FREE PRODUCT INVESTIGATION REPORT
ALONG BRIGHTON AVENUE
OAKLAND, CALIFORNIA

WITH

CORRECTIVE ACTION WORKPLAN

FOR

FORMER DESERT PETROLEUM STATION #793
4035 PARK BOULEVARD
OAKLAND, CALIFORNIA

APRIL 3, 1997

BY

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CORRECTIVE ACTION WORKPLAN

INTRODUCTION AND HISTORY

Desert Petroleum was notified on November 30, 1989, by Alameda County Health Department, that gasoline was trickling into the sewer on Brighton Avenue through a crack in the bottom of the sewer manway. The regular unleaded supply piping failed the subsequent tank and piping intergrity tests. On December 7, 1989 all fuel was removed from the underground storage tanks (UST's). A 1/2 inch hole was discovered in the regular unleaded supply line beneath the eastern pump island and an Unauthorized Release Report filed on December 8, 1989.

Soil borings RS1, RS2, RS3, RS4, RS5 and RS6 were drilled and sampled on December 11, 12 and 13, 1989 by Remediation Service, Int'l. Borings RS1, RS2, RS5 and RS6 were converted into groundwater monitoring wells. At this time an exploratory excavation near the discovery of gasoline in the sewer manway exposed three different underground lines. The storm drain was encountered at around the 2.5 and 3 foot depth, the sewer drain line at approximately the 5 foot depth and a water supply line at about the 6 foot depth. Gasoline appeared to be seeping from the fill around the sewer line. The native formation exposed in this excavation is a tight clay. This excavation was converted into monitor well RS7 by installing an 8 foot section of 4 inch perforated PVC pipe and then backfilling the excavation with pea gravel.

Resna Industries' Water Works Corporation (August 21, 1990 and September 19, 1990) and Levine-Fricke (September 8, 1993) collected soil and groundwater samples from six soil borings situated near the north-south portion of the sewer lateral in the site vicinity to investigate the probability of neighboring sites being impacted.

On June 22 and 23, 1994 the three gasoline UST's and the waste oil UST were removed. After documentation sampling the excavated soil placed back into the pit, for temporary storage, was removed August 8-11, and 14, 1995, along with material from the pump island area. Documentation samples were obtained at that time.

The pump island excavation extended to the footing of the building to a depth of 17 feet. Pea Gravel was used to backfill the base of the excavation to about the 5.5 foot depth. A 6 inch perforated PVC (0.020 inch slot) was installed into the pea gravel backfill vertically from about the 14 to 4 foot depth, with blank PVC casing to surface for future infiltration. The remainder of the excavation was compaction backfilled to the pre-existing surface with A/B. This well is noted as R3.

On August 31, 1995 the former waste oil area was exploratory excavated to the 17 foot depth and samples obtained. At that time another exploratory excavation was performed to the 17.5 foot depth west of the building. Recovery/infiltration wells R1 and R2 were installed into these excavation using 6 inch slotted PVC (0.020 inch slot) from about the 7 to 17 foot depths with backfill of pea gravel to the 3 foot depth, with compacted A/B fill to surface. These wells are noted as R1 and R2, see Figure 3.

Western Geo-Engineers conducted a Soil Probe Survey (SPS) along the sewer lateral north of the site in May, 1996 to define the extent and degree of soil and groundwater TPHg contamination. Free product sheen was discovered in the front yard of 4032 Brighton Avenue.

Weekly purging of water from RS-7 for interim free product removal commenced on August 14, 1996 and was terminated on September 9, 1996. A total of 303 gallons of water and a sheen of product were recovered.

On September 20, 1996 air monitoring of the crawl spaces and sewer manways was conducted as directed by Alameda County Health. The crawl spaces monitored along Hampel Street are located at the addresses 1211, 1215, 1221, and 1227; those along Brighton Avenue are located at the addresses 4006, 4026, and 4032 and 4003 Park Boulevard. All air samples obtained were below detection limits for TPHg, Benzene, Toluene, Ethylbenzene and Xylenes.

On January 17, 1997 a subsequent SPS was performed to further define the extent of the free product and to help develop a corrective action workplan for free product removal.

