Environmental Restoration Services

Site Investigations * Fuel Tank Closures and Installations * Site Remediation * Regulatory Reporting

Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Second Floor
Alameda, CA 94502

October 4, 2002

20107

Attn: Mr. Barney Chan; Haz Mat. Specialist for : DiSalvo Trucking
4919 Tidewater Ave., Oakland

Re: Revision of ERS February 6, 2001 Corrective Action Plan

Dear Mr. Chan,

This revised Corrective Action Plan (CAP) has been prepared by Environmental Restoration Services, (ERS) to address requirements by the Alameda County Department of Environmental Health (ACDEH) to take Remedial Action (RA) at a Leaking Underground Storage Tank (LUST) site, 4919 Tidewater Ave., Oakland, California.

The ERS Corrective Action Plan, dated February 6, 2001, is being revised due to the following changes in scope and costs:

1. Plans to redevelop the subject property, as planned in the first CAP, have fallen through and therefore, the terminal building will remain and excavations will need to be re-paved.
2. EBMUD treatment fees have decreased.
3. Soil disposal costs have risen.
4. The number of oxygen injection points have increased to expedite bio-degradation.

The purpose of this CAP revision is to investigate the most cost effective RA for the site. This report first reviews the known site history, describes the site vicinity, and presents existing chemical data. Then, three recommendations for corrective action, enhanced in-situ bio-degradation, groundwater extraction and aquifer excavation, are given.

1.2 Site Location

The site is located in a light industrial district of Oakland, California on property at 4919 Tidewater Ave.(Figure 1).

500 Santa Cruz Avenue * Menlo Park California * Phone 650/325-3216 * Fax 650/327-2984

1.3 **Previous Subsurface Work at Site**

Previous subsurface work at the site includes soil excavation and bio remediation, groundwater disposal, soil borings with soil and groundwater sampling, monitor well construction and sampling. Previous work description and chemical results from all work conducted to date are given in reports by Geo Environmental Technology (GET) of San Jose dated April, 1989, June 1989 and February 1991, in reports by Gen-Tech Environmental, Inc., (GTE) dated May 1994 and November 1994, in a Report from ERS September 1995 and a report from PIERS Environmental Services Inc. (PIERS) dated December of 2000.

2.0 SITE DESCRIPTION

2.1 Site Description and Hydrogeologic Setting

The site is located on the west side of Tidewater Ave.. A 16,000 square foot metal trucking terminal building is located on the northwest portion of the approximate four acre parcel. A 3000 square foot truck repair building is located on the northeast portion of the parcel The majority of the remaining property is paved with asphalt. The site is located at the fringe of the San Leandro Bay on soil that appears to have been imported to fill the location to approximately four feet above the mean high tide elevation. The imported fill caps the entire site and contains sands, gravels, concrete and asphalt. Native silty clay, silt, clayey sand and peat underlie this fill.

2.2 Vicinity Map

A vicinity map is given in Figure 1 which includes the location of any known hydraulic influences. San Leandro Bay lies approximately 100 feet southeast of the site. A site map is given in Figure 2 which includes information on adjacent streets, site building locations, locations of existing wells and December 2000 soil boring locations.

2.3 Existing Analytical Results

In April of 1994, three monitoring wells were installed and eleven soil borings were installed at the site by GTE. In June of 1995, ERS installed one monitoring well and two soil borings at the site. In December of 2000, PIERS installed twelve soil borings at the site (Figure 2). From April of 1994 to September of 2000, approximately eight groundwater monitoring events have been performed by GTE, ERS and PIERS.

2.3.2 **Depth to Groundwater**

Depth to groundwater based on the monitor well sampling is approximately two to four feet below ground surface.

2.3.3 **Soil Profile**

The boring logs for the monitor wells show predominantly import sands and gravels underlain with peat.

3.0 RECOMMENDATIONS FOR CORRECTIVE ACTION

Based on historic soil and groundwater investigations, ERS believes that the vertical distribution of groundwater containing diesel has been adequately characterized. The floating characteristics of the low density hydrocarbons combined with a high plasticity, bay mud aquatard, appears to have stopped the downward migration of diesel contamination at a depth of approximately five to six feet below ground surface (bgs.).

Horizontally, ERS believes that the December 2000 groundwater investigation has characterized the horizontal extent of diesel impacted groundwater, as depicted in the iso-consentration map in Figure 2.

In addition, ERS believes that the extent of any soil contamination on the site is due to the migration of the hydrocarbon on the shallow groundwater as it moves through the imported sand and gravel fill material. The majority of the impacted soil was adequately removed by the 1989 excavation.

Because the contaminates exist within the relatively shallow aquifer range (2.5 to 5.5 feet) at the site and this section of the subsurface contains sand and gravel fill materials, ERS believes that several Corrective Action scenarios will work towards mitigating the diesel impacted groundwater.

The first CAP scenario entails the injection of an Oxygen Releasing Compound (ORC). A 7% solution of hydrogen peroxide (H_2O_2) would be injected into the aquifer at locations within the diesel contaminated groundwater plume. ERS believes this will stimulate natural bio-degradation of the diesel by providing dissolved oxygen to the current, oxygen depleted, impacted groundwater plume. ERS believes this to be the slowest CAP scenario to site closure.

The second CAP entails the development of a groundwater extraction system, designed to draw from a series of extraction trenches located within the contaminate plume. The extracted groundwater will then be treated on-site and discharged. ERS believes this will work well to both remove the higher concentrations of hydrocarbon from the groundwater and help to draw back the relative slow migration (0.0016% gradient) of the plume.

The third CAP entails the excavation and disposal of the majority of the impacted aquifer , to a depth of approximately six feet. Clean imported soil would then be used to backfill the excavation. ERS believes this to be the fastest CAP to site closure.

All details of each CAP scenario are described in this section, including projected costs of each CAP from inception to site closure. A groundwater Preliminary Remediation Goal (PRG) of 640 parts per billion of TPH/diesel (the BA-RWQCB RBSL, Table B) will be used for site closure.

3.1 Enhanced Bio-Degradation

This corrective action plan scenario calls for the injection of a hydrogen peroxide into the diesel impacted shallow aquifer. Four additional groundwater monitoring wells will be installed to monitor levels of dissolved oxygen and the rate of contaminate bio-degradation.

