm to 40,000 ppm.

Remedial efforts at the site are currently focused on off-site soil vapor extraction. On-site remedial activities should be initiated following the ongoing tank replacement project. This should avoid the potential destruction of an on-site soil vapor extraction system during the tank replacement project.

PERFORMANCE TESTING

Vapor extraction probes were installed at the site in order to test the feasibility of soil venting as a remedial method, and to provide data for the design of an in-situ soil venting system. Six vapor extraction probes, consisting of one-half inch diameter steel pipe, and an existing three inch diameter monitoring well were used to execute the performance testing.

Three of the probes were driven to depths of 20 feet, with perforations from 15 to 20 feet deep, while the three remaining probes were driven to a depth of thirty feet, with perforations from 24 to 29 feet deep (see Figure 2). The perforated sections allow for the flow of vapors from the soil into the extraction vents.

Results of the performance testing indicated that subsurface soil conditions would support a soil venting system incorporating vapor extraction vents spaced approximately 30 feet on center (see Table 1). The proposed system design actually incorporated a closer vent spacing layout of approximately 15 to 20 feet on center, in an effort to expedite remediation at the request of ARCO.

SOIL VENTING SYSTEM

The in-situ soil venting system consists of two major components:

- o Twenty five soil vapor extraction probes (or soil vents), one vadose well, associated piping, and manifold device
- o A mobile extraction and treatment device

The twenty five soil vents, consisting of one-half inch diameter steel pipe, were driven to depths of up to 34 feet with pneumatic equipment (see Figure 3). Seven of the soil vents are perforated from a depth of 16 to 21 feet, while the eighteen remaining soil vents are perforated from 25 to 34 feet. The original design called for the installation of twenty eight soil extraction probes, but subsurface obstructions prevented the installation of three probes. Since the design incorporated a vent spacing more compact than required by subsurface conditions, the elimination of these probes should not impact the effectiveness of the remedial effort.

In addition, an existing three-inch monitoring well is utilized as a vadose well for the remediation of soils containing petroleum hydrocarbons between the depths of approximately 22 and 27 feet. This well is essentially an oversized soil vent which provides a medium for a higher flow rates of vapors from soils in the vicinity of the well.

Both the soil vents and the vadose well have been piped to a below-grade manifold device which will control individual vapor extraction flow rates. The vent piping has been routed across the site in shallow trenches and buried in the trenches at a depth of approximately one foot. The surface of the parking lot in the remediation area was repaired with asphalt paving to match the surrounding surfaces.

*EP&W
VENT
NOT VENTILATED?*

A mobile extraction and treatment device shall be used initially to extract and treat soil vapor for petroleum hydrocarbons. The device consists of an extraction pump or blower, and an internal combustion engine powered by propane. This device is capable of extracting soil vapor and oxidizing greater than 98% of the petroleum hydrocarbons. Emissions from the combustion device shall comply with the requirements of air-quality permits issued by the Bay Area Air Quality Management District (BAAQMD). The combustion device has previously been permitted on other sites under the BAAQMD's jurisdiction, and the permit has been transferred to this site.

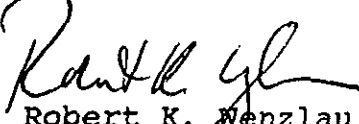
*PERMIT
TRANSFERRED?*

After hydrocarbon concentrations are reduced to levels which are anticipated to be acceptable for long term ambient venting (LTAV), the mobile extraction and combustion device shall be replaced by an electric vacuum pump and dilution system. The system is tentatively scheduled to begin operation in mid-February 1990, and is projected to continue operating for approximately one year.

A report on the system installation and initial start-up monitoring data will be forthcoming. PACIFIC appreciates this opportunity to be of service. Please call if you have any questions concerning the contents of this report.

Sincerely,

PACIFIC ENVIRONMENTAL GROUP, INC.