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PURPOSE AND SCOPE

The following documents the collection and analysis of soil and groundwater samples from selected locations along Brighton Avenue in an effort to define the extent of free gasoline found previously during the May, 1996 investigation along the City of Oakland sanitary sewer mains and laterals associated with the neighboring properties surrounding 4035 Park Boulevard, Oakland CA. The workplan for the investigation was approved by the Alameda County Health and impementation of the workplan began on January 15, 1997.

SITE LOCATION AND DESCRIPTION

Former Desert Petroleum #793 is a non-active station. The underground storage tanks (UST's), associated product dispensing piping and hydraulic hoists have been removed. The site is located on the northwest corner of the intersection of Park Blvd. and Hampel at 4035 Park Blvd., Oakland, California, see Figure 1. Figure 2 is a portion of the U.S.G.S. Oakland East, photorevised 1980 7.5 minute quadrangle map and shows the site at an approximate elevation of 210 feet above mean sea level in projected section 32; T1S; R3W; MDB&M. Figure 3 represents the areas investigated during May, 1996 and January, 1997.

LOCAL GEOLOGY, HYDROGEOLOGY AND GEOMORPHOLOGY.

GEOMORPHOLOGY

The site is situated on the western slope of the Berkeley Hills, east of Redwood Peak (elev. 1619 feet amsl) and south of Indian Gulch at an elevation of approximately 210 feet amsl. The Berkeley Hills are a northwest-southeast trending range within the Coastal Range Province of California. Erosion of the Coastal Ranges has filled the valleys within and boardering the Coastal Range with sequences of gravels, silts, sands and clays.

STRATIGRAPHY AND GROUNDWATER OCCURRENCE

4035 PARK BOLUEVARD

The native soil that comprised the sidewalls and floor of the UST excavation cavity and the over-excavation of the pump dispenser and waste oil areas consists of dark brown silty clay to the thirteen foot depth. This clay is found to extend to the 17 foot depth in the northern waste oil over-excavation (R2) and to 17.5 feet in the excavation produced west of the building (R1), see Figure 3. MW1 shows this clay to extend to the 20 foot depth at the southeast corner of the site, RS-5 shows this clay to extend to the twenty three foot depth. This clay is covered with imported fill consisting of about one foot of brown clay with gravel and 6 inches of red gravel, as the base, beneath 4 inches of asphalt, in the UST area. Asphalt at MW1 is about 3 inches thick with no fill, beneath the south side of the building within the pump dispenser over-excavation this fill is found above a 1 inch asphalt layer that slopes to the northwest from 1.5 feet below the surface at the southeast corner of the building to 8 feet below the surface at the northwest corner of the building where it was exposed in the western excavation (R1). Beneath the fill and dark brown clay is a light brown firm to stiff clay with occasional gravel size pebbles. These pebbles are subrounded to rounded and do not interconnect and appear to be of metavolcanic origin. Within the UST excavated area and at MW1 this brown gravelly clay is found at the 13 foot depth. In the excavations north and west of the building this gravelly clay is encountered at 17 and 16 foot depths respectively.

A sand is found in MW1, beneath the brown gravelly clay at the twenty foot depth and at the 21 and 22 foot depths at RS-6 and RS-5 respectively. Underlaying this sand is a silty clay.

During the quarterly monitoring of DP 793 groundwater in the monitoring wells was between 12 to 18 feet below the surface.

BACKYARDS WEST OF HAMPEL STREET, EAST OF BRIGHTON AVENUE, NORTH OF PARK BOULEVARD AND SOUTH OF GREENWOOD AVENUE.

Figure 7 depicts the lithologic sequence near the sewer lateral that leaves 4035 Park Boulevard and heads north along the fence lines of adjacent properties, before turning west at 1215 Hampel Avenue. Figure 7 is based on visual inspections of the soils exhumed from hand auger borings conducted during the May, 1996 and January, 1997 investigations and from the Remedial Services, Int'l borehole log for RS-5.