3.1.1 **Monitoring Well Installations**

The four existing monitor wells are not showing contaminate levels in the center of the plume and no plume defining wells exist to the north and northwest of the plume. Therefore, construction of four additional monitoring wells (MW5 through MW8) are proposed (Figure 3).

Prior to initiating drilling, monitor well permits will be obtained from the Alameda County Department of Public Works. ACDEH will be notified a minimum of 72 hours prior to drilling.

Prior to mobilization of the drill rig on-site, and prior to leaving the site, all associated equipment and well installation equipment will be thoroughly cleaned to removed all soil, oil, grease, mud, tar, etc. The cleaning process will consist of high pressure steam cleaning of the drilling equipment and a high-pressure hot water final rinse. Before drilling each boring, all drilling equipment will be steam-cleaned.

A nominal 8-inch diameter boring will be advanced using a hollow stem auger. Soils will be visually logged and samples collected every five feet. In addition, olfactory and visual observations of petroleum hydrocarbons will be noted on the logs.

Based on the anticipated groundwater depth of approximately 3 feet in the vicinity of the site, it is expected that the boring will be terminated, and the monitor well constructed, at a depth of approximately 8 feet below ground surface. The final choice of screened interval will be selected by the site engineer on the basis of geologic field observations during drilling. The well casing and screens for the monitor well will be constructed with 2-inch diameter, Schedule 40, flush-joint threaded material. The PVC screens will consist of factory-milled 0.020 inch slots. The screens will be installed at the interval from approximately 2 to 8 feet below ground surface. A sand pack of clean washed Monterey 2/12 sand will be placed adjacent to the entire screened interval and will be extended a recommended minimum distance of two feet above the top of the screen. The sand pack will be placed by carefully pouring sand down the annulus between the hollow stem and the well casing. The auger will be raised periodically and an auger flight removed to allow the sand to fill the annulus between the casing and the borehole wall.

A one foot thick bentonite pellet seal will be placed above the sand pack. The seal will be placed in the same manner as the sand pack. The bentonite will be hydrated with clean water at the quantity of 1 gallon per pound of bentonite. The bentonite will be hydrated three times and allowed to swell for a minimum of 45 minutes. The annulus above the bentonite seal will be grouted with a cement/bentonite grout. The grout will consist of clean water mixed with Portland cement and powdered bentonite. The grout will be placed in the same manner as the sand pack, or after the auger flights are entirely withdrawn from the borehole.

Well completion will consist of a locking PVC cap and subsurface traffic-rated utility box set at or slightly above grade in concrete.

In order to obtain accurate groundwater elevations, monitor well head elevation of MW5 through MW8 will be surveyed by a California Registered Civil Engineer to an accuracy of 0.01 feet. Elevations will be determined relative to MSL and the existing well heads will be used as benchmarks. Water levels in each of the monitor wells will be measured within a one hour period. The water surface elevations in the wells will be calculated using the survey data. Then, the horizontal hydraulic gradient will be calculated based on accurately determined well locations. The gradient calculated will include a magnitude and direction.

After the concrete and cement/bentonite grout have set for a minimum of 24 hours, the new wells will be developed by swabbing, surging, and/or bailing with clean equipment in order to prepare the well for collection of a representative groundwater sample. A minimum of five casing volumes will be purged from the well, or until the water is relatively clear. Electrical conductivity (EC), pH, and temperature will be measured periodically to ensure that these parameters stabilize during the course of development. Water generated during development will be stored separately, on-site, in labeled 55gallon drums pending analytical results.

3.1.2 **Pre-Injection Monitoring Well Sampling Procedure**

Prior to the injection of hydrogen peroxide to the aquifer, groundwater samples will be obtained from monitoring wells MW1 through MW8. Groundwater samples will be collected as follows:

Each well will then be bailed until the volume of water withdrawn is equal to at least three casing volumes. To assure that a representative groundwater sample is collected periodic measurements of the temperature, pH and specific conductance will be made. The sample will be collected only when the temperature, pH, and/or specific conductance reach relatively constant values. The groundwater will also be measured for dissolved oxygen before and after well purging.

Water samples will be collected using a new disposable bailer. An effort will be made to minimize exposure of the sample to air. Subsequent to collection, the samples will immediately be stored on ice in an appropriate ice chest. Samples will be transported under Chain-of-Custody procedures to North State Environmental Labs (NSEL) of South San Francisco.

Care shall be taken to collect all excess water resulting from the sampling and cleaning procedures. The excess water will be contained in a pre-labeled 55-gallon drum on-site pending receipt of laboratory analyses.

The following analyses will be performed by NSEL on groundwater samples obtained from the monitor wells: TPH-diesel (EPA Method 8015M)

3.1.3 **Slurry Wall Construction**

In order to prevent the contaminate plume from further migrating off-site, either by natural migration or by injection activities, approximately 400 feet of concrete slurry wall will be constructed along the northern (down gradient) property lines, as shown in Figure 3.

The slurry wall shall be constructed by excavating an approximate 12 inch wide by seven foot deep trench on-site and backfilling the trench with a concrete (three sack per yard mix) slurry. Soil excavated from the trench (approximately 100 yards) will be stockpiled on-site. The soil will be profiled per BFI disposal profile requirements and properly transported and disposed of at a Class III landfill.

3.1.4 **Hydrogen Peroxide Injection Procedure**

The approximate 60,000 square foot contaminate plume will be divided into 100 square foot (10' x 10' grid) sections for a total of approximately 600 injection points within the contaminate plume (Figure 3).

Near the center of each 10' x 10' grid, an injection point will be advanced using a 1.5" diameter, vibra-push Geo-Probe to a depth of four feet. The injection probe will be screened from four to two feet bgs.. Approximately 5 gallons of a 7% H_2O_2 solution will be injected through each probe, into the aquifer. At the grids that contain a monitoring well, the injection points will be placed approximately ten feet from the well. This will help to establish the influencing radius of each injection.

3.1.5 **Micro-Organism Injection Procedure**

Approximately one month after the H_2O_2 injections are complete, a one-gallon solution of Solmar L-104 Hydrocarbon Consuming Micro-Organisms (HCMO) will be introduced into the aquifer using the same injection points. The solution will consist of two pounds of L-104 HCMO per five gallons of water. After the HCMO introduction is complete, the injection borings will be backfilled with a neat cement grout.

