gettler — ryan inc.

91 MAY 15 PM 3:36

May 15, 1991

County of Alameda
Department of Environmental Health
Hazardous Materials Division
80 Swan Way, Room 200
Oakland, California 94621

Attention: ~~Larry Seto~~ Dennis

Reference: ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

Gentlemen:

As requested by ARCO Products Company, we are forwarding a copy of the Remedial Action Plan presented for the above referenced location.

Please do not hesitate to call should you have any questions or comments.

Sincerely,

Keith E. Bullock

Keith E. Bullock

KEB/jpz

Enclosure

cc: Mr. Charles Carmel, ARCO Products Company
Mr. Tom Callaghan, Regional Water Quality Control Board
Mr. H. C. Winsor, ARCO Products Company

2150 west winton avenue • hayward, california 94545-1210 • (415) 783-7500

GeoStrategies Inc.

REMEDIATION ACTION PLAN

ARCO Service Station No. 4931
731 W. MacArthur Boulevard
Oakland, California

790904-11

May 15, 1991

GeoStrategies Inc.
2140 WEST WINTON AVENUE
HAYWARD, CALIFORNIA 94545
(415) 352-4800

May 15, 1991

Gettler-Ryan Inc.
2150 West Winton Avenue
Hayward, California 94545

Attn: Mr. Keith Bullock

Re: REMEDIATION ACTION PLAN
ARCO Service Station No. 4931
731 W. MacArthur Boulevard
Oakland, California

Gentlemen:

This Remediation Action Plan (RAP) has been prepared by GeoStrategies Inc. (GSI) for the ARCO Service Station at the above referenced location (Plate 1) This document describes the selected interim remediation method to recover separate-phase and dissolved hydrocarbons identified in the uppermost aquifer beneath the site.

SITE ANALYSIS

The site is currently an active service station. There are eleven monitoring wells at the site; Wells A-2 through A-12 (Plate 2).

A petroleum hydrocarbon product loss reportedly occurred in November 1982. As a result, four ground-water monitoring wells (A-1 through A-4) were installed in December 1982. Four additional ground-water monitoring wells (A-5 through A-8) were installed by Groundwater Technologies Inc. (GTI) in March 1983. Well A-1 was destroyed during the replacement of the underground storage tanks in August 1983. To further delineate the extent of lateral migration of petroleum hydrocarbons, Pacific Environmental Group Inc. (PACIFIC) installed four additional ground-water monitoring wells (A-9 through A-12) in December 1987. Historically, dissolved hydrocarbons have been detected in Wells A-2, A-3, A-4, A-9 and occasionally been detected in Wells A-5 and A-6. Separate-phase product has been observed in Wells A-2, A-4, A-5 and A-8 at thicknesses up to 0.5 feet, 4.0 feet, 0.002 feet (only observed in the first quarter of 1984), and up to 2.0 feet, respectively.

Soils encountered beneath the site appear to consist primarily of 12 to 19 feet of clay and silt materials, underlain by sand and clayey sand, with minor clay interbeds to the total depth explored of 45 feet. Two geologic cross-sections were constructed from available boring logs and are presented on Plates 3 and 4.

The plume currently consists of separate-phase hydrocarbons near Wells A-4 and A-8 and dissolved hydrocarbons in Wells A-2, A-3 and A-9. The dissolved hydrocarbon plume appears to be confined beneath the property boundaries. However, further delineation of the dissolved plume may be necessary east of the underground tanks and in West Street, between Wells A-11 and A-12 to substantiate the areal extent.

HYDROGEOLOGIC DATA

Water-level Data

Historical water-level measurements indicate that the hydraulic gradient has fluctuated between 0.01 and 0.07. Currently, ground-water flow direction in the shallow water-bearing zone is to the southwest. The most current water-level data (first quarterly 1991) were used to construct the potentiometric map presented on Plate 5.

Ground-water Analytical Data

Ground-water samples have been collected from the monitoring network on a quarterly basis since March 1989. The most current ground-water sampling results (first quarter 1991) were used to construct a TPH-Gasoline/Benzene concentration map (Plate 6). The ground-water analytical database is presented in Table 1.

Aquifer Test Data

A hybrid step-drawdown/constant-rate test was performed in monitoring well A-9 in April 1991, to estimate aquifer yield potential in the shallow aquifer zone, evaluate the area of influence from pumping, calculate hydraulic properties for an interim remediation system to estimate the optimum start-up discharge rate and pump depth settings and select the appropriate treatment facility equipment. The heterogeneous, anisotropic nature of the subsurface geology and observed cone of depression development during the test correlate with the calculated transmissivity values. The area of influence resulting from pumping Well A-9 for 1116 minutes at a constant flow rate of 12 gallons per minute (gpm) appears to have extended beyond the boundaries of the presently understood hydrocarbon plume to the north, west, and south while pumping Well A-9. Pumping influence from Well A-9 to east-northeast (in the vicinity of Well A-2) appears to be limited (Plate 7) over the short term.

Based on aquifer test results, pumping Well A-9 should be able to provide eventual hydrodynamic control of the hydrocarbon plume with the exception of the east-northeast area. However, extended pumping may eventually permit control and capture of dissolved hydrocarbons in this direction also. A model simulating pumping Well A-9 was developed and run to project hydrodynamic influence over an approximate 30 day period. The simulation model suggests that hydrodynamic control of the groundwater beneath the site can be achieved (Plate 8) if Well A-9 is pumped longer than 30 days. Notwithstanding, a second recovery well may be necessary in the proximity of Wells A-2 and A-3 to effectively control and mitigate the dissolved plume. A summary of aquifer test data is presented in Table 2.

PURPOSE OF REMEDIATION

The purpose of interim remediation will be to recover separate-phase and dissolved hydrocarbons from the uppermost water-bearing zone. The screening and development process for selecting applicable remedial action alternatives are summarized in Table 3. Remediation will be implemented to obtain eventual site closure from Alameda County Department of Health Services and the State of California Regional Water Quality Control Board.

GROUNDWATER REMEDIATION DESIGN

Monitoring well A-9 (6-inch-diameter) will be utilized as a recovery well to control separate-phase and dissolved hydrocarbons. Well A-9 was chosen because of its location with respect to the plume and hydraulic gradient beneath the site. Based on aquifer test data, the flow rate from Well A-9 is estimated to be in the range of 8 to 12 gpm.

System Components

The ground-water extraction and treatment system will consist of an electric two-pump system installed in Recovery Well A-9 to recover separate-phase floating product and attenuate dissolved TPH-Gasoline and benzene concentrations in the uppermost water-bearing zone. Separate-phase product will be pumped to a double-contained product storage drum. Dissolved hydrocarbons will be pumped from Recovery Well A-9 to the on-site treatment facility. Components of the treatment facility will consist of a double-contained product storage drum, a particulate filter, and two 1,200-pound carbon adsorption vessels in series. After groundwater has been treated in the carbon vessels, it will be discharged to the approved outfall. A process flow diagram is presented on Plate 9.

Carbon Usage

Groundwater extracted from Recovery Well A-9 will be routed to a particulate filter and then to the carbon adsorption vessels. The carbon vessels have been sized to provide a minimum of 30 days each of treatment at an average anticipated flowrate of 10 gpm and a maximum TPH-Gasoline concentration of 25,000 parts per billion (ppb).

Additional Extraction Wells

Should additional extraction wells be necessary to mitigate ground-water conditions, the proposed system design is capable of treating the additional expected water flow up to a maximum of 50 gpm.

SYSTEM DISCHARGE PERMITS

The interim ground-water extraction and treatment system requires a East Bay Municipal Utility District (EBMUD) Sanitary Sewer System permit for effluent discharge. The EBMUD groundwater discharge flow rate limit is 17 gpm. If additional wells are required and cumulative discharge is above this rate, a National Pollution Discharge Elimination System (NPDES) permit will be requested.

