Applied GeoSystems, Inc.
A RESNA Company

RESNA
Working To Restore Nature

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ADDENDUM FOUR TO WORK PLAN
INTERIM GROUNDWATER REMEDIATION

at

ARCO Station 601
712 Lewelling Boulevard
San Leandro, California

69034.07 3/6/92

Prepared for

ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

by

RESNA Industries, Inc.

March 5, 1992

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March 5, 1992
69034-07.A4F
69034.07

Mr. Chuck Carmel
ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

Subject: **Addendum Four** to Work Plan for Interim Groundwater Remediation at ARCO Station 601, 712 Lewelling Boulevard, San Leandro, California.

Dear Mr. Carmel:

At the request of ARCO Products Company (ARCO), RESNA Industries, Inc. (RESNA) has prepared this Addendum Four to the Work Plan for **interim remediation of onsite hydrocarbon-impacted groundwater at the above-subject site.** The original Work Plan for Subsurface Investigations and Remediation was submitted to ARCO and governing regulatory agencies in March 1991. The location of the subject site is shown on the Site Vicinity Map, Plate 1.

This Addendum Four, a Remedial Action Plan (RAP), will need to be approved by the Regional Water Quality Control Board (RWQCB) and the Alameda County Health Care Services Agency (ACHCSA), prior to installation and operation of the proposed interim groundwater remediation system.

The proposed scope of work under this RAP consists primarily of the engineering design, permitting, construction, and start-up of an interim groundwater remediation system at the above subject site. The proposed interim remediation system is intended to extract and treat petroleum hydrocarbon bearing groundwater and constrain the migration of hydrocarbon constituents.

PREVIOUS WORK

A summary of previous work performed at this site by RESNA (formerly Applied GeoSystems [AGS]) and others is included in the Work Plan for Subsurface Investigations

and Remediation referenced above (AGS, March 1991). Addendum One to this Work Plan, detailing the proposed subsurface investigation and a vapor extraction test (VET) to be performed, was also submitted for review and approval to ARCO, RWQCB and ACHCSA (AGS, March 1991). RESNA completed all proposed phases of work outlined in Addendum One by September 1991. Results of the work completed are summarized in the "Subsurface Environmental Assessment and Vapor Extraction Test Report" (RESNA, October 1991). The Generalized Site Plan, Plate 2, shows the location of the existing onsite and offsite wells. Table 1 summarizes the cumulative results of laboratory analyses of water samples collected during quarterly monitoring of onsite wells since July 1990.

Briefly summarized, based on results of previous investigations conducted by RESNA and others, RESNA concludes the following:

- The majority of gasoline and waste-oil hydrocarbons at concentrations above 100 parts per million (ppm) in the soil at the site, outside the immediate areas of the former gasoline-storage and waste-oil-storage tanks, appear to be within or just above the layer of interbedded clayey sand to silty clay at depths between five and eleven feet below grade. The presence of water in this relatively permeable zone appears to have facilitated the movement of gasoline and waste-oil hydrocarbons laterally.

- The lateral extent of hydrocarbons in the soil associated with the former gasoline-storage tanks at the site has been delineated below 100 ppm total petroleum hydrocarbons reported as gasoline (TPHg) in the southern part of the site (to 8.4 ppm in B-13/MW-8 and to 23 ppm in B-12/MW-7), and northwest of the former gasoline tank excavation (to 15 ppm in B-7/MW-2), and in the eastern portion of the site (B-11/MW-6). The lateral extent of TPHg the soil has not been delineated below 100 ppm in the western (B-8/MW-3 and B-9/MW-4) and northeastern (B-10/MW-5) areas of the site.

- The lateral extent of hydrocarbons in the soil associated with the former waste-oil-storage tank has been delineated to total oil and grease (TOG) levels of less than 30 ppm, south (B-12/MW-7) and downgradient (to the southwest) (B-13/MW-8) of the former waste-oil tank excavation.

- The vertical extent of TPHg in the soil beneath the site has been delineated to less than 1.0 ppm or less than 10 ppm at depths of eleven and a half to sixteen and a half feet below ground surface with the exception of the eastern vicinity of the former gasoline tanks and near the former waste-oil tank. The vertical extent of hydrocarbons associated with the former waste-oil tank has not been delineated in the vicinity of this former tank.

- The lateral and vertical extents of petroleum hydrocarbons in the groundwater have not been delineated at the site with the exception of waste-oil related hydrocarbons which have been delineated to less than 5 ppm southwest of the former waste-oil tank pit excavation.

- A potential source of gasoline hydrocarbons reported in the groundwater may be the gasoline hydrocarbons reported in the soil of the former gasoline tank excavation.

- Tank leaks were reported at the Shell station and Greenhouse Plaza sites located across Lewelling Boulevard, relatively upgradient to ARCO Station 601. Several other facilities with identified tank leaks are located within approximately 1/6-mile radius of the site.

- Laboratory results of air samples and field organic vapor measurements taken at MW-1, MW-4, MW-5, MW-6, and MW-8 during the vapor extraction test (VET) indicated that significant levels of petroleum hydrocarbons exist throughout a major portion of the site.

- The VET also showed that the conditions of high groundwater table (about eight to eleven feet below grade), and low permeability soils appear to preclude sustaining significant vapor extraction flow rates using vertical vapor extraction wells.

DESCRIPTION OF PROPOSED INTERIM GROUNDWATER REMEDIATION SYSTEM

The purpose of the proposed interim groundwater remediation system is to contain and capture the onsite hydrocarbon plume, and to remediate the hydrocarbon-impacted groundwater beneath the site to hydrocarbon concentration levels acceptable to the RWQCB and ACHCSA for closure of the site. After the interim groundwater remediation system is installed, the adequacy of the capture zone achieved with the interim remediation system will be reassessed. Plates 3 and 4 depict the proposed remediation site plan and the process flow schematic of the interim groundwater remediation system, respectively.

After discussions with ARCO, RESNA proposes a passive interim groundwater remediation system similar to a French drain. This passive recovery system is necessary due to the projected low pumping rates of less than 0.5 gallons per minute [gpm] associated with silty clay soils (low aquifer yield) encountered at the site, the migration of hydrocarbon-impacted groundwater offsite towards the west property line, and due to the existing shallow groundwater table at the site (eight feet below grade). The groundwater collection pipes

will be installed near the west, north west and southern property lines at approximately eight to twelve feet below grade in sand bedding. The collection pipe will be sloped so as to gravity drain to a collection sump at the remediation compound. Plate 3 shows the location of the drain pipes and the remediation compound. The sump, approximately 12-feet deep will be equipped with a sump pump, controlled by an automatic high and low level indicator switch which will turn on/off the sump pump, a mechanical flowmeter, an overheating circuit breaker, sample port, flow control valve, and a well vault with a traffic rated cover.