3.1.6 **Post-Injection Monitoring Well Sampling Procedure**

Approximately two months after the injection of hydrogen peroxide and HCMO to the aquifer, groundwater samples will be obtained from monitoring wells MW1 through MW8. Groundwater samples will be collected as described in section 3.1.2.

3.1.7 **Continued Bio-Degradation Corrective Action and Monitoring**

Groundwater monitoring will be conducted at the site on a quarterly schedule as described in section 3.1.2. Re-injection of both H_2O_2 and HCMO will be conducted at the site on an annual schedule as described in sections 3.1.4 and 3.1.5. To estimate CAP costs, the anticipated time to reach the groundwater remediation goal for this corrective action scenario is six years.

3.1.7 **Bio-Degradation Corrective Action Costs**

Well Installations		
Permits	Project Managment (PM); 8hrs@$75	$ 600
Workplan	PM; 10hrs@$75 Assoc. Engineer (AE) 2hrs@$90	$ 930
Well Install	$1000 per well	$ 4000
Well Survey		500
PM	PM; 16hrs@$75	$1200
Well Sampling (8 wells)		$2000
Slurry Wall		
Trenching		
400'L x 12"W x 7'D	Backhoe 40hrs@$100; $200 Mob.	$ 4200
Concrete	100 yrds @ $100	$10000
Labor	80hrs @ $55	$ 4400
PM	40hrs@$75	$ 3000
Soil Disposal	100 yrds @ $50	$ 5000
H_2O_2 Injection		
H_2O_2	10-55gallon drums, 50% sol.@ $300per	$ 3000
Vironex(GeoProbe)	3 days @ $2000 per	$ 6000
Materials		$ 400
PM	20hrs @ $75	$ 1500
HCMO Injection -		
HCMO	300 lbs @ $33per	$10000
Vironex(GeoProbe)	3 days @ $2000 per	$ 6000
Materials		$ 400
PM	20hrs @ $75	$ 1500
Well Sampling(8 wells)		$ 2000
Report	PM; 16hrs@$75 Assoc. Engineer (AE) 2hrs@$90	$ 1380
15% Markup on Subcontractors&Materials		$ 6800
	Total Initial Cost	$ 74,810
Annual Costs		
Quarterly Monitoring	4 x $2000	$ 8 000
H_2O_2, HCMO Re-injection		$ 28,800
Reports		$ 1380
	Total Annual	$ 38,180
5 Additional Years Bio-Degradation Corrective Action and Monitoring	5 years @ $ 38,180 per	$109,900

Total Bio-Degradation Scenario RA Cost $ 265,710

3.2 Groundwater Extraction System

This remedial action scenario calls for the removal of the diesel from the shallow aquifer through a system of groundwater recovery trenches. 500 feet of additional groundwater recovery trenches will be installed to aid in the recovering the entire plume of impacted water.

3.2.1 Recovery Trench Construction

Approximately 500 feet of recovery trenches will be excavated at the locations shown in Figure 4. The trenches will be 18 inch wide by 5 foot deep and will be lined with a filter fabric. Each trench will have a 6" perforated drain line at the bottom and will be backfilled with 1.5-inch drain rock to within 12 inched from the surface. The trenches will then be capped with concrete. At each end of the trench, a 12 inch perforated stand pipe will be installed as an extraction point (Detail, Figure 4)._Soil excavated from the trenches (approximately 150 yards) will be stockpiled on-site. The soil will be profiled per Allied Waste Inc. AWI disposal profile requirements and properly transported and disposed of at a AWI Class III landfill.

3.2.2 EBMUD Discharge Permit

A permit from East Bay Municipal Utility District (EBMUD) will be obtained to discharge up to 5 gallons per minute of groundwater to the sanitary sewer system. The permit will require that the groundwater be pre-treated before discharge.

3.2.3 Groundwater Recovery and Treatment

Groundwater will be extracted from three recovery sumps and/or extraction stand pipes located at the end of each recovery trench (Figure 4). A pumping limit of 5 gallons per minute will be established for the discharge permit.

A suction pump will be used to draw groundwater from the extraction points to the holding tank. Groundwater is drawn to the pump through a half inch braided poly line contained within an underground 1 1/2 inch, schedule 40, ABS pipe that will have a minimum 1% fall from the pump location back to the recovery point. (Detail in Figure 4.) At the recovery point, the 1 1/2 inch secondary containment pipe will drain into the recovery sump/pipe. (Detail in Figure 4.)

The groundwater will be discharged into a 20,000 gallon, closed top, three-stage oil water separator tank. The tank will be equipped with a high water shut off switch. In case of failure, groundwater will over flow through the secondary containment and back to the recovery point.

Floating product will be passively skimmed from the top of the first separation tank using CEE Selective Oil Skimmer (CEE Product Specifications attached). The skimmer will be emptied weekly into a double contained 55 gallon drum. The drum contents will be removed with the normally scheduled shop waste oil removal.

Diesel contaminated groundwater entering the top of the tank will have approximately 66 hours to separate, with most diesel molecules remaining at the top of each separation tank and lower concentrations of dissolved diesel moving to the bottom. The third separation tank will discharge from approximately 6 inches off the bottom into a 1500 gallon tank.

From the 1500 gallon tank, the groundwater will be pumped through two, 2000 gallon carbon filters. A sample recovery port will be installed between the two carbon filters. This port will be sample bi-weekly. The samples will be recovered by filling two, 1 liter amber sample bottles and two, 40 VOAs until the containers have completely filled with water, with no head space. The samples will then be transported on ice under proper Chain-of-Custody to a State certified lab where it will be analyzed for Total Petroleum Hydrocarbons as diesel (TPH/d) and BTEX.

When the primary filter effluent exceeds the EBMUD discharge limits, the primary carbon filter will be replaced with new carbon. The spent carbon will then be stockpiled on-site. The carbon will be profiled per BFI disposal profile requirements and properly transported and disposed of at a BFI Class I or II landfill.