Robert K. Wenzlau, P.E.
Senior Engineer



enclosures

TABLE 1
 INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac ("H2O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >MW3	--	14.0	22.0-27.0'	--	8.0	3.0"
A	.1	--	15.0-20.0'	5.0'	--	1/2"
B	.02	--	15.0-20.0'	15.0'	--	1/2"
C	0	--	15.0-20.0'	20.0'	--	1/2"
F	.17	--	24.0-29.0'	20.0'	--	1/2"
Extrc >MW3	--	12.0	22.0-27.0'	--	8.0	3.0"
A	.1	--	15.0-20.0'	5.0'	--	1/2"
B	.05	--	15.0-20.0'	15.0	--	1/2"
C	0	--	15.0-20.0'	20.0'	--	1/2"
F	>.25	--	24.0-29.0'	20.0'	--	1/2"
Extrc >MW3	--	12.0	22.0-27.0'	--	8.0	3.0"
A	.1	--	15.0-20.0'	5.0'	--	1/2"
B	.04	--	15.0-20.0'	15.0'	--	1/2"
C	0	--	15.0-20.0'	20.0'	--	1/2"
F	>.25	--	24.0-29.0	20.0'	--	1/2"
Extrc >MW3	--	12.0	22.0-27.0'	--	8.0	3.0"
A	.1	--	15.0-20.0'	5.0'	--	1/2"
B	.04	--	15.0-20.0'	15.0'	--	1/2"
C	0	--	15.0-20.0'	20.0'	--	1/2"
F	>.25	--	24.0-29.0'	20.0'	--	1/2"
Extrc >A	--	2.0	15.0-20.0'	--	15.0	1/2"
MW3	.015	--	22.0-27.0'	5.0'	--	3.0"
B	.01	--	15.0-20.0'	10.0'	--	1/2"
C	0	--	15.0-20.0'	15.0'	--	1/2"
F	0	--	25.0-29.0'	15.0'	--	1/2"

TABLE 1
 (continued)

INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac("H ₂ O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >A MW3	--	2.0	15.0-20.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	.01	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0'	--	1/2"
Extrc >A MW3	--	2.0	15.0-20.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	.01	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0'	--	1/2"
Extrc >A MW3	--	2.0	15.0-20.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	.03	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0'	--	1/2"
Extrc >D MW3	--	2.5	24.0-29.0'	--	15.0	3.0"
	0	--	22.0-27.0'	5.0'	--	1/2"
	0	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0	--	1/2"
Extrc D MW3	--	2.5	25.0-29.0'	--	15.0'	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	0	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0	15.0	--	1/2"

TABLE 1
 (continued)

INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac ("H ₂ O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >D MW3 B C F	--	2.5	24.0-29.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	.01	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0'	--	1/2"
Extrc >D MW3 B C F	--	2.5	24.0-29.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	.01	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	.005	--	24.0-29.0'	15.0'	--	1/2"
Extrc >D MW3 B C F	--	2.5	24.0-29.0'	--	15.0	1/2"
	0	--	22.0-27.0'	5.0'	--	3.0"
	0.2	--	15.0-20.0'	10.0'	--	1/2"
	0	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	15.0'	--	1/2"
Extrc >MW3 B D E F	--	14.0	22.0-27.0'	--	11.0	3.0"
	.02	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	5.0'	--	1/2"
	.01	--	24.0-29.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	20.0'	--	1/2"
Extrc >MW3 B D E F	--	13.0	22.0-27.0'	--	12.0	3.0"
	.03	--	15.0-20.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	5.0'	--	1/2"
	.01	--	24.0-29.0'	15.0'	--	1/2"
	0	--	24.0-29.0'	20.0'	--	1/2"

TABLE 1
 (continued)

INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac ("H2O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >MW3	--	15.0	22.0-27.0'	--	12.0	3.0"
B	.04	--	15.0-20.0'	15.0'	--	1/2"
D	0	--	24.0-29.0'	5.0'	--	1/2"
E	.01	--	24.0-29.0'	15.0'	--	1/2"
F	0	--	24.0-29.0'	20.0'	--	1/2"
Extrc >MW3	--	15.0	22.0-27.0'	--	12.0	3.0"
B	.04	--	15.0-20.0'	15.0'	--	1/2"
D	.005	--	24.0-29.0'	5.0'	--	1/2"
E	.01	--	24.0-29.0'	15.0'	--	1/2"
F	0	--	24.0-29.0'	20.0'	--	1/2"
Extrc >E	--	20.0	24.0-29.0'	--	16.0	1/2"
A	.005	--	15.0-20.0'	10.0'	--	1/2"
D	0	--	24.0-29.0'	10.0'	--	1/2"
B	0	--	15.0-20.0'	3.0'	--	1/2"
F	.02	--	24.0-29.0'	5.0'	--	1/2"
Extrc >E	--	12.0	24.0-29.0'	--	16.0	1/2"
A	.01	--	15.0-20.0'	10.0'	--	1/2"
D	0	--	24.0-29.0'	10.0'	--	1/2"
B	.005	--	15.0-29.0'	3.0'	--	1/2"
F	.04	--	24.0-29.0'	5.0'	--	1/2"
Extrc >E	--	14.0	24.0-29.0'	--	16.0	1/2"
A	.005	--	15.0-20.0'	10.0'	--	1/2"
D	0	--	24.0-29.0'	10.0'	--	1/2"
B	.005	--	15.0-20.0'	3.0'	--	1/2"
F	.055	--	24.0-29.0'	5.0'	--	1/2"