Extracted water from the sump will be pumped to the groundwater treatment system which will consist of a 150 gallon storage tank, a 20 micron filter to remove particulate, and two in-series 400 pound liquid phase activated carbon canisters (Plate 4). The carbon canisters will ensure that effluent water discharged to the onsite sewer lateral (Plate 3) will meet the discharge requirements set forth by the Ora Loma Sanitary District (OLSD). A totalizing flowmeter will be installed in the effluent water pipe connected to the onsite sewer lateral. It is estimated that the groundwater treatment system will need to operate for a minimum of two to five years. Enclosed in Attachment A are typical manufacturer's specifications on liquid phase carbon. The removal rates for using a system containing activated carbon are greater than 99%. Attachment B summarizes results of water balance calculations that predict a liquid phase carbon changeout frequency of about three and a half months per canister.

RESNA has installed as an interim floating product remediation system passive floating product skimmers in monitoring wells MW-3, and MW-5. Floating product collected in the skimmer is disposed of when full or on a monthly basis per governing regulations. With continuous operation of the groundwater remediation system, floating product levels in impacted groundwater are expected to decrease with time. Any floating product collected in the collection sump at the remediation compound will either be pumped to an aboveground storage tank or will be disposed on a regular basis. The sump will be equipped with a level sensor that will shut off the pump and the groundwater treatment system if the level of floating product rises to approximately six inches below the pump intake. This will ensure that no product is pumped through the liquid-phase carbon canisters, thus preventing violation of the wastewater discharge permit levels for hydrocarbons.

As a part of spill prevention and containment, the storage tank and the two liquid-phase carbon canisters will be installed in double containment tanks with overfill protection. Other preventive measures will include: a pressure indicator installed on the carbon canisters to prevent over-pressurizing the canisters; two high and one low level indicators in the storage tank; the control of the transfer pump by the high and low level indicator to transfer water from the storage tank to the two carbon canisters and to the sewer; the shutdown of the upstream sump pump by the other high level indicator in the storage tank

to prevent overfilling of the tank; a high pressure switch and indicator to shutoff the transfer pump in event of the particulate filter being plugged; and a remote monitoring system to continuously monitor and periodically report the process variables which can influence the systems' performance and cause an alarm or shut-down condition. **When any alarm conditions are triggered the remote monitoring system will notify RESNA's San Jose office personnel by facsimile so the condition can be readily rectified prior to system restart.** Any system failure causing a release will be reported immediately to the OLSD and a written report will be filed with OLSD within five working days of any such release.

Sewer Discharge Requirements

The treatment system will be designed to meet the OLSD's sewer discharge requirements. Discharge requirements for treated groundwater as set by OLSD are as follows:

Pollutant	Limit
TPH	15 ppm
Lead	1 ppm
Zinc	3 ppm
Chromium	0.5 ppm
Cadmium	0.2 ppm
Nickel	1.0 ppm
Benzene	ND
Toluene	ND
Ethylbenzene	ND
Total Xylenes	ND

ppm = parts per million.
ND = Below laboratory detection limits. The groundwater remediation system will be designed to treat extracted groundwater to typical benzene, toluene, ethylbenzene and total xylene detection limits of 0.5 ppb.

PROPOSED SCOPE OF WORK

Based on results of previous subsurface investigations, RESNA proposes the following project Tasks 1 through 7, listed below, as a method of approach to remediate hydrocarbon-impacted groundwater at the site.

These tasks outlined below are described in detail in ensuing sections:

- Task 1. Remedial Action Plan
- Task 2. Design of Plans and Specifications

- Task 3. Building and Discharge Permits
- Task 4. Bid Package and Evaluation
- Task 5. Construction and Construction Inspection
- Task 6. System Startup and Operation
- Task 7. System Startup Report.

Task 1. Remedial Action Plan (RAP)

Prepare and submit this Remedial Action Plan (RAP, Addendum Four to the Work Plan) to the RWQCB and ACHCSA for review, comment, and approval, prior to groundwater remediation system installation and operation. This RAP describes the proposed interim groundwater remediation system detailed above, its design, installation and proposed operation and maintenance. A preliminary schedule of work, including a construction schedule, is presented. Engineering drawings are included as appropriate.

Task 2. Design of Plans and Specifications

Work under this task includes: engineering calculations; bill of materials; preparation of approximately 70 % complete Plans and Specifications including site and remediation compound layouts; trench and section details, process and instrumentation diagram (P&ID), and a one line electrical diagram; in-house plan check and review; and one set of revisions to the Plans and Specifications by ARCO. On completion of the Plans and Specifications, the Plans will be ready to be submitted to the local City Building, Planning and Fire Departments for approval, prior to installation. One set of revisions to the Plans and Specifications is planned, to incorporate changes by the City Building Department. Also under this task, RESNA personnel will meet with Pacific Gas & Electric Company (PG & E) and City of San Leandro personnel to discuss electrical service requirements, the proposed discharge point and City requirements for sewer hookup.

Task 3. Building and Discharge Permits

An OLSD Wastewater Discharge Permit will be completed and submitted to the Industrial Waste Department of OLSD for approval, in order to discharge treated groundwater to the sewer. The sewer permit application will include a site history, analytical results for heavy metals, VOCs, and any other suspected pollutants.

Since no off-gas from the groundwater treatment system will be emitted, an air permit from the Bay Area Air Quality Management District (BAAQMD) will not be necessary to allow for construction of the proposed groundwater remediation system. The complete set of Plans and Specifications will be submitted to the City of San Leandro Building, Planning and Fire Departments for review, comment, and final approval prior to construction and

installation of the remediation system. As a part of the permit approval process, the City Building Department will inspect all open utility trenches carrying water lines prior to their closure and tie-in to the aboveground groundwater treatment system.

Task 4. Bid Package and Bid Evaluation

After the design is completed, a bid package will be prepared for submittal to construction contractors. A minimum of three pre-qualified contractors will receive the bid package. One meeting with each contractor is included under this task, as well as time to answer contractor questions. This will not be a publicly advertised Bid Period with sealed bids. One site visit with each contractor is also planned. Contractor bids will be evaluated and recommendations made for award of the construction contract.

Task 5. Construction and Construction Inspection

Upon approval of the RAP and after having secured the City Building, Fire and Planning Department Permits, and on selection of a general contractor, system installation in accordance with the approved Plans and Specifications will be initiated. System installation will include: capital equipment procurement (liquid phase carbon, filter, and the storage tank); construction of utility trenches to contain all necessary water, vapor and electrical lines; installation of necessary underground pipes and electrical conduits to and from the proposed treatment compound; pressure testing of lines for leaks; construction of the sump; City inspection of utility trenches and sump prior to closure; construction of the remediation compound; electrical service and sewer hookups; Pacific Bell hookup for the remote monitoring system; and installation and plumbing of all soil and groundwater remediation equipment. **Horizontal vapor pipes will also be installed in the groundwater recovery trenches at five feet below grade to allow for vapor extraction at a later date if deemed necessary.** These vapor pipes will be capped to prevent water infiltration.