Groundwater from the secondary carbon filter will be discharged to a sample box. Groundwater effluent samples will be recovered from the sample box bi-weekly or as per EBMUD permit requirements. The samples will be recovered by immersing two, one liter amber sample bottles and two, 40 VOAs into the sample box with a Teflon gloved hand, until the containers have completely filled with water, with no head space. The samples will then be transported on ice under proper Chain-of-Custody to a State certified lab where it will be analyzed for Total Petroleum Hydrocarbons as diesel (TPH/d) and BTEX.

From the sample box, the groundwater will flow through a meter and into the sanitary sewer system.

3.2.4 Groundwater Extraction System Reporting

Included in the quarterly well monitoring reports will be a report describing the amount of groundwater discharged, the amount of product recovered from passive skimming, influent and effluent analytical results collected during the three month period, and disposal manifests, will be prepared and submitted to the ACDEH.

3.2.5 Continued Groundwater Extraction Corrective Action and Monitoring

To estimate RA costs, the anticipated time of continued groundwater extraction for this corrective action scenario is three years. At the end of three years, an annual injection of both H_2O_2 and HCMO will be conducted at the site for two years, as described in sections 3.1.4 and 3.1.5. Also for an additional two years, groundwater monitoring will be conducted at the site on a quarterly schedule as described in section 3.1.2. The anticipated time to reach the groundwater remediation goal for this corrective action scenario is five years

3.2.6 **Groundwater Extraction Remedial Action Costs**

Recovery Trenches		
Trenching		
400'L x 18"W x 5'D	Backhoe 60hrs@$100; $200 Mob.	$ 5600
Drain rock	100 yrds @ $20	$ 2000
Concrete	11 yrds @ $100	$ 1100
Pipe/Filter fabric		$ 1900
Pumps	3 @ $150	$ 450
PM/Labor	40hrs@$75 80hrs @ $45	$ 6600
Soil Disposal	120 yrds @ $35	$ 4200
EBMUD Discharge Permit		
Application Fee		$ 2 500
Treatment System		
Mob. 20,000 gal. Phase Separator		$ 600
1500 gallon tank		$ 1300
Two, 2000 gallon carbon filters		$ 3000
4000 lbs activated carbon		$ 6000
PM/Labor	40hrs@$75 80hrs @ $45	$ 6600
Pump, sample box, meter, valve		$ 850
Excavate, dischrge line to sewer	Backhoe 8hrs@$100; $200 Mob.	$ 1000
Asphalt	600 sq ft @ $ 4.00	$ 2400
	Total Initial Cost	$ 46,100
Annual Costs		
EBMUD Treatment fees	400 ccf.@ $0.45	$ 180
EBMUD Capacity fees	34 ccf.@ $50 x12	$ 20,400
Quarterly Monitoring	4 x $1250	$ 5000
Carbon changing	6x 2000 lbs @ $1.50 per	$ 18,000
System Monitoring	24 sample @ $125	$ 3 000
20K gal. Phase Separator Rental		$ 17,600
Labor	120hrs @ $55	$ 6600
PM	150hrs@$75	$ 11, 200
Carbon Disposal	120 yrds @ $50	$ 6000
	Total Annual	$ 87,980
Three Year Continued Groundwater Extraction		
Initial Cost		$ 46,100
Annual Costs	3 years @ $88,000 per	$ 264,000
H_2O_2, HCMO Injection	two times@ $ 15,700per	$ 31,400
Monitoring	2 years @ $ 5000 per	$ 10,000

Total Groundwater Extraction Scenario RA Cost **$351,500**

3.3 Aquifer Excavation

This remedial action plan scenario calls for the physical removal of the diesel impacted shallow aquifer by excavating the majority of the on-site plume of impact and disposing of the soil at a Class III Landfill. The area of groundwater contamination beneath the existing terminal building has been excluded from the limits of excavation. This will mean that two excavations, one on each side of the terminal building, will be excavated. The excavation on the down-gradient side of the terminal building (northwest side) will be left open for three months and be de-watered 6 times (every two weeks) to draw affected groundwater from beneath the terminal building and from off-site. Approximately 2,000,000 gallons of impacted groundwater will be treated on-site and discharged to the sanitary sewer under permit with EBMUD.

3.3.1 **Soil Profiling**

Approximately 40 soil samples (four composited samples per 1000 yards of soil) will be recovered from the contaminate plume area at a depth of approximately three feet bgs., and tested as per Allied Waste Inc. (AWI) soil disposal profiling requirements. If the results are below the allowable thresholds for the AWI Forward Class III landfill site in Manteca Ca. , the soil will be accepted for disposal as non-hazardous waste. CAP cost estimates will be based on acceptance for disposal as non-hazardous waste at AWI's Forward Class III landfill site.

3.3.2 **Soil Excavation and Disposal**

The area of the existing on-site contaminate plume is approximately 60,000 square feet. Excluded from excavation is approximately 10,000 square feet of plume area beneath the existing terminal building. The average depth to clean (bay mud aquatard) soil is 6 feet. ERS estimates that the top two feet of soil will be unimpacted, leaving an approximate 4-foot section of affected soil for excavation and disposal. This calculates to approximately 50,000 square feet of excavation area with 4 cubic feet of soil per square foot for disposal, or approximately 7500 cubic yards, or approximately 10,000 tons of soil for disposal, from two separate excavations (Figure 6).

An estimated 10,000 tons of non-hazardous soil will be transported under Allies Waste Inc Special Waste Manifests and disposed of at the AWI Forward Class III landfill site in Manteca Ca.. AWI Special Waste Manifests and final disposal gate tag will be contained in the appendix of a Final Report.

3.3.3 **Over-excavation Sidewall Sampling and Groundwater Grab Sampling**

Soil samples will be recovered from the excavation sidewalls, every 20 feet, under the direction of the ACDEH, using a 2 inch diameter by 3 inch long brass sleeve within a bullet sampler. Using 15 feet of extension and a slide hammer, the bullet sampler will be lowered to the desired sample location at each excavation sidewall. The sampler will be driven into the sidewall until the brass liner has completely filled. The brass liner will then be sealed with Teflon and plastic caps and transported on ice to NSEL under proper Chain-of-Custody procedures.