The surface consists of fill on a light brown clay. This light brown clay appears to have been erroded/removed from the areas near BH1, BH2, BH3 and BH4. Underlaying the light brown clay is a stiffer, dark brown to chocolate colored clay, similar to the clay found near the surface at DP 793 station site. Starting with the dark brown-chocolate clay a similar sequence in lithology is found along and beneath the sewer lateral. Beneath the dark brown clay is a moist light brown silty clay containing occassional gravel and sand, followed by a sand with occassional gravel; the aquifer sand. Groundwater is associated with this sand and has a potentiometric rise, into the overlaying clays, of 7 to 12 feet.

Figure 7 is a cross sectional view along the backyards of the investigated area and shows the association the sewer lateral has with the lithology. Boring A3, exposed the top of the sewer at 1211 Hampel Avenue and indicated that the fill surrounding the sewer is native clay.

Figure 8 depicts the lithologic cross section along the eastern gutter of Brighton Avenue. The lithologic sequence is similar to that shown in Figure 7; a light brown clay underlayed by a dark brown clay, followed by a moist silty light brown clay and the aquifer sand which contains occassional gravels.

Figure 8 also shows the subsurface relationship of the sewer lateral and the natural gas line (2" PVC) for service to the homes. Free product was found floating on top of groundwater in test holes west of the Brighton Avenue gutter and east of the gas line.

SOIL PROBE SURVEY

Location of Test Holes

WEGE drilled a total of 19 SPS (Soil Probe Survey) test holes at selected locations along Brighton Avenue to help define the extent of the free product that was discovered during the May, 1996 Sewer Lateral Investigation. The test hole locations were similar to the locations proposed in the workplan. Actual field placement of a given test hole was dependent on underground utility locations, landscape configuration of the individual frontyards and the results of the previous sample(s) analyses from the on-site laboratory.

Collection and Analysis of Soil and Water Samples

A slide hammer was used to drive a 5/8 inch diameter steel rod to the desired sampling depth. A steel sampler with an inner plunger and a 3/8 inch by 2 inch brass sleeve fitted to the end was used to gather a small (1 to 4 grams) soil plug of the relatively undisturbed soil from the base of the hole. The sample was placed into a pre-weighed 40 ml VOA Vial.

Soil samples were collected from approximately the 5, 10, and 15 foot depth intervals at each SPS test hole. See Table 2 for the actual sample collection depths.

The soil was examined under an Ultraviolet (U.V.) scope to determine if any petroleum fluorescence was present in the sample. The sample was then weighed, placed on a hot plate and allowed to come to equilibrium. After the sample reached equilibrium, a headspace sample was obtained with a 3 CC syringe and injected into an FID (flame ionizing detector) chromatograph.

When water was encountered in a test hole it was sampled by lowering 1/4 inch tubing into the hole and pulling a sample of the top of the water to the surface using the vacuum provided by a 60 cc syringe. The samples were collected in 40 ml VOA vials. The water was examined under the ultraviolet (UV) scope for petroleum fluorescence and then placed on a hot plate. After the sample reached equilibrium a sample of the headspace was collected with a 3 cc syringe and injected into a calibrated FID chromatograph. The resulting chromatograms were examined for volatile organics.

The chromatograph was calibrated prior to sampling using known concentrations of the compounds to develop standard chromatograms.

Results of the Soil Probe Survey

Figure 4 is a combination of both the May, 1996 and the January, 1997 SPS showing the groundwater plume as it travels from 4035 Park Boulevard north and then west along the sewer lateral to Brighton Avenue where it spreads in a north south direction along the natural gas utility fill and gutter area of Brighton Aveune. Figure 5 is a larger scale of the groundwater plume and depicts the free product plume along the east gutter of Brighton Avenue.

Figure 6 shows the relative groundwater elevation from measurements obtained from the SPS test holes on January 16, 1997. The gradient simulates the topography of the area.

As described earlier, Figures 7 and 8 are lithologic cross sections paralleling Brighton Avenue and show the utilities of concern. The backyard sewer lateral, Figure 7 and the natural gas utility section is Figure 8.