Task 6. System Startup and Operation

System Monitoring

After completion of system installation, and after approval by the City for continuous discharge, operation of the proposed interim groundwater remediation system will be initiated in compliance with all applicable regulatory agencies. Startup procedures will include system monitoring, maintenance and sampling for the first five days of operation. Operation and maintenance of the groundwater remediation system, described previously, typically include: daily site inspections the first five days of operation; site visits once every week for the first month; and once every two weeks for the next one month. The remote monitoring system will be on line 24 hours per day throughout system operation. After the

first two months of operation, site visits will be made at a minimum once every month for the remainder of the life of the remediation system. Modifications to this typical schedule will be made if additional requirements are specified by the guidelines set forth by OLSD, and as necessary.

Site inspections will include: monitoring and adjustment of systems parameters to optimize groundwater remediation system efficiency; periodic sampling of influent and effluent to the groundwater treatment system as required by OLSD; other periodic maintenance procedures including inspection and cleaning of all lines, process equipment, carbon changeout, etc. Results of periodic sampling of system influent and effluent water as required by OLSD during the startup phase and later months of operation will be used as an indication of the frequency of carbon changeout required. A totalizing flow meter will be installed to determine the quantity of treated ground water discharged to the sewer. A remote monitoring system will be installed to continuously monitor and periodically report the variables which can influence the systems' performance and cause an alarm condition. The monitoring system will also notify RESNA's San Jose office when an alarm condition exists.

System Sampling

In accordance with typical OLSD permit requirements, during the startup phase, influent and effluent samples to the interim groundwater remediation system will be taken daily for the first five days of operation and every week thereafter for the next one month after which sample collection will be performed once every two weeks for the second month of operation. After the first two months of operation, sample collection will be on a monthly basis for the life of the remediation system. Water samples collected will be analyzed for petroleum hydrocarbons, and other required constituents as set by OLSD in the wastewater discharge permit. If at any time the results of laboratory analysis show discharge parameters to be exceeded, a confirmation sample will be taken immediately and analyzed on a 24 hour turnaround basis. If discharge parameters are still exceeded, the system will be shut down and any necessary corrective action will be performed before repeating the start-up sequence. OLSD will be notified that discharge parameters were exceeded within 24 hours of such indication. It is estimated that the groundwater remediation system operation and monthly monitoring will continue for a minimum of two to five years. Modifications to the above sampling schedule will be made if additional requirements are set forth by OLSD in the wastewater discharge permit for this site, and as necessary for efficient operation of the system.

During the first day of operation of the interim groundwater remediation system, treated water will be stored in an aboveground tank. Effluent samples will be collected and analyzed on a 24-hour basis to demonstrate that treated water meets OLSD discharge requirements, prior to restart of the system with continuous discharge to the sewer.

Task 7. System Startup Report

An initial startup report will be prepared and submitted to ARCO, and the appropriate regulatory agencies. This report will document all field data collected, laboratory results of influent and effluent water samples collected and analyzed, and carbon breakthrough calculations and other relevant data. Based on results obtained, recommendations will be made to further optimize system performance and expedite remediation of subsurface impacted groundwater.

SCHEDULE

Plate 5 shows the preliminary schedule to complete Tasks 1 through 7. This schedule is contingent upon obtaining regulatory agencies approval within the estimated time frames shown on Plate 5. The permitting time frame is expected to take as long as the engineering time frame.

DISTRIBUTION

It is recommended that a copy of this Addendum Four to the Work Plan be submitted for review and approval to:

Mr. Lester Feldman
California Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Guy Telham
San Leandro Fire Department
835 East 14th Street
San Leandro, California 94577

Mr. Larry Seto
Alameda County Health Care Services Agency
Hazardous Materials Division
80 Swan Way, Room 200
Oakland, California 94621

Please call us at (408) 264-7723 if you have any questions or comments regarding this Addendum Four to Work Plan.

Sincerely,
RESNA

Valli Voruganti
Project Engineer

Joel Coffman
Project Geologist

Joan E. Tiernan, Ph.D., P.E.
Engineering Manager

cc: Mr. H.C. Winsor, ARCO Products Company

Attachments: List of References Cited

Plate 1, Site Vicinity Map
Plate 2, Generalized Site Plan
Plate 3, Proposed Remediation Site Plan
Plate 4, Process Flow Schematic
Plate 5, Preliminary Time Schedule

Table 1, Cumulative Results of Laboratory Analyses of Groundwater Samples

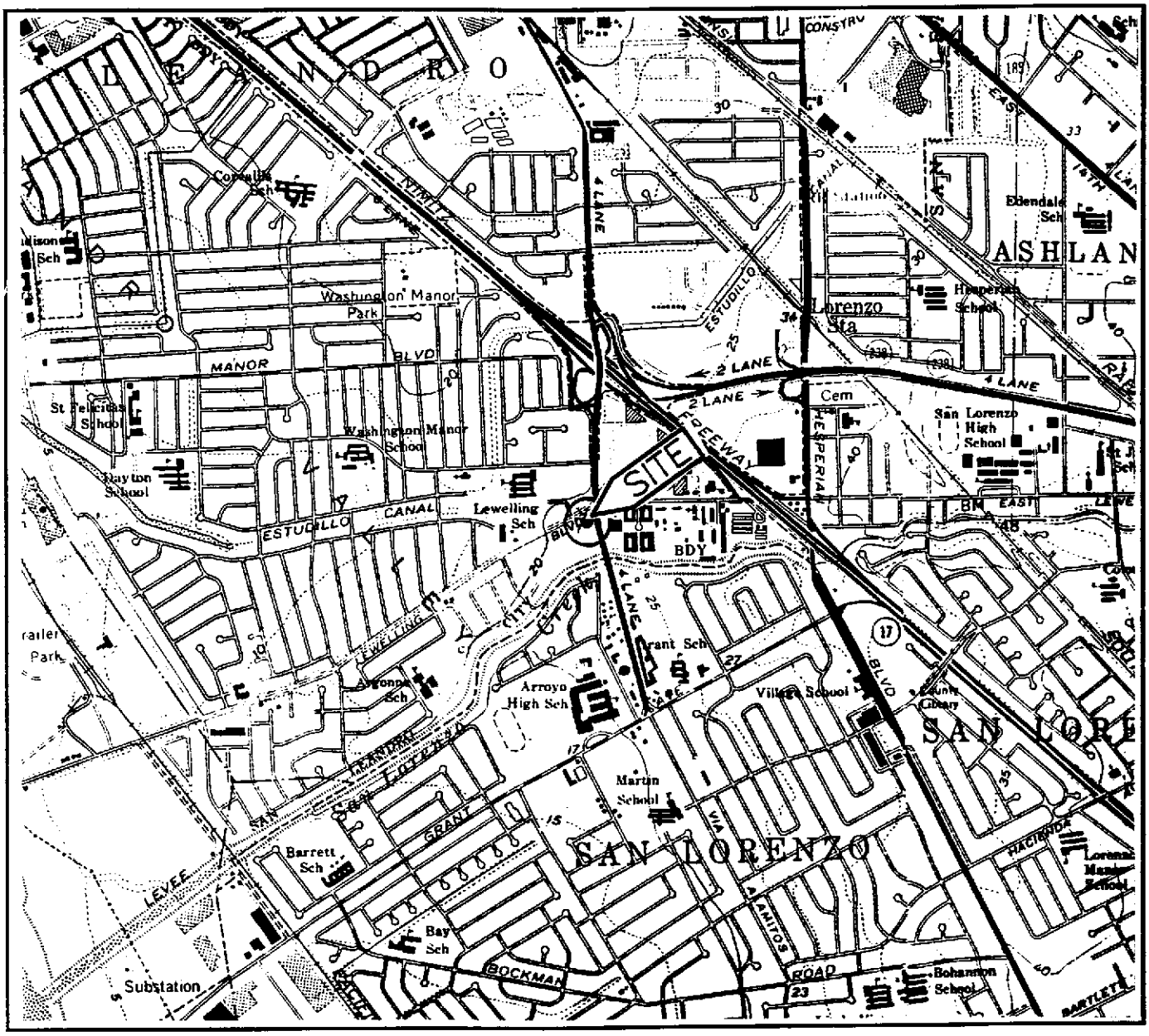
Attachment A, Manufacturer's Specifications on Liquid Phase Carbon
Attachment B, Water Balance Calculations