TABLE 1
 (continued)

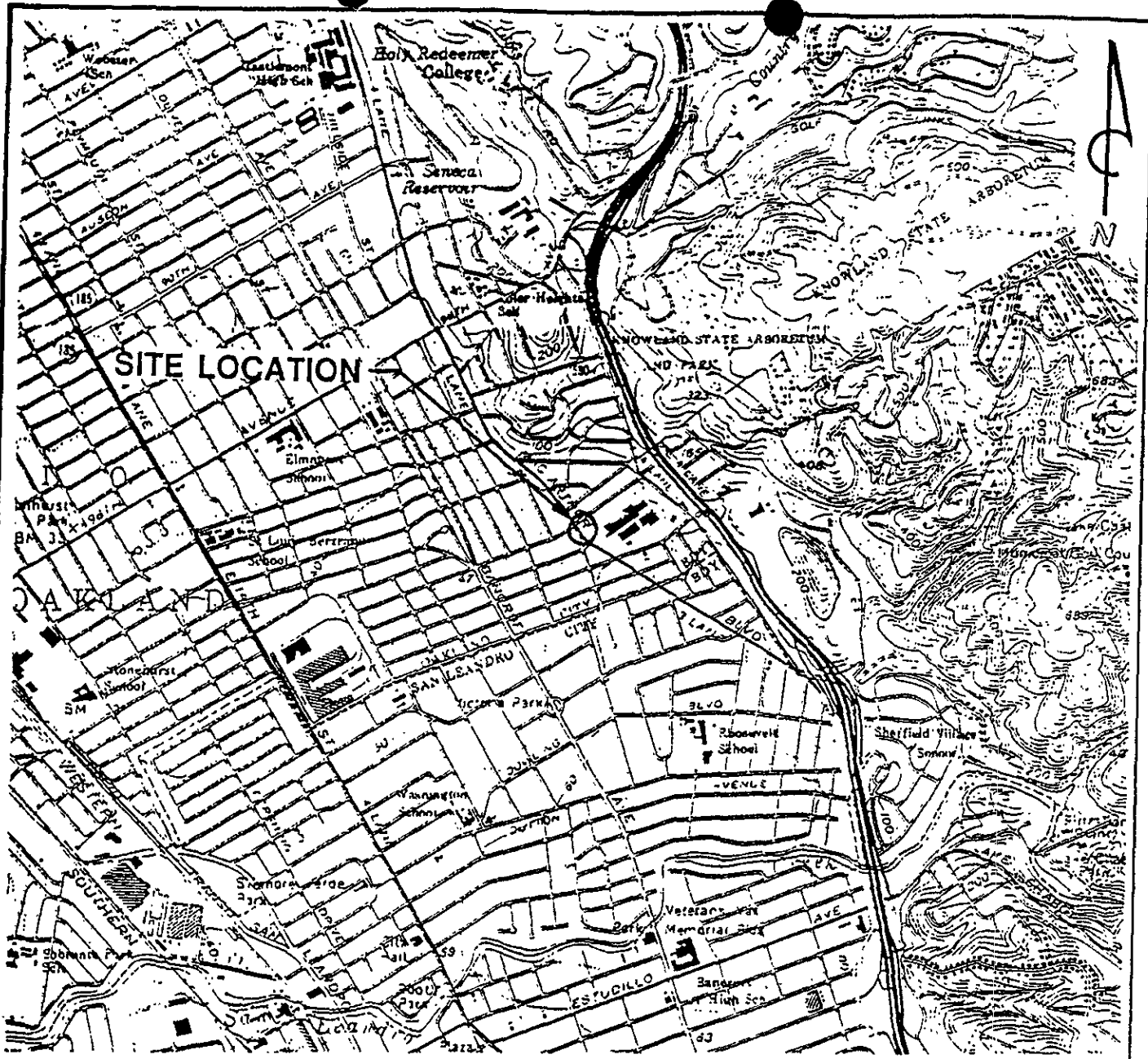
INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac ("H2O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >E	--	12.0	24.0-29.0'	--	16.0	1/2"
A	.01	--	15.0-20.0'	10.0'	--	1/2"
D	0	--	24.0-29.0'	10.0'	--	1/2"
B	.005	--	15.0-20.0'	3.0'	--	1/2"
F	.08	--	24.0-29.0'	5.0'	--	1/2"
Extrc >E	--	10.0	22.0-27.0'	--	16.0	1/2"
A	.015	--	15.0-20.0'	10.0'	--	1/2"
D	0	--	24.0-29.0'	10.0'	--	1/2"
B	0	--	15.0-20.0'	3.0'	--	1/2"
F	.1	--	24.0-29.0'	5.0'	--	1/2"
Extrc >C	--	2.5	15.0-29-0.0'	--	16.0	1/2"
A	.01	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	0	--	15.0-20.0'	5.0'	--	1/2"
F	0	--	24.0-29.0'	3.0'	--	1/2"
Extrc >C	--	3.0	15.0-20.0'	--	17.0	1/2"
A	.03	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	.005	--	15.0-20.0'	5.0'	--	1/2"
F	0	--	24.0-29.0'	3.0'	--	1/2"
Extrc >C	--	3.0	15.0-20.0'	--	17.0	1/2"
A	.02	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	.005	--	15.0-2.0'	5.0'	--	1/2"
F	0	--	24.0-29.0'	3.0'	--	1/2"