SOIL BORINGS

Location of Soil Borings

In order to confirm the lithology and to obtain certifed groundwater and soil samples, WEGE hand augered three soil borings. The soil borings were advanced with a three inch diameter hand auger. One soil boring (A3) was located in the backyard of 1215 Hampel Avenue to intersect the sewer pipe and determine what was used as fill material around the pipe. The other two borings were located in the planter areas east of the eastern curb of Brighton Avenue (A1 and A2). The hand augered soil borings were located near SPS locations and help verify the lithology that was being investigated.

Collection of Water Samples

Groundwater was encountered in SPS holes 1 through 7, 9, and 11 through 19 and boreholes A1, A2 and A3. And in the previous May, 1996 SPS study in holes TP2 through TP6, TP8, TP9, TP14 through TP16 and TP18. A film of free product was observed in SPS holes TP9, and 3, 5, 6, 7, and 14. Water from SPS test hole 13 exhibited a bright yellow fluorescence when examined under UV scope, indicating a high percentage of dissolved petroleum hydrocarbons in the water, see Table 2. Depth to water measurements were obtained from the test holes and bore holes prior to their destruction at the end of each day, after allowing the water level in the holes to stabilize for at least 3 hours.

Selection and Certified Laboratory Analysis of Water Samples

A total of three water and three soil samples were obtained from each of the three soil borings, preserved and Chain-of-Custody delivered for certified laboratory analysis to North State

Environmental (NSE), see Table 3.

The soil and water samples from the bore holes were analyzed by NSE for concentrations of Total Petroleum Hydrocarbons as Gasoline (TPH-G) using EPA method 5030/GCFID and Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) using EPA method 8020.

<u>Results of Certified Analysis</u>

The results from the certified laboratory analysis of soil and groundwater samples collected from the three soil borings are found in Appendix A Laboratory Report and presented on Table 1 - Soil and Table 3 - Water.

The soil samples were obtained just above groundwater at the the 0.9 foot depth of A1, at the 7 foot depth of A2 and the 4.5 foot depth of A3. A1 and A3 contained trace amounts of Toluene at 0.017 mg/Kg and A2 contained 0.68 mg/Kg TPHg, 0.24 mg/Kg Benzene, 0.032 mg/Kg Toluene, 0.009 mg/Kg Ethylbenzene and 0.024 mg/Kg Xylenes. All soil samples contained unconfirmed trace amounts of Methyl tertiary-Butyl Ether (MTBE), 0.14 mg/Kg in A1, 0.07 mg/Kg in A2 and 0.085 mg/Kg in A3.

Three water samples were obtained, two from A1, shallow water and deep water, and a water sample was obtained from A2. The shallow water from A1 contained 0.6 ug/L Benzene, 2.0 ug/L of Toluene and 15 ug/L MTBE. The deeper water sample from A1 contained 1.0 ug/L of Toluene and 15 ug/L MTBE. The A2 sample contained 200 mg/L TPHg, 24 mg/L Benzene, 35 mg/L Toluene, 5.8 mg/L Ethylbenzene, 24 mg/L Xylenes and 3.3 mg/L MTBE.

SOIL TAINTED WITH TOTAL PETROLEUM HYDROCARBONS, GASOLINE RANGE.

The investigations conducted by RSI, Resna, Levine-Fricke and Western Geo-Engineers indicates that after over-excavation of the pump dispenser area, the only remaining area of tainted soil not associated with groundwater transport is beneath the former service station building, see Figure ~~9~~. 10

GROUNDWATER TAINTED WITH DISSOLVED TOTAL PETROLEUM HYDROCARBONS, GASOLINE RANGE.

Dissolved range of TPHg has been delineated as shown on Figures 4 and 5. The dissolved hydrocarbons leave the former Desert Petroleum site north following the sewer lateral and then proceed west at 4032 Brighton Avenue as the sewer lateral T's west towards Brighton Avenue. At Brighton Avenue the dissolved plume extends north and south beneath the eastern curb/sidewalk and west to the water supply underground utility trench.

FREE PRODUCT ALONG BRIGHTON AVENUE.

Figure 5 depicts the extent of free product shown found floating on groundwater beneath Brighton Avenue and the western curb/sidewalk. The free product plume is found in the curb/sidewalk area in front of 4032 Brighton Avenue and extends for about 140 feet north along the eastern curb of Brigton Avenue, bounded on the west by the natural gas utility and on the east by the front yards of the neigborhood. Vertically the free product is found on groundwater in a sand between five and ten feet beneath the surface.