LIST OF REFERENCES CITED

RESNA/Applied GeoSystems, March 21, 1991, Work Plan for Subsurface Investigation and Remediation at ARCO Station 601, RESNA/AGS Report 69034-4W.

RESNA/Applied GeoSystems, March 21, 1991, Addendum One to Work Plan at ARCO Station 601, RESNA Report 69034.04.

RESNA, October 17, 1991, Subsurface Environmental Assessment and Vapor Extraction Test at ARCO Service Station 601, RESNA Report 69034.04.



Base: U.S. Geological Survey
7.5-Minute Quadrangles
Hayward/San Leandro, California
Photorevised 1980

N

LEGEND

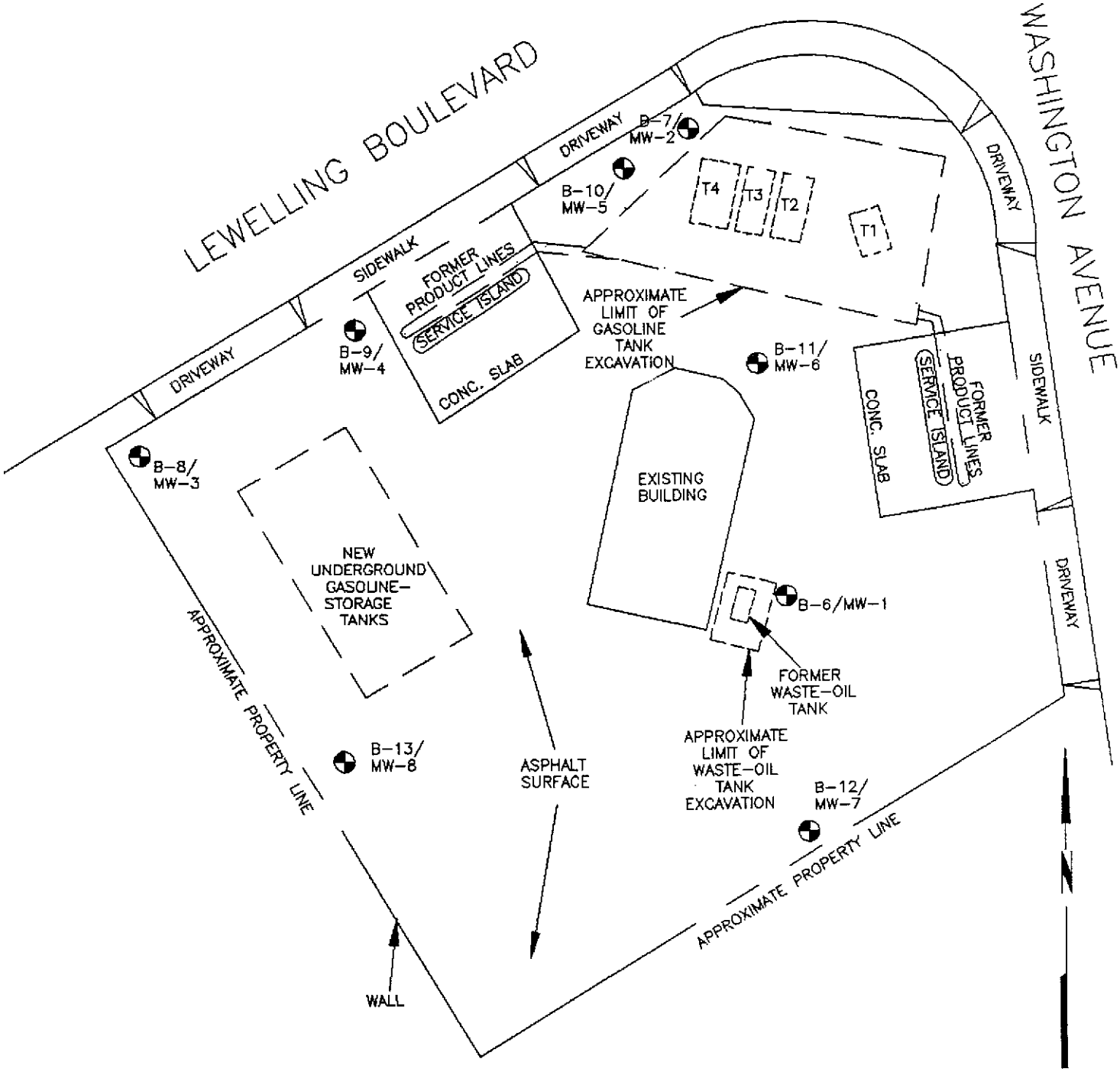
⊙ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

RESNA	**SITE VICINITY MAP** **ARCO Station 601** **712 Lewelling Boulevard** **San Leandro, California**	**PLATE** **1**
PROJECT 69034.07		



EXPLANATION

B-13/ MW-8 = Groundwater monitoring well (RESNA, 1990 and 1991)