TABLE 1
 (continued)

INFLUENCE STUDY PERFORMANCE DATA

Probe/Well ID	Influence Vac ("H2O)	Extraction Note cfm	Perforated Depth	Capture Radius	Extraction Vacuum ("Hg)	Probe/Well Diameter
Extrc >C	--	3.0	15.0-20.0'	--	17	1/2"
A	.02	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	.005	--	15.0-20.0'	5.0'	--	1/2"
F	0	--	24.0-29.0'	3.0'	--	1/2"
Extrc >C	--	3.2	15.0-20.0'	--	3.2	1/2"
A	.02	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	.01	--	15.0-20.0'	5.0'	--	1/2"
F	0	--	24.0-29.0'	3.0'	--	1/2"
Extrc >F	--	3.0	24.0-29.0'	--	17.0	1/2"
A	.02	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	0	--	15.0-20.0'	5.0'	--	1/2"
E	.01	--	24.0-29.0'	5.0'	--	1/2"
Extrc >F	--	3.0	24.0-29.0'	--	17.0	1/2"
A	.01	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	.005	--	15.0-29.0'	5.0'	--	1/2"
E	.01	--	24.0-29.0'	5.0'	--	1/2"
Extrc >F	--	3.0	24.0-29.0'	--	17.0	1/2"
A	.02	--	15.0-20.0'	20.0'	--	1/2"
D	0	--	24.0-29.0'	20.0'	--	1/2"
B	0	--	15.0-20.0'	5.0'	--	1/2"
E	.02	--	24.0-29.0'	5.0'	--	1/2"



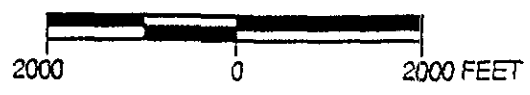
SITE LOCATION



QUADRANGLE LOCATION

REFERENCE:
 USGS 7.5 MIN. TOPOGRAPHIC MAP
 TITLED: OAKLAND EAST, CALIFORNIA
 DATED: 1959 REVISED: 1980
 TITLED: SAN LEANDRO, CALIFORNIA
 DATED: 1959 REVISED: 1980

SCALE



PACIFIC ENVIRONMENTAL GROUP INC.