GROUNDWATER OCCURANCE BENEATH BRIGHTON AVENUE.

Groundwater was not encountered in a SPS test hole until the formation became sandy and/or silty. The groundwater would then rise in the test hole, indicating confined conditions, see Figures 6, 7 and 8.

WORKPLAN

PURPOSE

Alameda County Health has requested a workplan that addresses the removal of free product from beneath Brighton Avenue and reduces the levels of gasoline range petroleum hydrocarbons found in the soils and groundwater beneath 4035 Park Boulevard and along the sewer lateral that leaves 4035 Park Boulevard heading north and then west to Brighton Avenue.

REMEDIAL ACTION TECHNOLOGIES

VAPOR EXTRACTION

The subsurface is composed primarily of clays, silty clays, sandy clay and a shallow groundwater aquifer of silty to clayey sands. RSI performed vapor extraction at RS-7 and from monitor wells at 4035 Park Boulevard with limited success. Crossection Figures 7 and 8 indicate that the groundwater is confined, limiting the vapor extraction exposure to the groundwater and free product. Past experience has shown that vapor extraction on clayey soils does not work. This technology will not be presented as the primary means of contaminant reduction, but may be considered as a polishing and/or oxygen enhancement component.

GROUNDWATER PUMPING

Localized pumping from intercept trenches that are proposed to be dug along the eastern curb area of Brighton Avenue can accumulate and remove the majority of the free product found in this area, but will leave residual coating of the free product on the sidewalls of the excavations and the fill material.

The extracted water with a film of product may possibly be permitted for direct sewer discharge. If some treatment will be required the recovered water may have to be transported to 4035 Park Boulevard for treatment prior to dumping to the sewer. Some or all of the treated water, depending on flow rates, will be treated with nutrients an surfactants and pumped into the infiltration well R3.

SURFACTINATION

Injection of TSP (Tri-Sodium Phosphate) into infiltration wells R3 and R4 with recovery at R1 and R2 will help wash the soils tainted with TPHg beneath the building at 4035 Park Blvd. It is proposed that not all of the infiltration fluids will be recovered. Some will continue to infiltrate and spread along the sewer lateral, following the same course as the unautorized release, eventually exiting at the recovery trenches intalled in Brighton Avenue.

The TSP will also inhance biodegradation by adding nutrients to the groundwater and the capillary fringe area along the water plume migration route. Other nutrients and/or oxygen enhancments may also be added to the infiltration flushing water.

RISK

Risks related to remedial actions of the site, the sewer lateral that leaves the site and is located beneath the backyards of the neighboring homes and the recovery trenchs planned for the eastern curb area of Brighton Area, see Figure 10, must be addressed prior to commencing or implementing remediation. The following catagories and their necessary safeguards and monitoring procedures should be addressed in proposals.

VAPOR PHASE HYDROCARBONS

Western Geo-Engineers has performed vapor studies that indicate there are no risk levels of gasoline range hydrocarbon vapors in the near surface, in the crawl spaces of the homes adjacent to the sewer lateral and in the sewer manways.

Future remedial actions may create a situation that could introduce vapor migration to the near surface, albeit the formation is clay and should retard such migration. A monitoring program should be developed and approved to demonstrate that no risk occurs.

explain

DISSOLVED PHASE HYDROCARBONS

Injection of water containing surfactants, oxygen enhancement compounds, and/or other nutrients will elevate the groundwater level at and near the injection well R3. Some or most of the fluid will be recovered from wells R1 and R2 and treated before disposal to sewer and/or injection back into R3. It is anticipated and planned to allow some of the injection fluid to leave the site and follow the same route as the unauthorized release, along the sewer lateral and backyards to the recovery trenches, to remediate the impacted soils and groundwater as delineated on Figure 4.

To insure that the injection of fluids are not supercharging the aquifer and forcing water/fluids to enter the crawl spaces beneath the homes located at 4038 and 4032 Brighton Avenue, french drains should be designed to intercept any shallow water migrating from the sewer lateral towards the homes, see Figure 10.