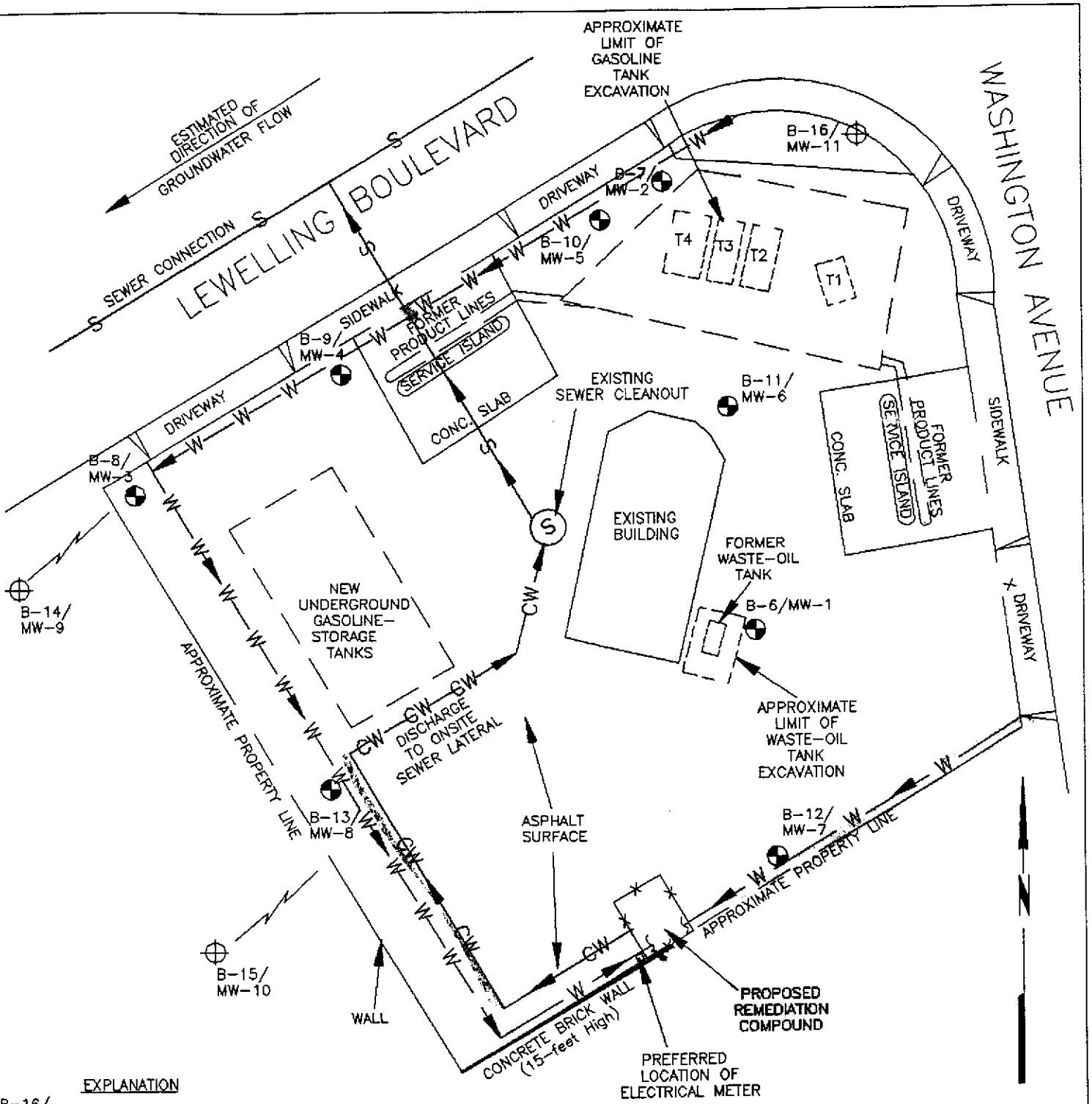
Approximate Scale

30 15 0 30 60

feet

Source: Surveyed by Ron Archer, Civil Engineer Inc.

RESNA	**GENERALIZED SITE PLAN** **ARCO Station 601** **712 Lewelling Boulevard** **San Leandro, California**	**PLATE** **2**
PROJECT 69034.07		



EXPLANATION

B-16/ MW-11 = Proposed groundwater monitoring well

B-13/ MW-8 = Groundwater monitoring well (RESNA, 1990 and 1991)

—W— = Water line (slope to drain)

—CW— = Clean water line (slope to drain)

—S— = Sewer line

Approximate Scale

30 15 0 30 60

feet

Source: Surveyed by Ron Archer, Civil Engineer Inc.

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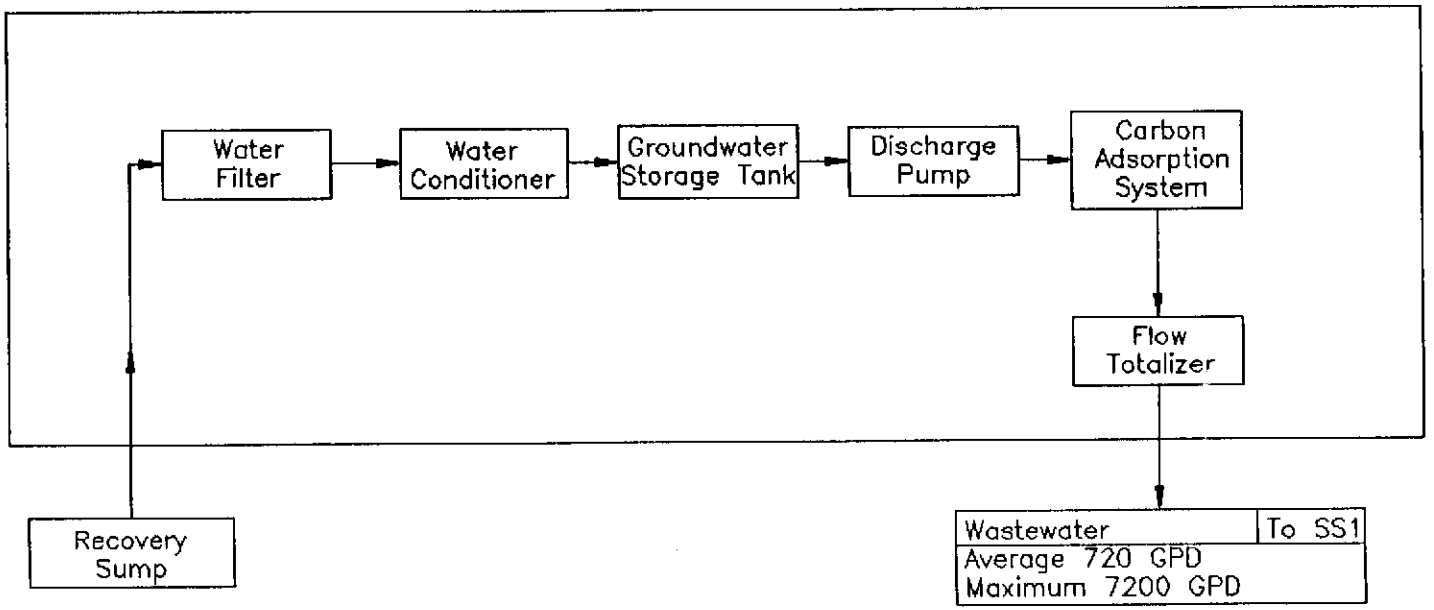
PROJECT 69034.07