As groundwater is recharging into the excavation, grab water samples will be recovered from the excavation under the direction of the ACDEH. The samples will be recovered by submerging the sample containers into the groundwater as it fills the excavation. Subsequent to collection, the samples will be immediately stored on ice in an appropriate ice chest. Samples will be transported under Chain-of-Custody to NSEL.

3.3.4 **Laboratory Analysis**

The following analyses will be performed by NSEL on the soil and groundwater samples recovered from the excavation:

EPA 8015M TPH / Diesel

3.3.5 **Northwest Excavation Dewatering, Treatment and Disposal Groundwater Recharge Sampling**

Approximately 330,000 gallons of diesel impacted groundwater will be pumped from northern excavation, treated on-site and discharged to the sanitary sewer under EBMUB permit, as described in section 3.2.2. This process will be repeated 6 times in order to draw impacted groundwater from beyond the northwest property line and from beneath the terminal building. As groundwater is recharging into the excavation, a grab water samples will be recovered from the excavation under the direction of the ACDEH, as described in section 3.3.3 and analyzed as described in section 3.3.4.

3.3.6 **Excavation Backfill**

The excavations will be backfilled with clean imported soil. The backfill will be placed in 12" lifts and mechanically compacted.

3.3.7 **Aquifer Excavation Corrective Action Costs**

Sample Recovery, soil profile	Vironex, one day@$2000	$ 2000
Asphalt removal/disposal	50,000 sq.ft.@ $1.00	$ 50,000
Excavator	200 hrs@ $175 $800 mob.	$ 35,800
Trucking/Disposal Fee	10,000 Tons @ $28 per	$ 280,000
Import/Trucking	5500 yrds @ $12 per	$ 66,000
Baserock/Trucking	2000 yrds @ $20 per	$ 40,000
Compaction	60 hrs@$125	$ 7,500
PM	200hrs@$75	$ 15,000
Compaction Testing		$ 3,000
Lab fees	70 samples@$50	$ 3,500
Asphalt Replacement (3")	50,000 sq.ft.@ $3.00	$ 150,000

EBMUD Short Term Discharge Permit
Application Fee $ 650

Treatment System

3 mo Rent/Mob. 20,000 gal. Phase Separator		$	5500
3 mo Rent/Mob. 1500 gallon tank		$	1300
3 mo Rent/Mob., 2, 2000 gallon carbon filters		$	1800
4000 lbs activated carbon		$	6000
PM/Labor	40hrs@$75 80hrs @ $45	$	6600
Pump, sample box, meter, valve		$	850
Excavate, dischrge line to sewer	Backhoe 8hrs@$100; $200 Mob.	$	1000
Asphalt	600 sq ft @ $ 4.00	$	2400
EBMUD Treatment fees	267 ccf.@ $0.45	$	120

Total Aquifer Excavation Scenario CAP Cost **$679,020**

4.0 CORRECTIVE ACTION RECOMMENDATION

The cost of the Enhanced Bio-Degradation CAP scenario described in section 3.1 appears to be the lowest cost at $265,710 over six years. However, the effectiveness of Enhanced Bio-Degradation in a heavily to moderately impacted diesel environment is questionable.

Groundwater Extraction CAP scenario, at a cost of $351,500 over five years (three years extraction, two years H_2O_2 , HCMO injection), is approximately 30% higher in cost than the Enhanced Bio-Degradation CAP scenario, but will remove approximately 10,000,000 gallons, or approximately 13,000 one hundred cubic foot (ccf) units of impacted groundwater over three years. Given that the aquifer zone is approximately 2 feet to 6 feet bgs. within the 60,000 square foot plume capture area, and given an liberal average porosity of 25% within the aquifer zone, approximately (240,000 cf x .25 / 100)=600 ccf of groundwater exists within the plume capture area. Theoretically, the Groundwater Extraction CAP scenario should remove 22 times the existing groundwater volume. At the end of three years, residual diesel levels may then effectively be remediated with the two inoculations of H_2O_2, HCMO injection.

Since the property is no longer being redeveloped, added costs such as groundwater treatment (due to the terminal building remaining), baserock import, compaction and re-paving (a necessity for the current use) along with higher soil disposal fees, the Aquifer Excavation CAP is now approximately 2.5 times more expensive than the Enhanced Bio-Degradation CAP scenario.

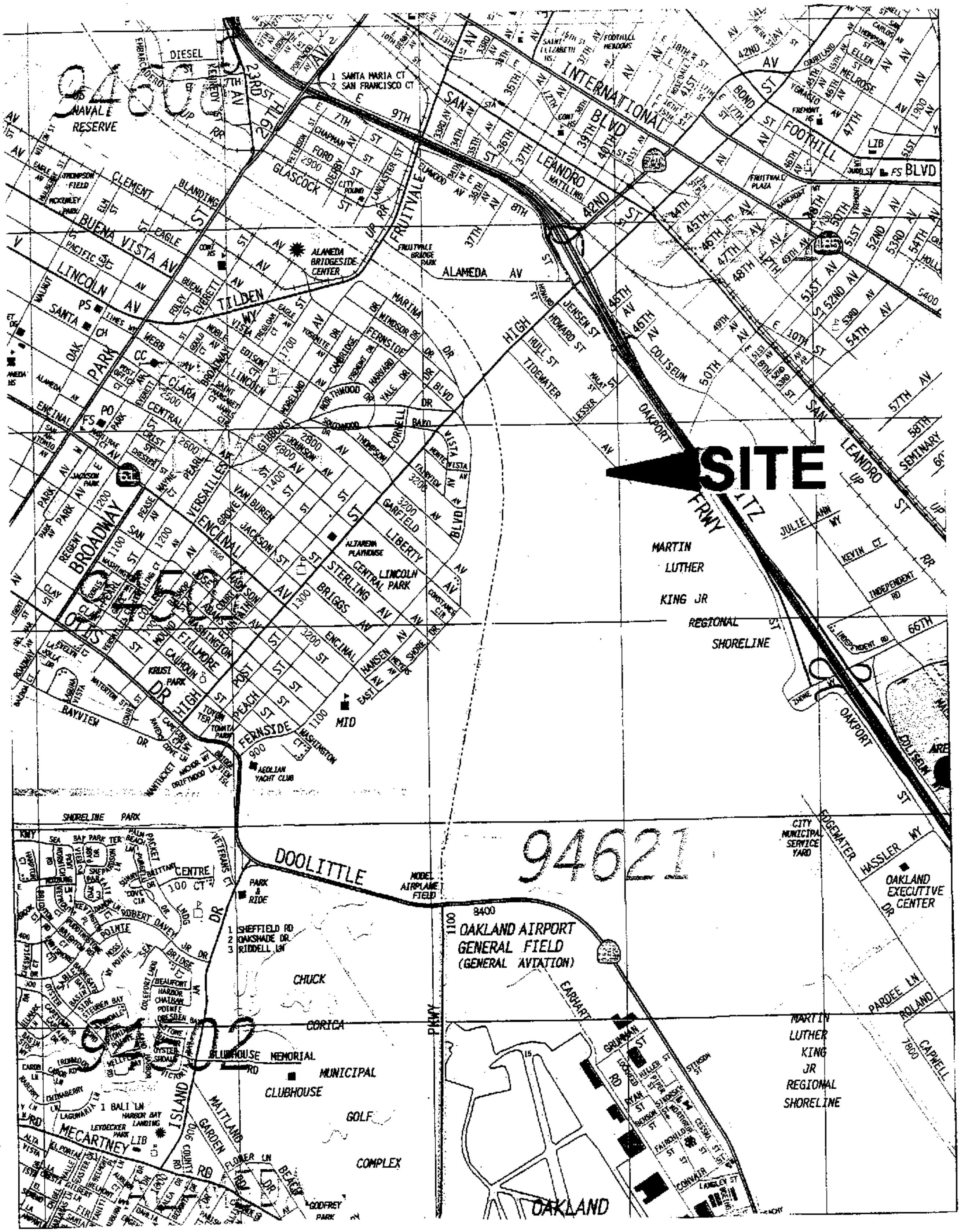
ERS recommends that the Groundwater Extraction CAP be implemented as the most cost effective corrective action for achieving the target clean up levels.