SYSTEM EVALUATION

An interim remedial system evaluation report will be prepared after 60 days of continuous system operation. The report will include a brief site history and evaluation of chemical and potentiometric data as they relate to system performance and efficiency.

The system evaluation will include time-series sampling data which will be performed in conjunction with system activation. Time-series samples will include pre-startup sampling to establish an appropriate baseline, and sample collection at 7, 14, 30 and 60 days after system activation.

If you have any questions, please call.

GeoStrategies Inc. by,

REGISTERED PROFESSIONAL ENGINEER
CARLA FRANCIS
M 19918
MECHANICAL
STATE OF CALIFORNIA

Jeffrey L. Peterson
Environmental Manager
R.E.A. 1021

Carla Francis, P.E.
Project Engineer

JLP/CF/mlg

Table 1.	Historical Ground-water Quality Database
Table 2.	Aquifer Test Results
Table 3.	Remedial Action Alternatives
Plate 1.	Vicinity Map
Plate 2.	Site Plan
Plate 3.	Geologic Cross-Section A-A'
Plate 4.	Geologic Cross-Section B-B'
Plate 5.	Potentiometric Map
Plate 6.	TPH-Gasoline/Benzene Concentration Map
Plate 7.	Well Influence Map
Plate 8.	Simulated Well Influence Map
Plate 9.	Process Flow Diagram

QC Review:
David H. Peterson
Senior Geologist
C.E.G. 1186

REGISTERED GEOLOGIST
DAVID H. PETERSON
No. 1186
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

TABLES

TABLE 1

HISTORICAL GROUND-WATER QUALITY DATABASE

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
21-Mar-86	A-2	31000.	----	----	----	----
07-Jan-88	A-2	12000.	920.	1500.	----	4000.
20-Mar-89	A-2	22000.	1200.	1800.	1200.	7700.
24-May-89	A-2	9000.	460.	260.	250.	2400.
18-Aug-89	A-2	14000.	900.	200.	<200.	1300.
27-Oct-89	A-2	16000.	1200.	340.	90.	3100.
15-Jan-90	A-2	9900.	1100.	460.	150.	2900.
04-Apr-90	A-2	16000.	1100.	400.	380.	3900.
30-Jul-90	A-2	16000.	1400.	340.	290.	3600.
30-Jul-90	A-2	16000.	1400.	340.	290.	3600.
29-Oct-90	A-2	14000.	1100.	210.	66.	2700.
16-Jan-91	A-2	15000.	1200.	800.	190.	4600.
21-Mar-86	A-3	1000.	----	----	----	----
07-Jan-88	A-3	250.	2.3	8.	----	21.
20-Mar-89	A-3	230.	1.6	<1.	3.	3.
24-May-89	A-3	170.	0.9	2.	1.	<3.
18-Aug-89	A-3	180.	0.7	1.	<1.	<3.
27-Oct-89	A-3	120.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-3	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-3	88.	1.2	2.0	0.8	4.
30-Jul-90	A-3	120.	8.3	2.9	2.3	12.
29-Oct-90	A-3	780.	10.	27.	18.	85.
16-Jan-91	A-3	69.	2.0	3.5	<0.5	9.6
20-Mar-89	A-4	360000.	1500.	3700.	6500.	35000.
24-May-89	A-4	1500000.	1000.	2000.	6000.	23000.
04-Apr-90	A-4	40000.	680.	320.	1400.	4900.

TABLE 1

HISTORICAL GROUND-WATER QUALITY DATABASE

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
21-Mar-86	A-5	88.	----	----	----	----
07-Jan-88	A-5	<50.	0.5	1.	----	4.
20-Mar-89	A-5	60.	0.5	1.	2.	10.
24-May-89	A-5	<50.	0.5	<1.	<1.	<3.
18-Aug-89	A-5	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-5	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-5	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-5	<50.	<0.5	<0.5	<0.5	<1.
30-Jul-90	A-5	<50.	<0.5	<0.5	<0.5	<0.5
29-Oct-90	A-5	280.	<0.5	<0.5	<0.5	<0.5
16-Jan-91	A-5	<50.	<0.5	<0.5	<0.5	<0.5
21-Mar-86	A-6	<10.	----	----	----	----
21-Mar-86	A-6	<10.	----	----	----	----
07-Jan-88	A-6	390.	54.	89.	----	110.
20-Mar-89	A-6	220.	33.	21.	9.	39.
24-May-89	A-6	110.	13.	6.	3.	13.
18-Aug-89	A-6	<50.	2.1	1.	<1.	<3.
27-Oct-89	A-6	55.	3.8	1.6	1.7	6.
15-Jan-90	A-6	100.	12.	2.5	5.5	18.
04-Apr-90	A-6	100.	17.	7.1	5.5	18.
30-Jul-90	A-6	<50.	2.6	<0.5	<0.5	1.2
29-Oct-90	A-6	<50.	0.7	<0.5	<0.5	<0.5
16-Jan-91	A-6	<50.	<0.5	<0.5	<0.5	<0.5
07-Jan-88	A-7	<50.	<0.5	1.	----	4.
20-Mar-89	A-7	<50.	0.9	<1.	<1.	<3.
24-May-89	A-7	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-7	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-7	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-7	<50.	<0.5	<0.5	<0.5	<1.

TABLE 1

HISTORICAL GROUND-WATER QUALITY DATABASE

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
04-Apr-90	A-7	<50.	<0.5	<0.5	<0.5	<1.
30-Jul-90	A-7	<50.	<0.5	<0.5	<0.5	<0.5
29-Oct-90	A-7	<50.	2.7	7.6	1.1	3.0
16-Jan-91	A-7	<50.	<0.5	<0.5	<0.5	<0.5
07-Jan-88	A-9	300.	45.	14.	----	43.
21-Mar-89	A-9	50.	2.8	1.	1.	3.
24-May-89	A-9	120.	26.	12.	4.	79.
18-Aug-89	A-9	14000.	400.	800.	400.	2000.
27-Oct-89	A-9	1700.	150.	36.	30.	110.
15-Jan-90	A-9	860.	140.	58.	38.	140.
04-Apr-90	A-9	620.	36.	13.	9.4	32.
30-Jul-90	A-9	180.	77.	1.6	2.1	4.2
29-Oct-90	A-9	110.	30.	3.7	4.1	8.3
16-Jan-91	A-9	<50.	15.	<0.5	<0.5	0.6
07-Jan-88	A-10	<50.	0.6	11.	----	4.
20-Mar-89	A-10	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-10	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-10	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-10	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-10	<50.	<0.5	<0.5	<0.5	<1.
30-Jul-90	A-10	<50.	<0.5	<0.5	<0.5	<0.5
29-Oct-90	A-10	<50.	2.3	6.9	1.2	3.0
16-Jan-91	A-10	<50.	<0.5	<0.5	<0.5	<0.5
07-Jan-88	A-11	<50.	1.1	2.	----	5.
20-Mar-89	A-11	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-11	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-11	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-11	<50.	<0.5	<0.5	<0.5	<1.