PROPOSED REMEDIATION SITE PLAN
ARCO Station 601
712 Lewelling Boulevard
San Leandro, California

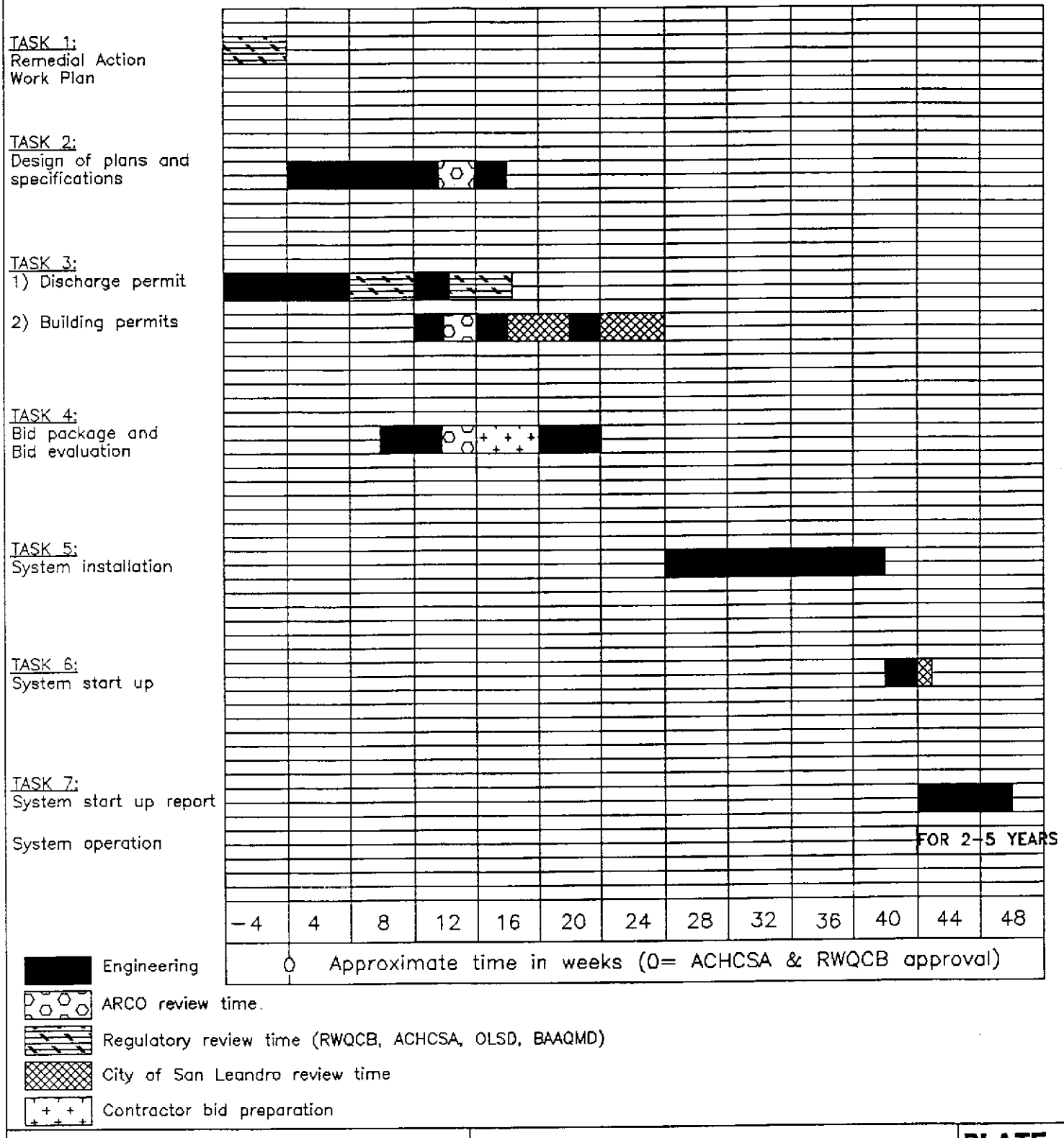
PLATE 3



EXPLANATION

SS1 = Sanitary sewer #1
GPD = Gallons per day

PLATE 4	**PROCESS FLOW SCHEMATIC** **ARCO Station 601** **712 Lewelling Boulevard** **San Leandro, California**	**RESNA** **PROJECT 69034.07**



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PROJECT **69034.07**

PRELIMINARY TIME SCHEDULE
ARCO Station 601
712 Lewelling Boulevard
San Leandro, California

PLATE
5

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF GROUNDWATER SAMPLES
ARCO Service Station 601
San Leandro, California
(Page 1 of 2)

Sample	TPHg	TPHd	B	T	E	X	TOG	BNAs	VOCs	Cd	Cr	Pb	Ni	Zn
MW-1														
07/18/90	Not sampled–floating product													
10/15/90	Not sampled–floating product													
01/09/91	Not sampled–floating product													
04/16/91	Not sampled–sheen													
06/10/91	Not sampled–sheen													
10/10/91	Not sampled–floating product													
MW-2														
07/18/90	35,000	850[a]	3,800 (3,200)	2,900 (2,400)	690 (270)	3,600 (2,900)	<5,000	340[a] 170[b]	39[c]	<20	50	50	NA	120
10/15/90	6,400	NR	650	290	110	560	NR	NA	18[c]	NA	NA	NA	NA	NA
01/09/91	13,000	NR	1500 (1700)	970 (1200)	390 (370)	1500 (2400)	NR	NA	6.5[d]	NA	NA	NA	NA	NA
04/16/91	54,000	NR	5,200	9,000	1,500	7,700	NR	NA	NA	NA	NA	NA	NA	NA
06/10/91	26,000	NR	3,000	2,500	880	4,200	NR	NA	NA	NA	NA	NA	NA	NA
10/10/91	10,000	NR	1,600	910	280	1,400	<5,000	NA	1.7[d]	<10	<10	11	72	91
MW-3														
07/18/90	NA	NA	NA	NA	NA	NA	<5,000	NA	NA	NA	NA	NA	NA	NA
10/15/90	Not sampled–floating product													
01/09/91	Not sampled–floating product													
04/16/91	Not sampled–sheen													
06/10/91	Not sampled–sheen													
10/10/91	Not sampled–floating product													
MW-4														
06/10/91	Not sampled–dry													
10/10/91	15,000	NA	5,300	1,500	470	1,300	NA	NA	NA	NA	NA	NA	NA	NA
MW-5														
06/10/91	100,000	NR	25,000	20,000	2,600	12,000	NA	NR	NA	NA	NA	NA	NA	NA
10/10/91	Not sampled–sheen													
MW-6														
06/10/91	Not sampled–dry													
10/10/91	Not sampled–dry													
MW-7														
06/10/91	Not sampled–dry													
10/10/91	Not sampled–dry													

See Notes on page 2 of 2.

TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF GROUNDWATER
ARCO Service Station 601
San Leandro, California
(Page 2 of 2)

Sample	TPHg	TPHd	B	T	E	X	TOG	BNAs	VOCs	Cd	Cr	Pb	Ni	Zn
MW-8														
06/10/91	5,800	NR	73	7.2	150	21	<5,000	NA	NA	NA	NA	NA	NA	NA
10/10/91	2,800	NR	31	6.1	4.5	3.9	NA	NA	NA	NA	NA	NA	NA	NA
DWAL:	—	—	—	—	—	—	—	—	—	10	50	50		5,000
MCLs:	—	—	1	NA	680	1,750	—	—	—	—	—	—	—	—
Als:	—	—	—	100	—	—	—	—	—	—	—	—	—	—
OLSD:	15,000	—	ND	ND	ND	ND	100,000	—	—	200	500	1,000	1,000	3,000

Results in micrograms per liter (ug/L) = parts per billion (ppb).
NA: Not analyzed.
NR: Not requested.
<: Results reported as less than the detection limit.
*: Applied analytical laboratories reports that the chromatograph resembled gasoline not diesel.
( ): BTEX results analyzed as VOCs.
TPHg: Total petroleum hydrocarbons as gasoline by EPA method 8015.
TPHd: Total petroleum hydrocarbons as diesel by EPA method 3550/3510.
B: Benzene, T: Toluene, E: Ethylbenzene, T: Total Xylene isomers.
BTEX: Measured by EPA method 8020/602.
TOG: Total oil and grease measured by Standard Method 503A/E.
BNAs: Base neutral and acid extractables including polynuclear aromatics concentrations are below laboratory reporting limits for respective compounds except as indicated. ([a] = naphthalene, [b] = 2-methylnaphthalene)
VOCs: volatile organics except for BTEX concentrations are below laboratory reporting limits for respective compounds except as indicated. ([c] = methylene chloride) ([d] = 1,2-DCA)
Cd: Cadmium
Cr: Chromium
Pb: Lead
Zn: Zinc
DWAL: California Department of Health Services recommended drinking water action levels (July 1990).
MCLs: Maximum Contaminant Level in ppb.
Als: Action Levels in ppb.
OLSD: Limits set forth by the Oro Loma Sanitary District

ATTACHMENT A

MANUFACTURER'S SPECIFICATIONS ON LIQUID PHASE CARBON

Quality Certified

AQUA-Carb™

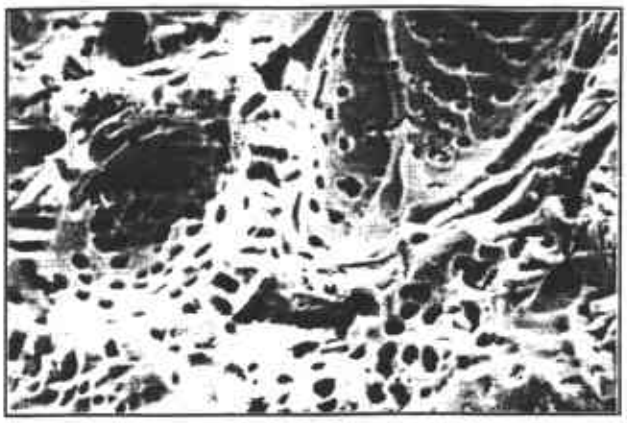
Water Treatment Carbons

DESCRIPTION

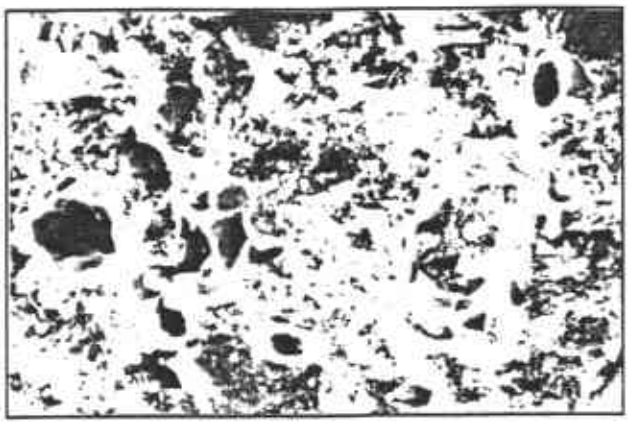
Westates' AQUA-CARB™ activated carbons are high performance adsorbants specifically designed for water treatment. Manufactured from unique high quality substrates, AQUA-CARB activated carbons feature internal pore structures that are ideally suited to remove organic compounds from water. High removal efficiency coupled with their very low water soluble ash content make AQUA-CARB activated carbons the best value for your water treatment needs.

QUALITY CERTIFIED

The process for manufacturing activated carbons involves procedures with many variables that require strict quality control. Westates maintains a modern ASTM quality control laboratory to certify that Westates products meet or exceed all required specifications.



Coconut Shell at 2.2kx mag.



Bituminous Coal at 250x mag.

SAFETY

Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

WESTATES CAPABILITIES

Westates has the facilities for manufacturing, regenerating and characterizing activated carbon. Selected high quality carbons are also available from other sources giving Westates the capability of supplying the best carbon for your treatment needs. We have more than 20 years experience in the design of activated carbon adsorption systems. Our technical staff provides expert guidance in selecting the right system for your needs. Our laboratory is fully equipped to provide complete quality control and a continuing analysis of your carbon to maintain maximum efficiency.

SPECIFICATIONS	CO-401	KP-401	CC-601	CC-401
Size (U.S. Sieve)	8 x 30	–	12 x 40	12 x 30
Iodine No. (Min)	900	850	1100	900
Hardness No. (Min)	97	92	99	99
Abrasion No. (Min)	76	76	99	99
Moisture (Max)	2%	2%	2%	2%
Mean Particle Diam.	1.45mm	1.9mm	1.1mm	1.2mm
Shape	Granule	Pellet	Granule	Granule
Ph Water Extract	7.5	7.5	9.5	9.5
Soluble Phosphate	N.D.*	N.D.	N.D.	N.D.
Ash (Water Soluble)	<1%	1%	1%	1%
Apparent Density (g/cc)	.49		.49	.52
(lb/ft³)	30.5	30.5	30.5	32

(Refer to selection guide on reverse)

*Non-Detectable

WESTATES carbon

ACTIVATED CARBON SYSTEMS

WESTATES CARBON, INC.
2130 Leo Ave., Los Angeles, CA 90040
PHONE (213) 722-7500
FAX (213) 722-8207 TWX: 910-321-2355

SA-CCPPP
Impregnated Coconut Shell Based Activated Carbon

Description SA-CCPPP is a high activity, specially treated granular activated carbon designed for use in vapor phase odor control. Applications for SA-CCPPP carbon include the removal of hydrogen sulfide, methyl mercaptans, general acid gases, and other odors typical in the treatment of sewage wastes, pulp and paper mills, and chemical plants.