Wells should be installed along the sewer lateral and along Brighton Avenue, to monintor the effects of the removal of water at the french drains and the effects of the infiltration water at R3, see Figure 10.

FREE PHASE HYDROCARBONS

Free phase product was first discovered in the sewer manway on Brighton Avenue in 1989. An excavation near this manway was converted into a product recovery/monitoring well and has exhibited occassional free phase product, RS7. The SPS investigations in May, 1996 and Janaury, 1997 located free phase product sheen along the eastern gutter area of Brighton Avenue out to the natural gas utility trench. This free phase product can be considered a source for: the continued degradation of groundwater, for vapor phase hydrocarbon accumulation/migration and for a contact and inhalation risk to workers that may be performing future underground utility work in the area.

To reduce the risk the free phase product must be removed. As described in the Dissolved Phase section, recovery trenches and monitor wells will be used to recover and monitor the effects of the remediation efforts for free phase product removal.

INFILTRATION FLUID

This corrective action plan, involves the introduction of fluids to the subsurface at injection area R3. By keeping the former pump island excavation pit full, fluid should flow or leak into the same paths taken by the leaked fuel. It is the intent to use oxygenants, surfactants and bio-nutrients to expedite the cleaning of soils beneath the building at DP 793 and along the sewer lateral from the site to Brighton Avenue. The introduction of these fluids is also intended to enhance the remediation of impacted groundwater as delineated on Figure 4.

The Risk of exposure from the introduction of oxygenants and nutrients is primarily to the operator of the treatment system. Safeguards such as splatter proof compound, high fluid level switches, vapor alarms etc. will need to be incorporated into the design of the remediation compound to safeguard the neighborhood from the accidental discharge of any fluids to the surface of the site and/or the accidental release of any vapors that may be generated from the treatment/injection compound. The site specific Health and Safety Plan should include handling and mixing controls for the fluids to be used, contingency plans for accidental releases, etc. All materials, fluids, etc. to be used in the injection/treatment shall be analyzed for potential risk and copies of all MSDS's (Material Safety Data Sheet) will be kept on site for review by any and all presonnel authorized to inspect the treatment compound.

MONITORING

To insure that the proposed remediation system is operating as planned and/or to evaluate if modifications are needed during the remediation phase a monitoring program will be proposed for approval and will be maintained throughout the remediation phase. The monitoring program should be able to indicate the trend of remediation progress, safeguard the neighborhood against the remediation activities, project necessary changes in the remediation phase as needed to enhance the clean-up efforts, to evalute the cost benefit and to be used in Risk Base Corrective Action modeling to determine when clean-up has succeeded and is no longer needed.

CONSTRUCTION

Construction of the proposed remediation system will be performed in Phases.

Phase 1

Area Relief Map

A scaled relief map of the area of construction, see Figure 10, will need to be developed due to the amount of surface relief (35 to 40 feet), the private landscaping with terraces, planters, brick and rock patios, ponds, trees, shrubs, etc., above ground structures (houses, garages and outbuildings) and underground utilities of the area to be remediated.

Phase 2 #? how many? Fig 10 shows 3

Installation of groundwater monitoring wells along the sewer lateral between the site toward Brighton Avenue.

Limited access to the backyards suggest that these wells will have to be installed by the hand auger method.

One inch Sch40 PVC 0.01 inch slotted casing will be installed into 4 inch diameter hand augered holes placed in the backyards near the sewer lateral at 4026 and 4038 Brighton Avenue and 1227 Hampel Avenue, see Figure 10. The borings will be hand augered using a four inch diameter bucket, to approximately ten feet below the surface, at least two feet into groundwater. Cuttings produced from the augering will be lithologically logged and inspected for presence of petroleum hydrocarbons, using a portable flame-ionizing or photo-ionizing detector. The borings will be drilled by a licensed well drilling contractor (C-57) and lithologic discriptions provided by a qualified geologist working directly under a California Registered Geologist.