TABLE 1

HISTORICAL GROUND-WATER QUALITY DATABASE

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
15-Jan-90	A-11	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-11	<50.	<0.5	<0.5	<0.5	<1.
30-Jul-90	A-11	<50.	<0.5	0.6	<0.5	0.5
29-Oct-90	A-11	<50.	0.6	2.4	0.6	1.5
16-Jan-91	A-11	<50.	<0.5	<0.5	<0.5	<0.5
07-Jan-88	A-12	<50.	<0.5	2.	----	<4.
20-Mar-89	A-12	<50.	<0.5	<1.	<1.	<3.
24-May-89	A-12	<50.	<0.5	<1.	<1.	<3.
18-Aug-89	A-12	<50.	<0.5	<1.	<1.	<3.
27-Oct-89	A-12	<50.	<0.5	<0.5	<0.5	<1.
15-Jan-90	A-12	<50.	<0.5	<0.5	<0.5	<1.
04-Apr-90	A-12	<50.	<0.5	<0.5	<0.5	<1.
30-Jul-90	A-12	<50.	<0.5	<0.5	<0.5	<0.5
29-Oct-90	A-12	<50.	<0.5	<0.5	<0.5	<0.5
16-Jan-91	A-12	<50.	<0.5	<0.5	<0.5	<0.5

TABLE 1

HISTORICAL GROUND-WATER QUALITY DATABASE

Current Regional Water Quality Control Board Maximum Contaminant Levels
Benzene 1. ppb Xylenes 1750. ppb Ethylbenzene 680. ppb

Current DHS Action Levels Toluene 100.0 ppb

TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline
PPB = Parts Per Billion
NOTE: 1. DHS Action levels and MCL's are subject to change pending State of California review.
2. All data shown as <X are reported as ND (none detected).
3. Ethylbenzene & Xylenes were combined in 1986 and 1988.

TABLE 2

AQUIFER TEST RESULTS

WELL NO.	PUMP RATE (gpm)	PUMPING DURATION (Min.)	MAXIMUM DRAWDOWN (Ft.)	COOPER-JACOB METHOD		NEUMAN METHOD	
				(1) T	(2) S	(1) T	(3) SY
A-3	12	1116	2.07	1092	$1.25x10^{-2}$	996	$1.74x10^{-2}$
A-4	12	1116	3.44	2170	$3.19x10^{-4}$	2081	$1.02x10^{-3}$
A-5	12	1116	3.62	2044	$5.08x10^{-4}$	2389	$2.82x10^{-3}$
A-6	12	1116	1.06	2215	$4.24x10^{-6}$	1731	$9.01x10^{-3}$
A-7	12	1116	1.17	2364	$6.48x10^{-3}$	2081	$9.65x10^{-3}$
A-8	12	1116	3.51	1625	$7.27x10^{-3}$	2179	$5.32x10^{-3}$
A-9	12	1116	4.55	(6)	(6)	(4) 2170	(7)
A-10	12	1116	3.53	(5)	(5)	2282	$2.42x10^{-3}$
A-11	12	1116	3.13	2247	$6.68x10^{-4}$	2282	$1.36x10^{-3}$
A-12	12	1116	2.11	2668	$1.18x10^{-2}$	2502	$1.86x10^{-3}$

1. T = Transmissivity (gpd/ft)
2. S = Storativity (dimensionless)
3. SY = Specific Yield (volume of delayed drainage from storage per unit drawdown per unit horizontal area)
4. Transmissivity value determined by Harrill/Recovery Method.
5. Insufficient late test data to use Cooper-Jacob Method.
6. Cooper-Jacob valid for observation wells only.
7. SY not completed as part of Harrill/Recovery Method.

TABLE 3

REMEDIAL ACTION ALTERNATIVES

TECHNICAL FACTORS

REMEDIAL ACTION	DESCRIPTION	APPLICATION	ADVANTAGES	DISADVANTAGES	DETAILED EVALUATION REQUIRED	RATIONALE FOR ELIMINATION FROM CONSIDERATION
QUARTERLY MONITORING/ SAMPLING AND/OR TRANSPORT MODELING (PASSIVE)	Water-level data and ground-water samples are collected/analyzed 4 times annually	Tracking ground-water flow and plume attenuation	1) Can be used in low permeability soils 2) Allows for natural plume attenuation 3) Minimum site disturbance 4) Can be used with other technologies	1) Relies on Passive remediation 2) Not appropriate without subsurface definition 3) No hydrodynamic control 4) May not receive site closure	No	1) Floating product onsite 2) Dissolved plume onsite
SUBSURFACE BARRIERS (PASSIVE)	Low permeability cut-off walls or diversions	Construction of a barrier into shallow low-permeability materials to provide plume containment	1) Plume containment 2) Used to segregrate multiple plumes from different sources 3) Protection from plume(s) migrating onto the site	1) Containment not remediation 2) Area within containment wall subject to flooding 3) Wall material chemical compatibility with containment difficult to achieve 4) Disruptive to site activities 5) May not receive site closure	No	1) Represents containment not remediation 2) Logistics and accessibility problems 3) Not economically feasible
PRODUCT-ONLY RECOVERY (ACTIVE)	Remove floating product from ground water surface	Uses skimmers, pumps, or bailers to remove free-phase product	1) Contaminate source reduction 2) Immediate application 3) No discharge permits required	1) No hydrodynamic control 2) Limited areal extent 3) Product storage permit required	No	1) Absence of hydrodynamic control may allow dissolved plume to migrate offsite

TABLE 3

REMEDIAL ACTION ALTERNATIVES

TECHNICAL FACTORS

REMEDIAL ACTION	DESCRIPTION	APPLICATION	ADVANTAGES	DISADVANTAGES	DETAILED EVALUATION REQUIRED	RATIONALE FOR ELIMINATION FROM CONSIDERATION
VAPOR EXTRACTION (ACTIVE)	Use of vapor collection points to remove hydrocarbons from soil	Remove residual concentrations of contamination	1) Free-product remediation in soils 2) In-Situ soil remediation 3) Eliminates/reduces source contamination 4) Reduces further potential ground-water contamination 5) Control nuisance conditions (i.e. vapors in buildings, utilities, etc.) 6) May enhance natural aerobic biodegradation 7) Minimum site disruption	1) Vapor discharge permit required 2) No hydrodynamic control 3) Noise abatement may be required	No	1) Low permeability may not allow for adequate air movement through tight soils 2) Limited soil data available
GROUND-WATER EXTRACTION (ACTIVE)	Pump contaminated groundwater and discharge to permitted outfall	Provide hydrodynamic control of local ground-water and mitigate hydrocarbon plume	1) Achieves hydro-dynamic control of local groundwater 2) Plume containment 3) Verifiable plume mitigation and cleanup to obtain site closure 4) Minimum disruption to site activities	1) Not effective for soils contamination 2) May contaminate clean soils 3) Requires long-term maintenance 4) Water discharge permit required	Yes	