Respectfully submitted this 4th day of October, 2002,

Bennett T Halsted

Samuel H Halsted P.E.

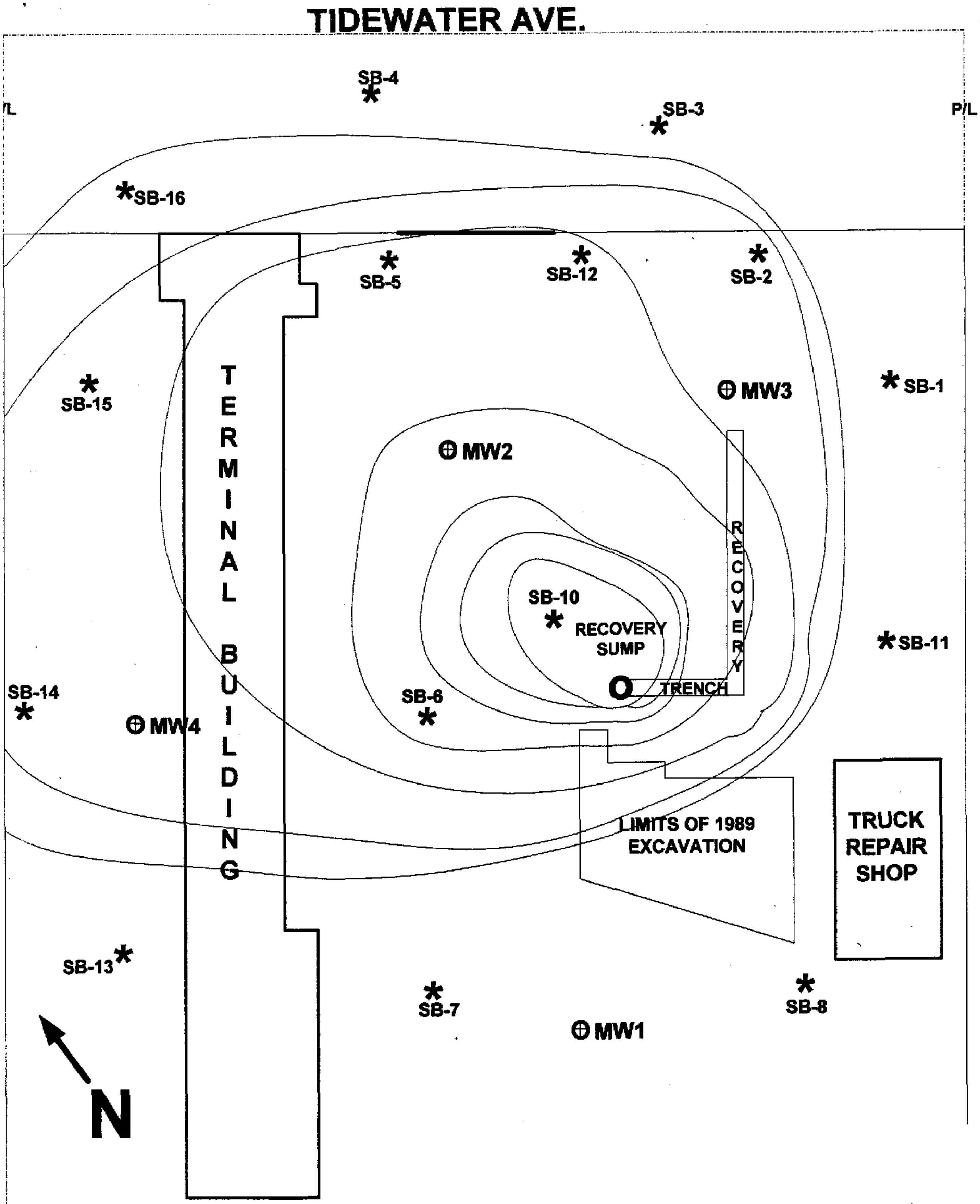
FIGURES



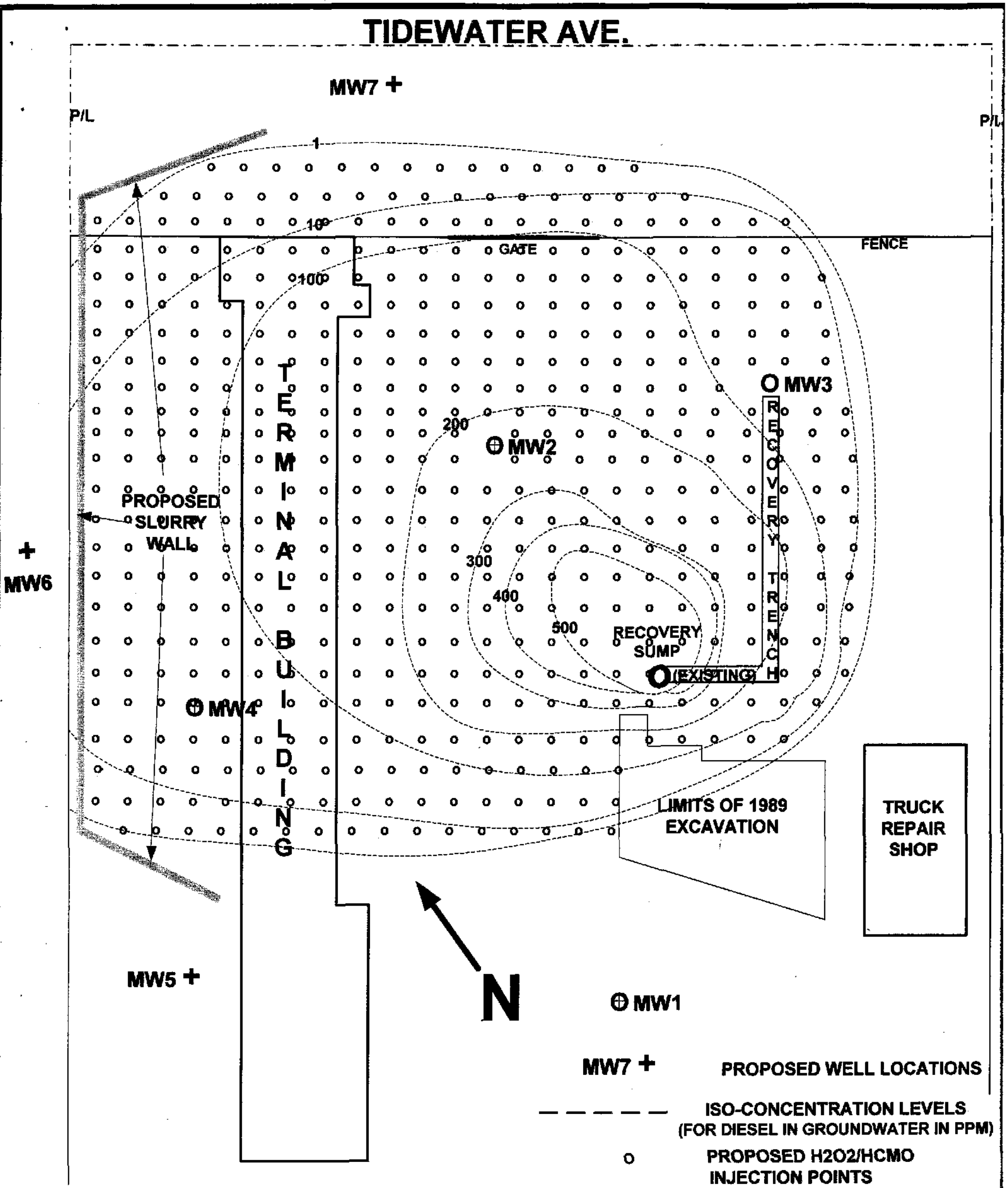
VICINITY MAP

4919 Tidewater St., Oakland, CA

DATE 9/19/02	SCALE 1"=1900'	BY:
Environmental Restoration Services 500 Santa Cruz Ave., Menlo Park, CA 94025		FIGURE 1



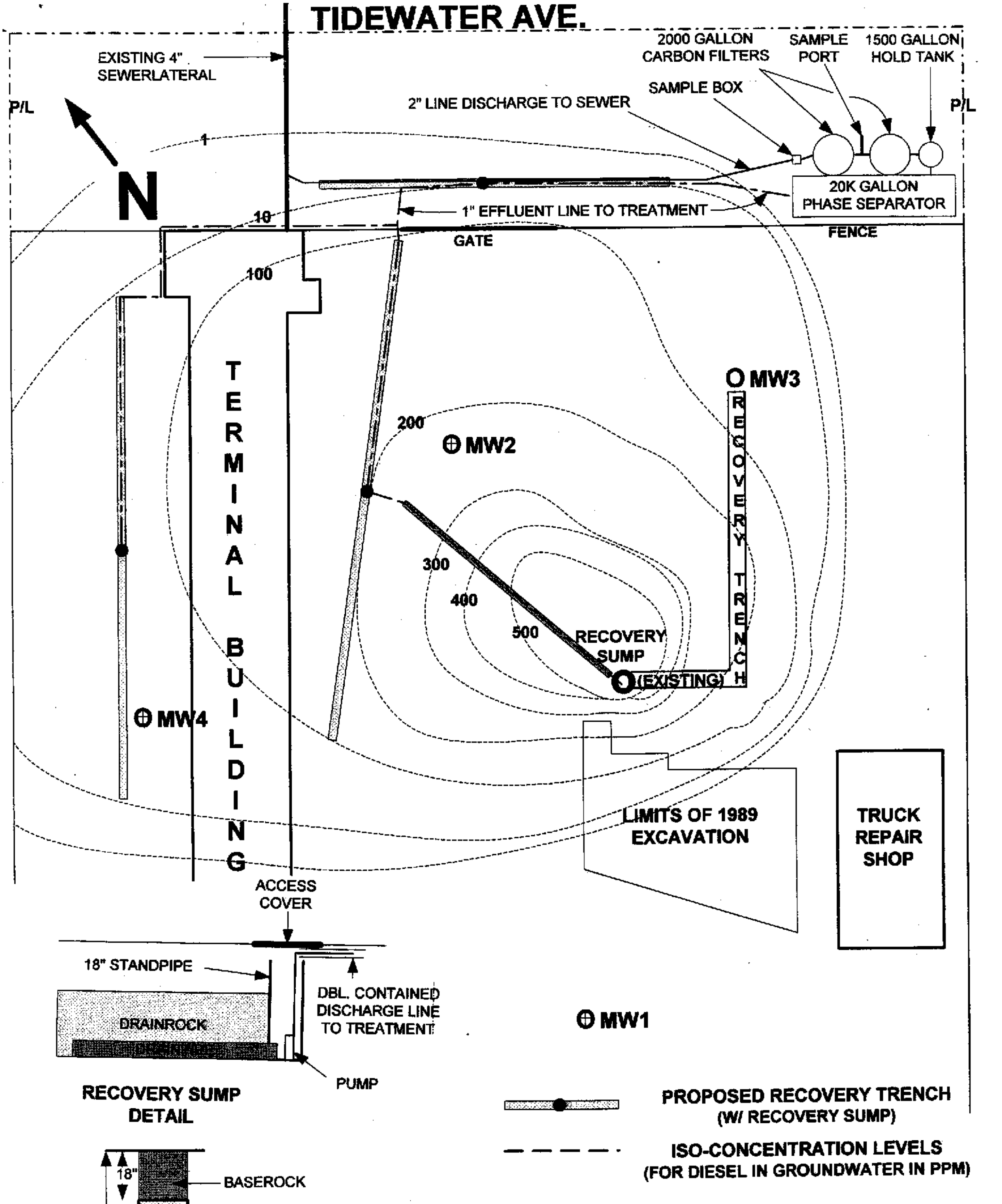
SITE PLAN 4919 Tidewater St., Oakland, CA		
DATE 10/1/02	SCALE 1"=50'	BY:
Environmental Restoration Services *500 Santa Cruz Ave., Menlo Park, CA 94025*		FIGURE 2