ARCO STATION #0276
 10600 MacArthur Boulevard
 Oakland, California

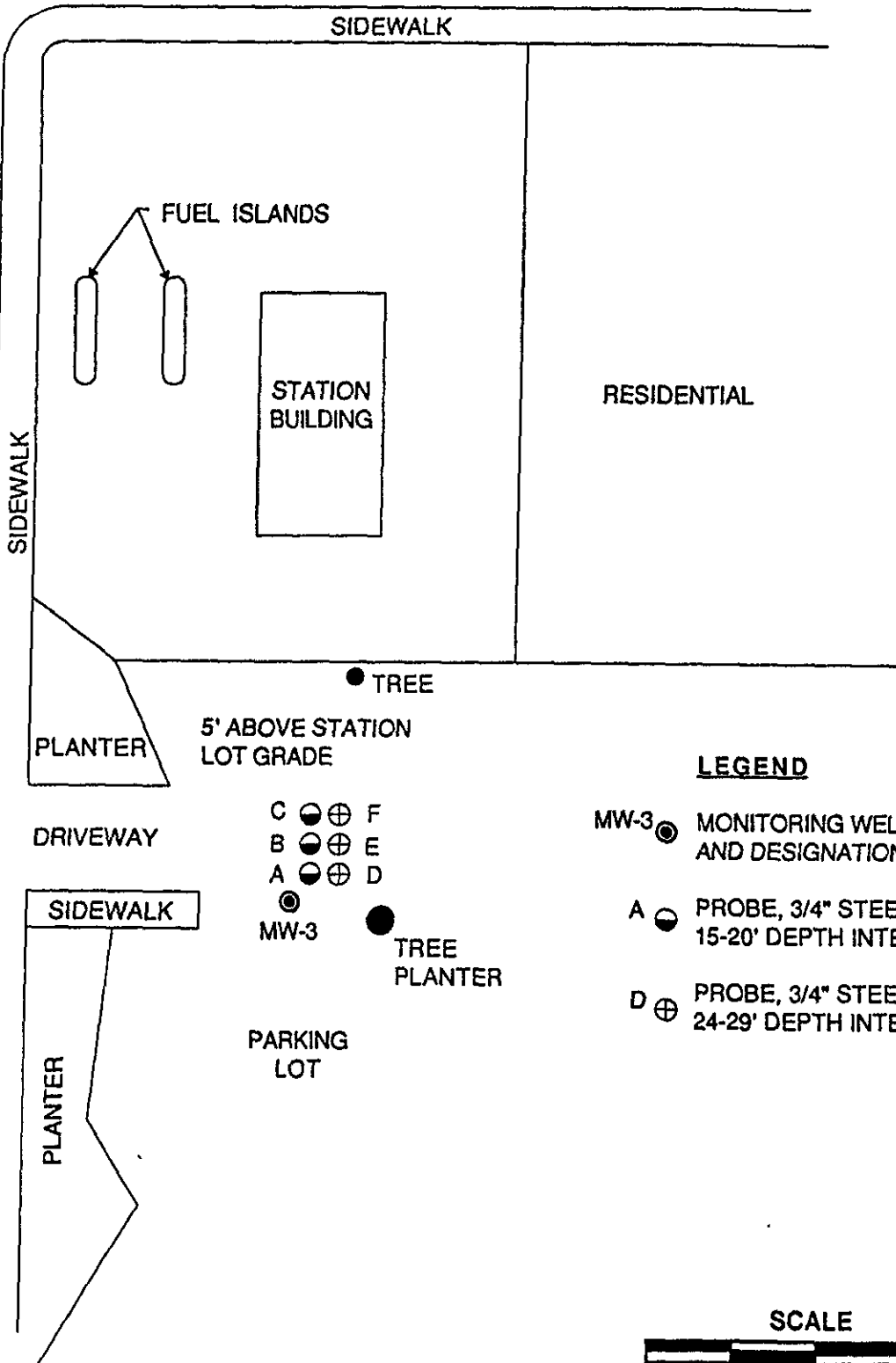
SITE LOCATION MAP

FIGURE:
 1
 PROJECT:
 330-40.03

106th STREET



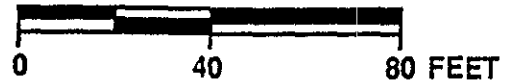
MACARTHUR BOULEVARD



LEGEND

- MW-3 ⊕ MONITORING WELL LOCATION AND DESIGNATION
- A ⊖ PROBE, 3/4" STEEL SCH 40 PIPE 15-20' DEPTH INTERVAL
- D ⊕ PROBE, 3/4" STEEL SCH 40 PIPE 24-29' DEPTH INTERVAL

SCALE



PACIFIC ENVIRONMENTAL GROUP, INC.