PHYSICAL PROPERTIES

Apparent Density	0.55 g/cc, ASTM D-2854
Hardness	95%, ASTM D-3802
Moisture, max	15%
Mean particle diameter, min	3.6 mm, ASTM D-2862
Uniformity coefficient, max	1.9, ASTM AWWA-B-604-74
Maximum head loss at 50 FPM velocity	1.2" w.c/ft bed depth
H_2S minimum breakthrough capacity *	0.14 g H_2S/cc carbon

* H_2S breakthrough capacity is determined by passing a moist air stream (85% R.H.) containing 1% H_2S at a rate of 1,450 cc/min. through a 1.0" diameter X 9" deep bed of uniformly packed activated carbon and monitored to 50 ppm breakthrough. Results are reported as grams H_2S removed per cc of carbon.

SUN-AG INC.
ENVIRONMENTAL PRODUCTS & SERVICES
105 S. Ave de la Estrella, Ste. 3, San Clemente, California 92672
(800) 468-4671 • FAX (714) 498-3847

SA400L Water Sorb
110 Gallon Sized Water Phase Carbon Unit

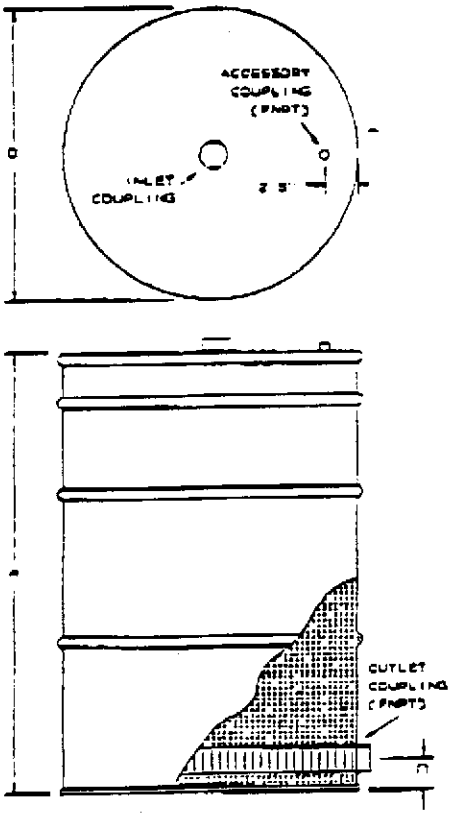
SA400L SUN-AG, Inc.'s Water Sorb, liquid purification system is a prefabricated activated carbon filtration system that makes use of the adsorptive properties of activated carbon to eliminate liquid pollution problems, caused by chemical contaminants.

The Water Sorb is designed to provide an efficient, economical way to control contaminant levels in process streams, waste water systems, and other liquid pollution situations.

Water Sorb internals consist of a proprietary PVC underdrain engineered to ensure even flow distribution and complete carbon bed use. A few of the use for Water Sorb are listed below:

Waste water	Solvent recirculation
Laboratory wastes	Process streams
Wet Scrubber liquids	Toxic spills

The Water Sorb is supplied ready for immediate use. It is easily connected to an existing system using the 2" NPT couplers, that are supplied on the inlet and outlet.



SPECIFICATIONS

Height	43"
Diameter	32"
Max Flow (gpm)	15
Max Pressure psi	10
Max Temp °F	125
Carbon Capacity	
Weight (Lbs)	400
Volume (ft³)	14.8
Shipping Weight (Lbs)	530

SUN-AG INC.
ENVIRONMENTAL PRODUCTS & SERVICES
25 S Ave de la Estrella, Ste. 3, San Clemente, California 92672

ATTACHMENT B

WATER BALANCE CALCULATIONS

WATER BALANCE CALCULATIONS

Design Criteria

Average pumping flowrate	=	0.5 gallons per minute (gpm)
Avg. Influent TPHg Conc.	=	31,000 µg/l (based on cumulative results of laboratory analyses of water samples (July 1990 to present)
Avg. Influent Benzene Conc.	=	4,600 µg/l (micrograms/liter, or parts per billion [ppb])
Avg. Infl. Toluene Conc.	=	3,800 µg/l
Infl. Ethyl benzene Conc.	=	707 µg/l
Avg. Infl. Total Xylenes Conc.	=	3288 µg/l
Carbon Canisters	=	Two, 400-pound activated liquid-phase carbon canisters

Assumptions

1) Based on manufacturer's specifications on liquid-phase carbon (Attachment B), carbon has an adsorption capacity of:

   5 pounds (lbs) TPHg/100 lbs carbon = 20 lbs TPHg/400-lb carbon canister

2) Breakthrough is said to have occurred when the first reported detectable levels of hydrocarbons are discharged to the sewer.

Sewer Discharge Requirements

The treatment system must be designed to meet the Oro Loma Sanitary District (OLSD) sewer discharge requirements. Preliminary discharge requirements for treated groundwater have been established by OLSD to be:

Pollutant	Limit
TPH	15 ppm[a]
Lead	1 ppm
Zinc	3 ppm
Chromium	0.5 ppm
Cadmium	0.2 ppm
Nickel	1.0 ppm
Benzene	ND[b]
Toluene	ND
Ethylbenzene	ND
Total xylenes	ND

ppm = parts per million
ND = Below laboratory detection limits.

The groundwater remediation system will be designed to treat extracted groundwater to typical benzene, toluene, ethylbenzene and total xylene isomers detection limits of 0.5 ppb.

Calculations

The average amount of TPHg in pounds per gallon, before activated carbon treatment, is calculated below:

$$\frac{31{,}000\ \mu grams\ TPHg}{1\ \ell\ H_{20}} \frac{1\ gram}{1{,}000{,}000 \mu grams} \frac{1\ lb}{454\ grams} \frac{3.785\ \ell}{1\ gallon} = \frac{2.6\times10^{-4}\ lbs\ TPHg}{1\ gallon\ H_2O}$$

The amount of TPHg in pounds per day, before activated carbon treatment is calculated below:

$$\frac{2.6\times10^{-4}\ lbs\ TPH}{1\ gallon\ H_2O} \frac{0.5\ gallons}{1\ minute} \frac{1440\ minutes}{1\ day} = \frac{0.18\ lbs\ TPH}{1\ day}$$

Carbon breakthrough rate is calculated as follows:

$$\frac{5\ lb\ TPHg}{100\ lbs\ Carbon} \frac{400\ lb\ Carbon}{One\ Canister} \frac{1\ day}{0.18\ lb\ TPHg} = \frac{111\ days}{One\ Canister}$$

Thus at the design criteria detailed above, liquid-phase carbon changeout will be required approximately once every four months. Influent concentrations of halogenated volatile organic compounds, and metals are either all nondetectable and/or below OLSD discharge limits.