Enhanced Bio-Treatment CAP

4919 Tidewater St., Oakland, CA

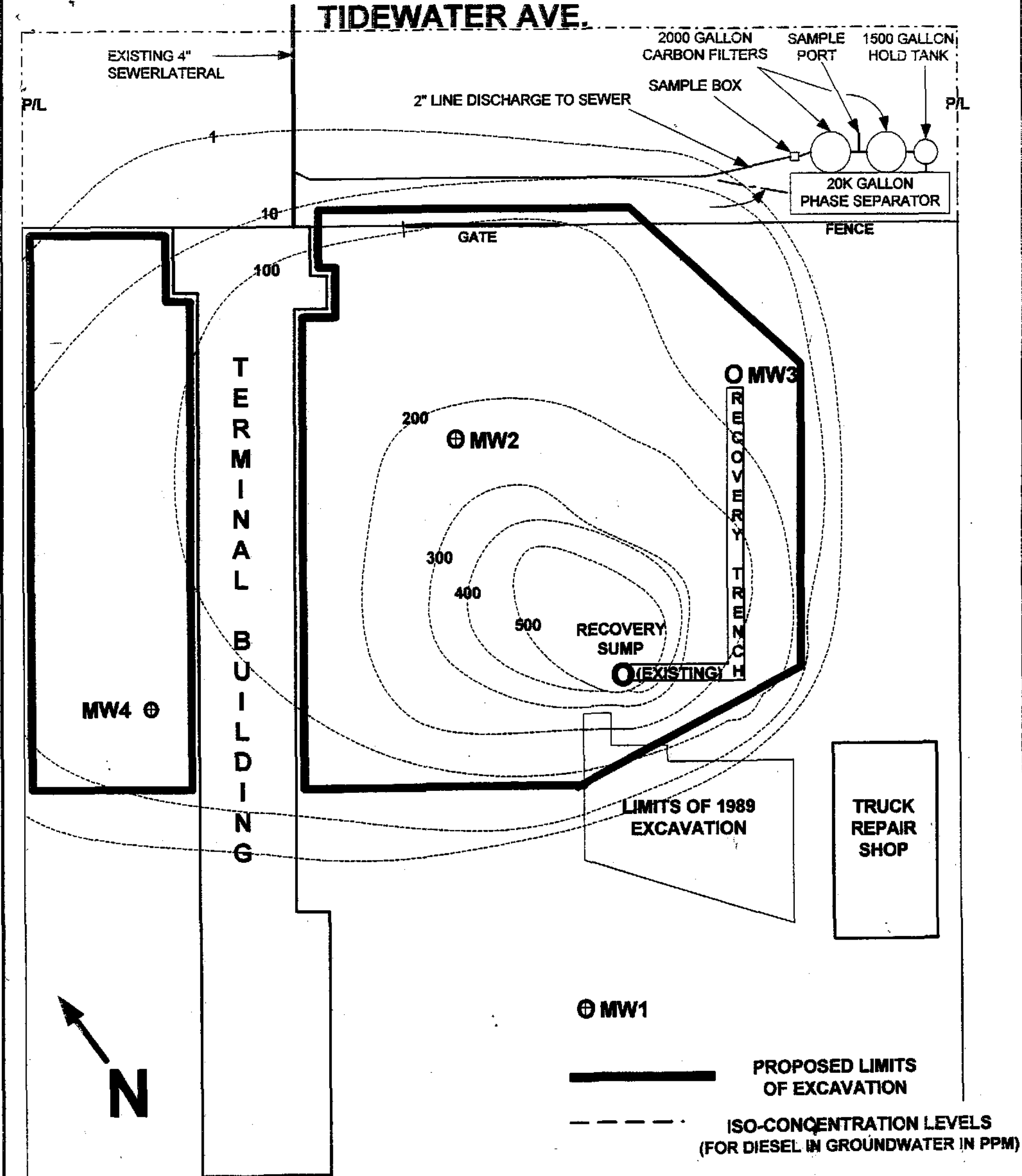
DATE 10/1/02	SCALE 1"=50'	BY:
Environmental Restoration Services ***500 Santa Cruz Ave., Menlo Park, CA 94025***		**FIGURE 3**



Groundwater Treatment CAP

4919 Tidewater St., Oakland, CA

DATE 10/1/02	SCALE 1"=50'	BY:
Environmental Restoration Services *500 Santa Cruz Ave., Menlo Park, CA 94025*		FIGURE 4



Aquifer Excavation CAP

4919 Tidewater St., Oakland, CA

DATE 9/19/02	SCALE 1"=50'	BY:
Environmental Restoration Services		FIGURE 5
500 Santa Cruz Ave., Menlo Park, CA 94025		