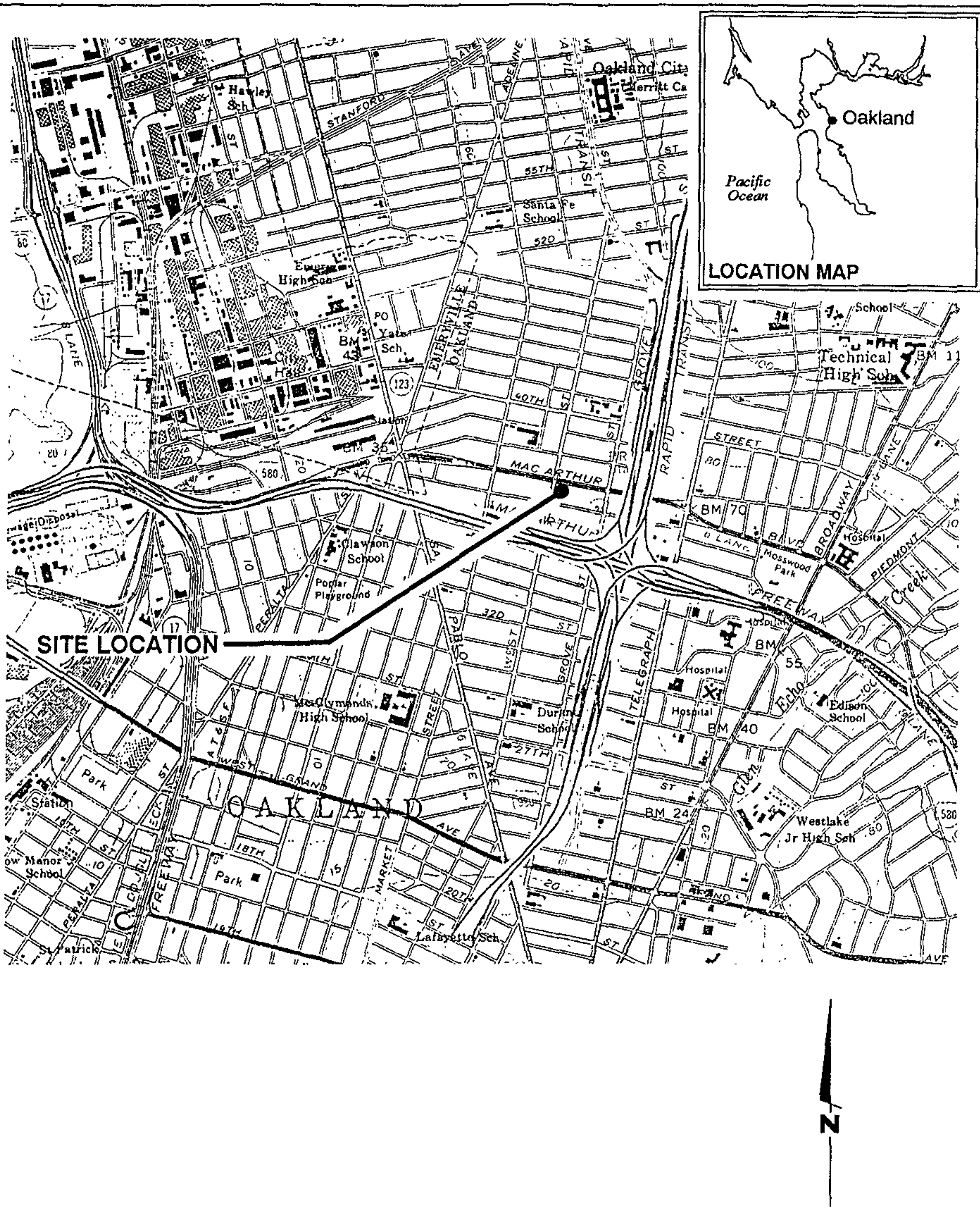
TABLE 3

REMEDIAL ACTION ALTERNATIVES

TECHNICAL FACTORS

REMEDIAL ACTION	DESCRIPTION	APPLICATION	ADVANTAGES	DISADVANTAGES	DETAILED EVALUATION REQUIRED	RATIONALE FOR ELIMINATION FROM CONSIDERATION
IN-SITU BIOREMEDIATION (ACTIVE)	Uses micro-organisms to decompose contaminants	Microorganisms stimulated to use contamination as a food source	1) Minimum site disruption 2) "Cleans" aquifer matrix 3) Can achieve results for obtainment of site closure	1) Mounding may be difficult to control 2) Potential for plume spreading 3) Requires continual monitoring of micro-organism population 4) Microorganism imbalance can result in well screen blockage 5) Requires O2 balance to maintain microorganisms	No	1) Low permeabilities may not permit injection and control of micro-organisms through aquifer 2) Aquifer complexity may result in poor system control
EXCAVATION (ACTIVE)	Removal of contaminated soils	Excavate soils with high concentrations of contamination to reduce source contamination	1) Effective for soils 2) Effective for source contamination 3) Effective for on-site aeration and reuse of existing soils 4) May minimize ground-water contamination	1) No hydrodynamic control 2) Depth limitations 3) Disposal options limited 4) Relocation of contamination versus remediation 5) Disruptive to site activities 6) Potential releases of vapors to atmosphere 7) Effective for on-site contamination only	No	1) Limited soil data available

ILLUSTRATIONS



Base Map: USGS Topographic Map

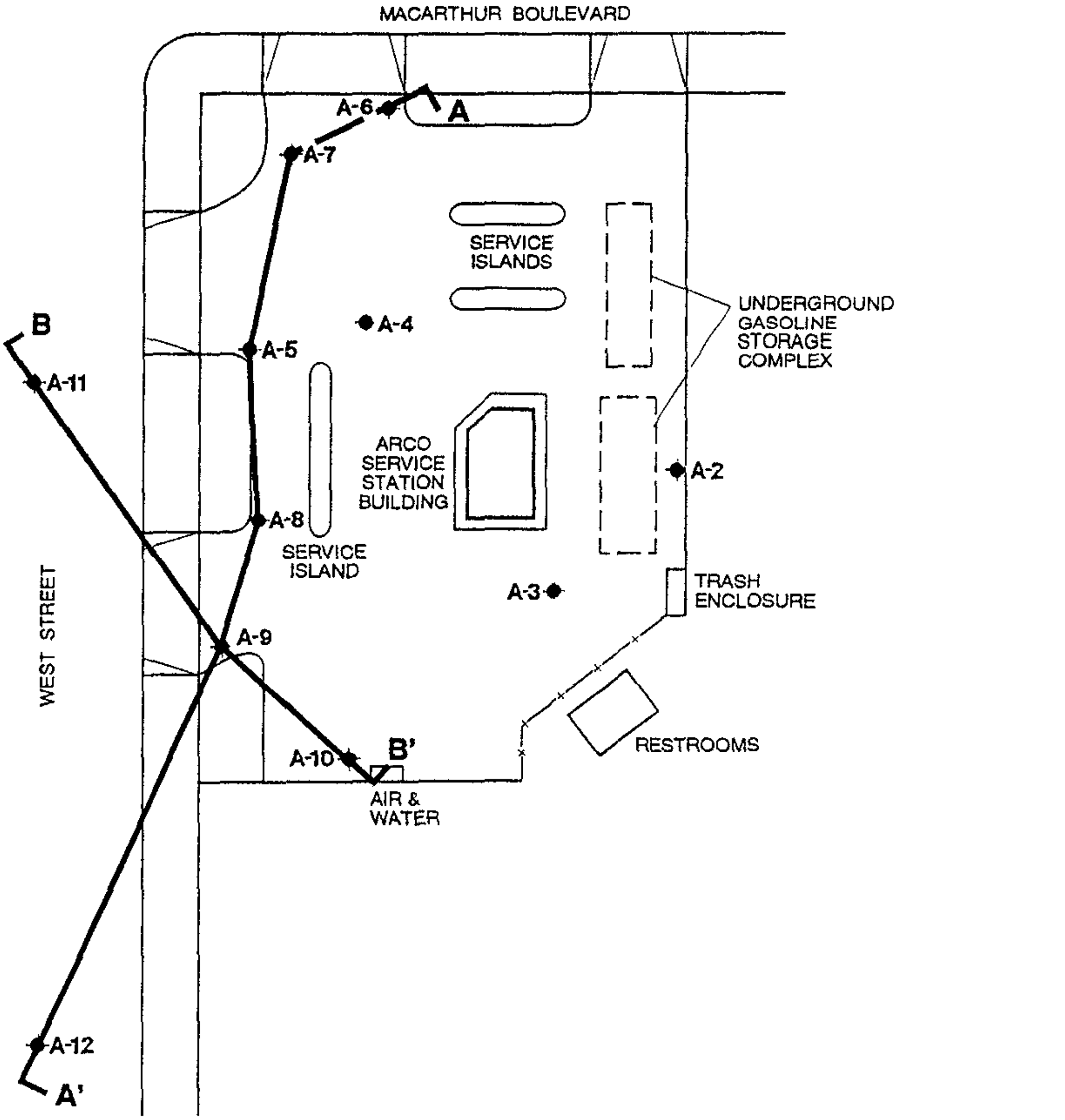
Approximate Scale : 1" = 2000'

GSI GeoStrategies Inc.