ARCO SERVICE STATION #0276
10600 MacArthur Boulevard
Oakland, California

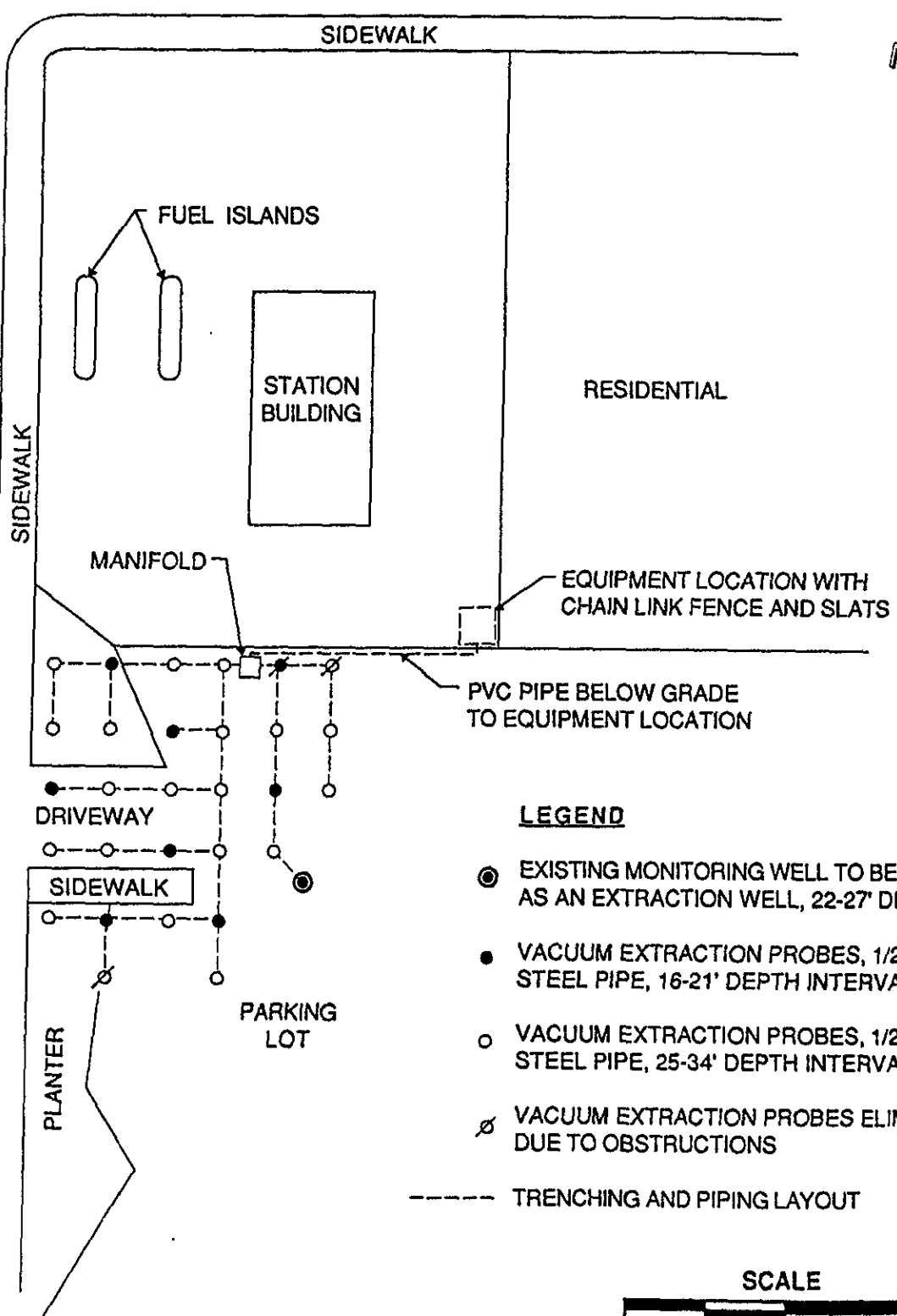
PERFORMANCE TESTING LAYOUT

FIGURE:
2
PROJECT:
330-40.03

106th STREET



MACARTHUR BOULEVARD

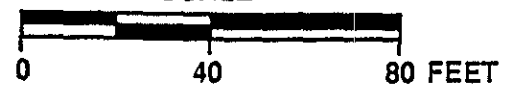


LEGEND

- EXISTING MONITORING WELL TO BE USED AS AN EXTRACTION WELL, 22-27' DEPTH
- VACUUM EXTRACTION PROBES, 1/2" SCH 40 STEEL PIPE, 16-21' DEPTH INTERVAL
- VACUUM EXTRACTION PROBES, 1/2" SCH 40 STEEL PIPE, 25-34' DEPTH INTERVAL
- ∅ VACUUM EXTRACTION PROBES ELIMINATED DUE TO OBSTRUCTIONS

----- TRENCHING AND PIPING LAYOUT

SCALE



PACIFIC ENVIRONMENTAL GROUP, INC.

ARCO SERVICE STATION #0276
10600 MacArthur Boulevard
Oakland, California

SOIL VENT SYSTEM

FIGURE:
3

PROJECT:
330-40.03