Vicinity Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
7909		1/90		



EXPLANATION

- A-2 — Ground-water monitoring well location
- Cross section

Note: Boring logs not available for Wells A-2 through A-4

N

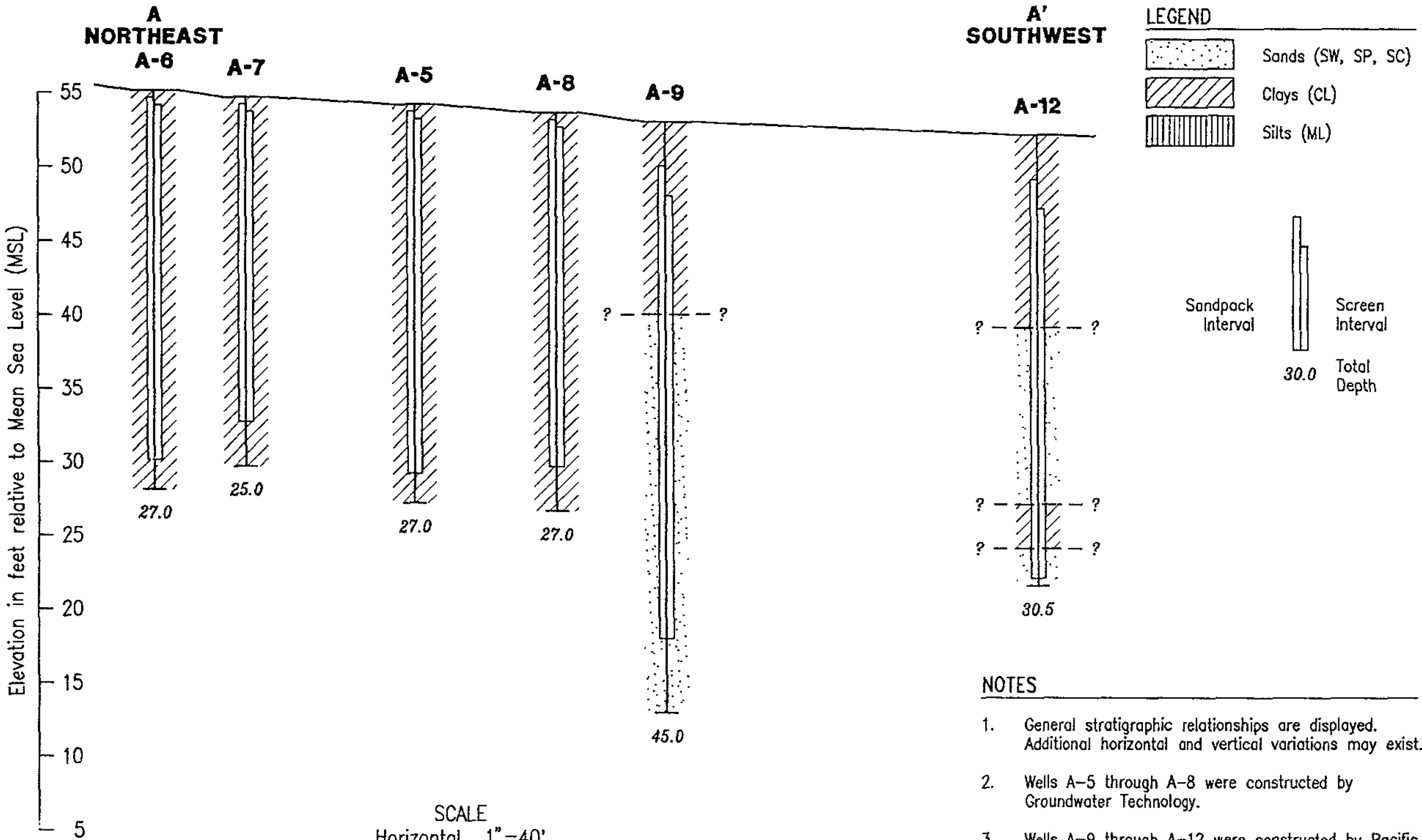
Scale in Feet: 0, 40, 80

GSI GeoStrategies Inc.

Site Plan
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE 2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
790904-11	DHP	5/91		



SCALE
Horizontal 1"=40'
Vertical 1"=10'

NOTES

1. General stratigraphic relationships are displayed. Additional horizontal and vertical variations may exist.

2. Wells A-5 through A-8 were constructed by Groundwater Technology.

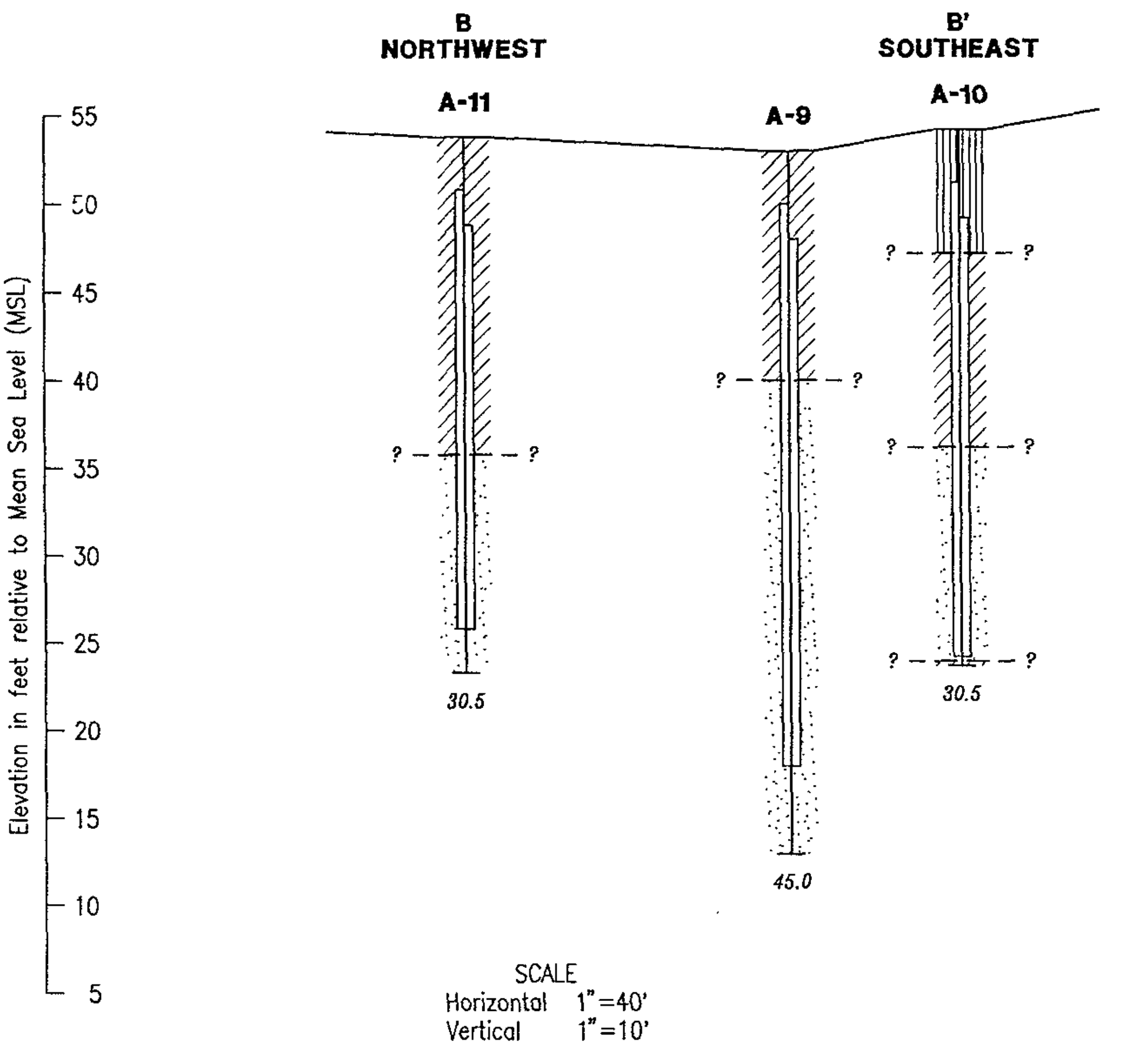
3. Wells A-9 through A-12 were constructed by Pacific Environmental Group.

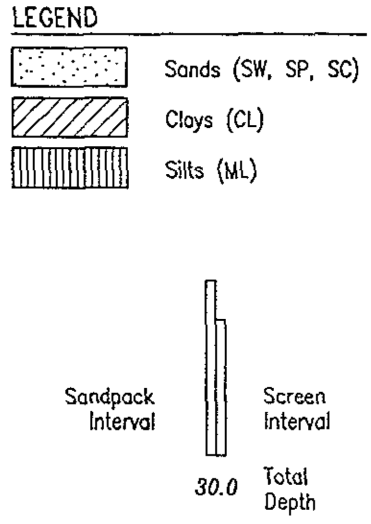
GeoStrategies Inc.

CROSS SECTION A-A'
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
3

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
790904-11	DHP	5/91	





NOTES

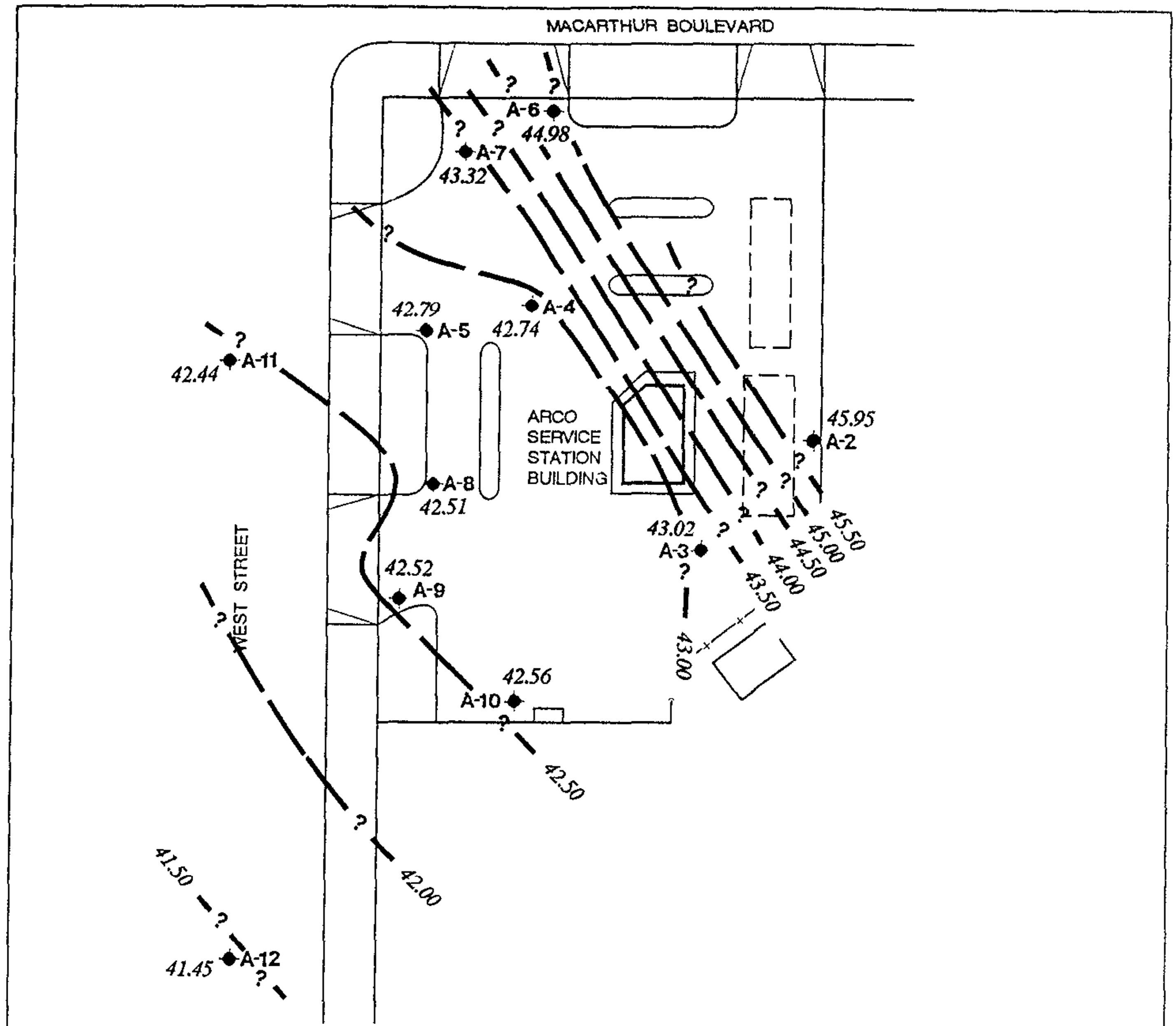
1. General stratigraphic relationships are displayed. Additional horizontal and vertical variations may exist.
2. Wells A-5 through A-8 were constructed by Groundwater Technology.
3. Wells A-9 through A-12 were constructed by Pacific Environmental Group.

GeoStrategies Inc.

CROSS SECTION B-B'
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
4

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
790904-11	DHP	5/91	



EXPLANATION

A-2 Ground-water monitoring well location

41.50 Ground-water elevation contour
Approximate Gradient = 0.05

41.45 Ground-water elevation in feet referenced to Mean Sea Level (MSL) measured on **January 16, 1991**

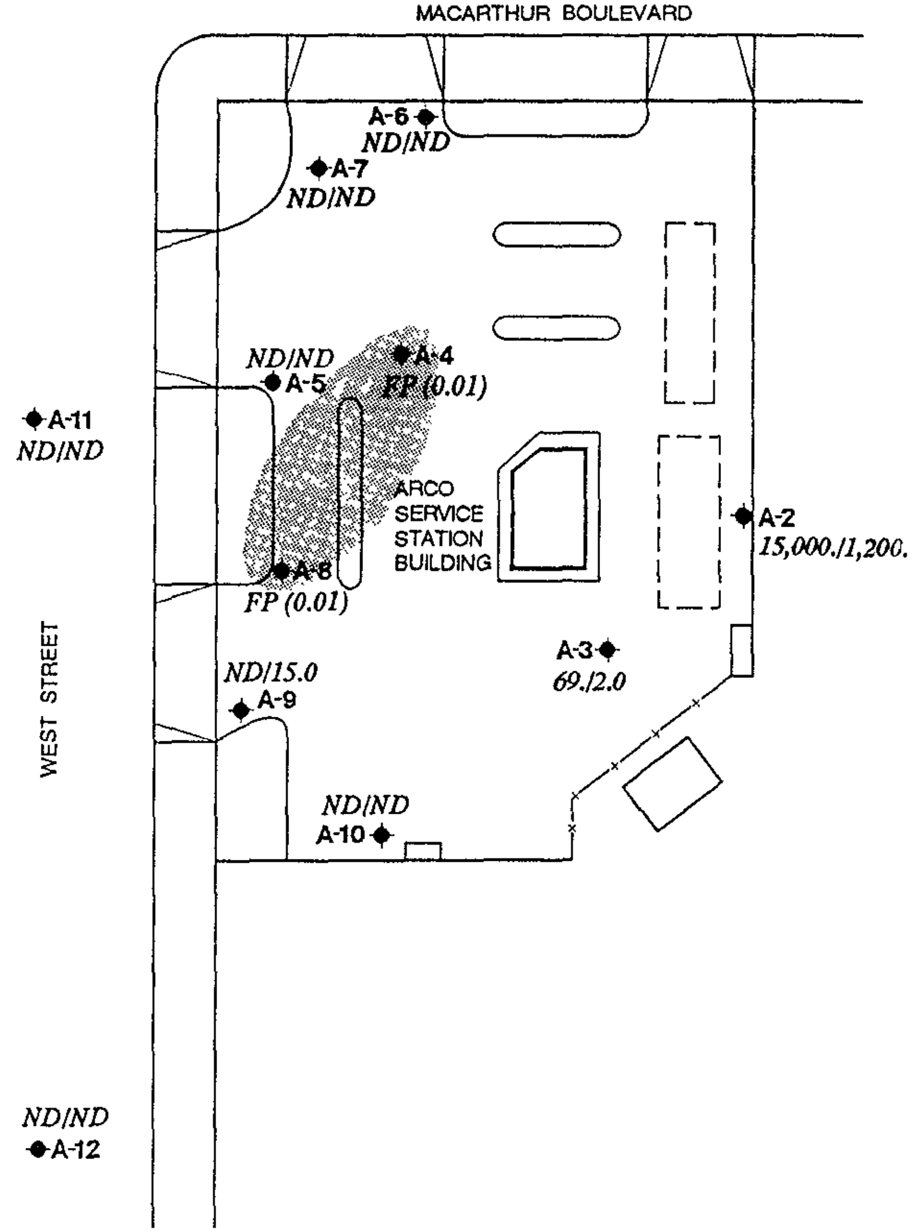
0 40 80
Scale in Feet

GSI GeoStrategies Inc.

Potentiometric Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

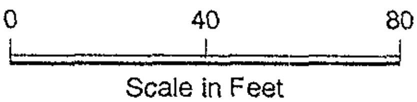
PLATE **5**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
790904-11	DHP/QLP	2/91	5/91	



EXPLANATION

◆ A-2	Ground-water monitoring well location
69./2.0	TPH-G (Total Petroleum Hydrocarbons calculated as Gasoline)/Benzene concentrations in ppb sampled on **January 16, 1991**
ND	Not Detected (see laboratory reports for detection limits)
FP (0.01)	Approx. Area of Floating Product (measured thickness in feet)

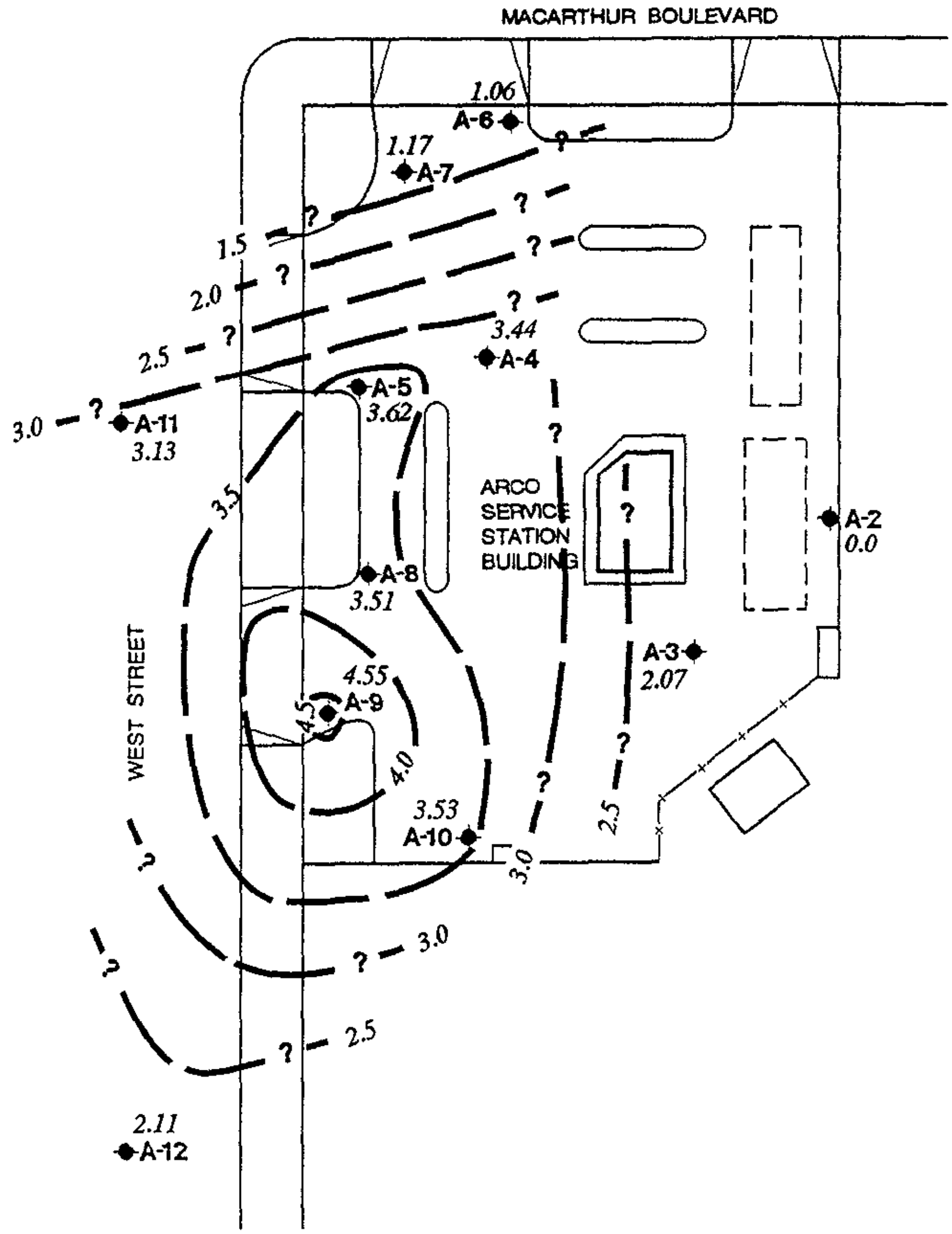


GSI GeoStrategies Inc.

TPH-G/Benzene Concentration Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE **6**

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
790904-11	DHP/9.2P	2/91	5/91	



EXPLANATION

◆ A-2	Ground-water monitoring well location
3.0 ⁄	Drawdown contour
2.11	Drawdown in feet relative to static water level after pumping Well A-9 for 1270 min. on April 5, 1991; 154 min. step-test, 1116 min. constant-rate test.

N

0 40 80

Scale in Feet

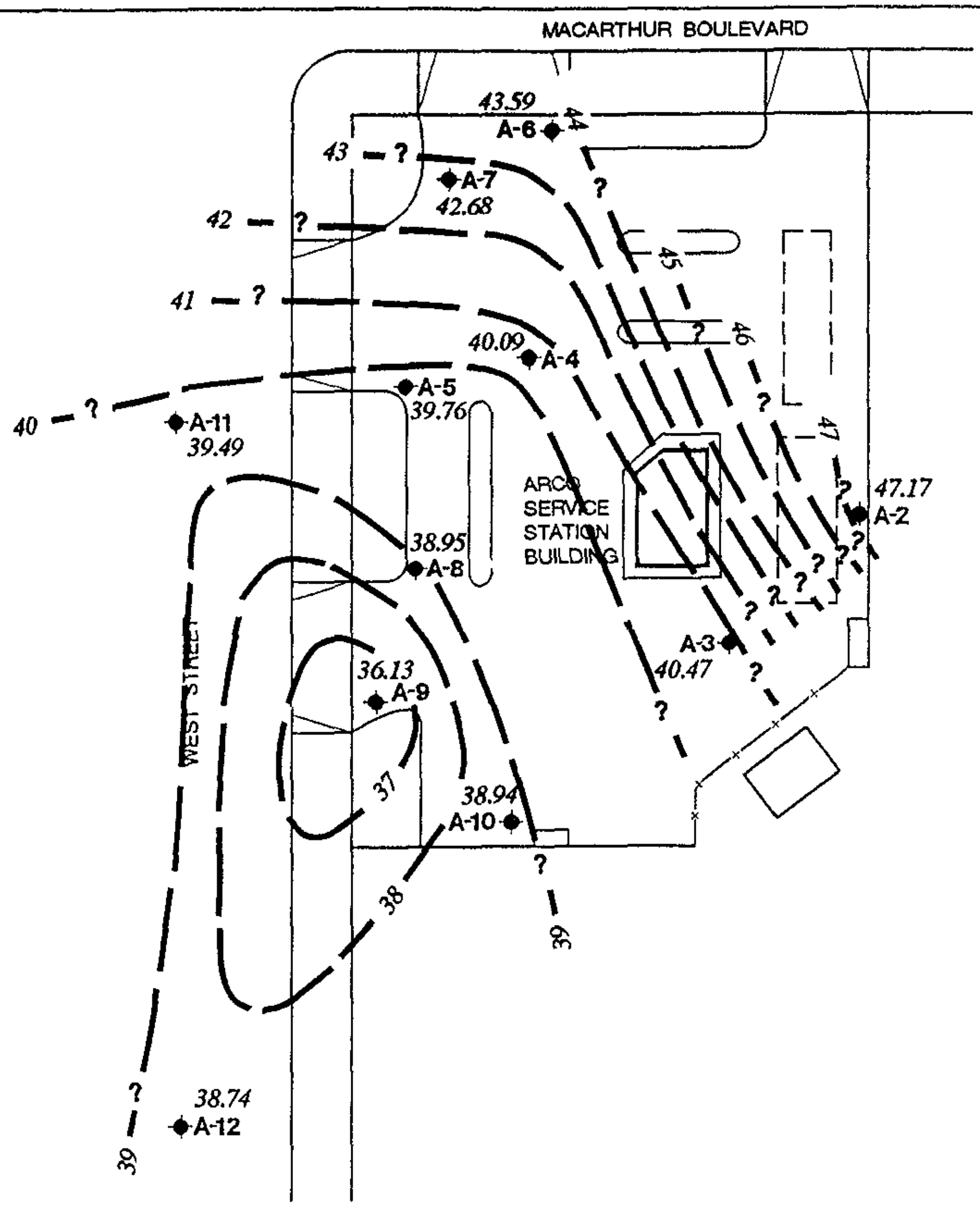
GSI GeoStrategies Inc.

Well Influence Map

ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE 7

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
790904-11	DHP/JJP	5/91		



EXPLANATION

◆ A-2 Ground-water monitoring well location

40 Computer simulated ground-water elevation contour in feet by pumping Well A-9 at 12 gpm for approximately 30 days.

38.74 Computer simulated ground-water elevation approximated to Mean Sea Level (MSL)

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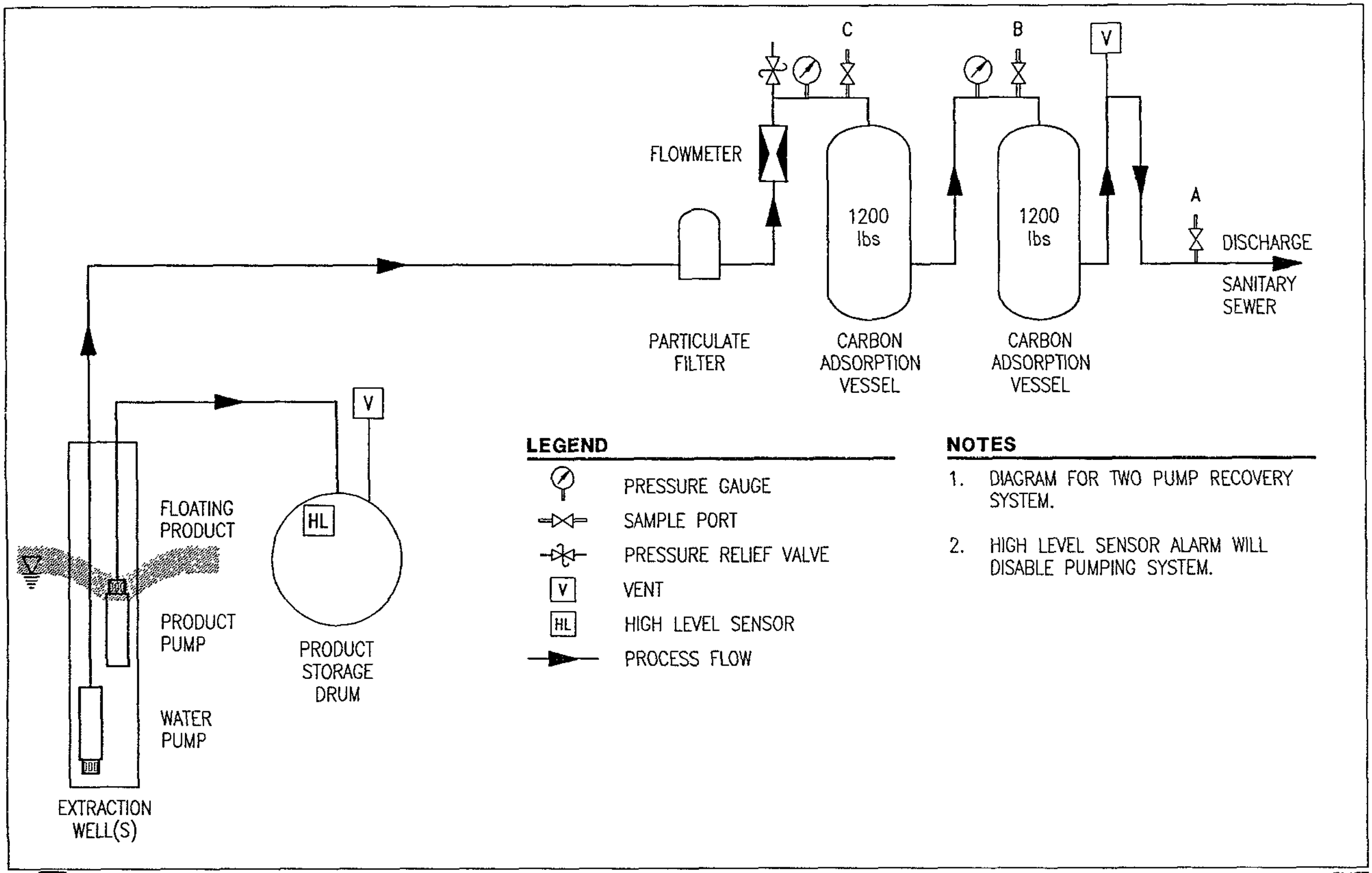
Simulated Well Influence Map
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE
8

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE	REVISED DATE
790904-11	DHP/	5/91		



GSI GeoStrategies Inc.

PROCESS FLOW DIAGRAM
ARCO Service Station #4931
731 W. MacArthur Boulevard
Oakland, California

PLATE **9**

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
790904-11	CJ	5/91	