The wells will be constructed of one inch Sch40 PVC 0.01 slot from the ten foot depth to the five foot depth with a plug and one inch Sch 40 blank PVC on top, to the surface. A filterpack of #2/12 sand will be placed adjacent to the slot from the ten foot depth to the four foot depth. One foot of hydrated bentonite will be placed above the sand from the four foot to three foot depth. Neat cement will be used as the sanitary seal to the surface. Well security will be provided by a four inch monument set one foot above ground level secured in a one foot cubed concrete pad.

Prior to any field activities the appropriate Health and Safety Plan will need to be approved by Alameda County Health and presented to the effected property owners, permits will be obtained from Alameda County Zone 7 to install the wells, permission obtained from individual land owners with conditions allowing access to the wells during the remediation and monitoring phases.

Installation of wells along Brighton Avenue.

To document the effectiveness of the remediation efforts three additional wells will be installed within the City right-of-way of Brighton Avenue. One well north of SPS test hole 14, one well near SPS test hole 10 and one well near SPS test hole TP18 see Figures 3 and 10. These wells will be drilled with eight inch hollow stem augers using a truck mounted rig. The holes well be continuous sampled to the fifteen foot depth. The first five foot of the borings will be explored with a hand auger due to the numerous underground utilities in the areas to be investigated. Once the boring has been inspected by hand augering to the five foot depth, the rig will be postioned over the hole to drill to around the fifteen foot depth. Of particular interest is the contact between the clay and the underlaying silty sand that is the aquifer. If necessary the borings will be advanced deeper that fifteen feet to intercept the aquifer sand.

Two inch Sch 40 F480 PVC 0.01 slot will be installed from the bottom of the hole to the five foot depth, with two inch Sch 40 blank F480 PVC to surface. #2/12 sand will be placed adjacent to the slot from the bottom to the four foot depth. A one foot thick hydrated bentonite seal will be placed above the sand from the four foot depth to the three foot depth. Neat cement will be placed above the bentonite seal to surface. Well security will be an eight inch water tight, bolt-down lid, traffic box, secured in a two foot square concrete pad, 1/4 inch above the grade of the surface. Additional well security will be a locking vapor/water tight casing cap.

All newly installed wells and existing wells will be surveyed by a licensed land surveyor for top of casing elevation, to 0.01 foot accuracy, reference to mean sea level.

All newly installed wells will be developed by surge and pump to obtain good hydraulic communication with the aquifer.

Prior to installation of the recovery trenches/french drains, the newly installed wells will be monitored for water level fluctuations and background chemcial analysis.

Water level fluctuations will be determined by installing pressure transducers with data loggers into each well to record the water level every hour for one week.

Phase 3

Construction of French Drains

Recovery/french drains will be installed along the eastern gutter area of Brighton Avenue and the backyards of 4032 and 4026 Brighton Avenue. The trench/drain along Brighton Avenue will be dug to approximately the six foot depth below the surface, east of the natural gas line that services the homes along Brighton Avenue. The backyard drain will be dug or horizontally drilled east of the houses and connected to the trench along Brighton Avenue with a perpendicular trench or horizontal well. The relief map generated in Phase 1, (see Figure 10) will help determine which of the two methods will be used.

Prior to any trenching/drilling activities, Underground Service Alert (USA) will be notified to alert all utility servers in the area of the trenching activities. The contractor will mark the areas to be be trenched in white paint and verify that all concerned underground utilities have been adequately delineated. All necessary permits will be obtained prior to any trenching. These will include but are not limited to The City of Oakland encroachment and digging permits and any Alameda County Health permits.

Trenching - for the french drains?

on Brighton?

Once all underground utilities have been marked and varified, the areas above and around the utilities that will be exposed by trenching will be hand dug to physically expose the various utilities; natural gas, water and sewer. Electrical phone and cable service is above ground. Once the underground utilities have been exposed, a two foot wide trench, between the various exposed utility pipes, can be dug by backhoe or trencher to around the six foot depth. It is anticipated that water will enter the excavation(s) since they must reach the aquifer. Dewatering should be necessary during the trenching/construction process.

Once the various trenches have been dug between the utility runs, they will need to be connected by hand digging around and beneath the utilities to the desired width and depth.

At the lowest surface elevation of the trench area a two foot square sump will be dug to the seven foot depth below surface and a 12 inch diamter slotted well casing with bottom plug will be installed vertically into this sump.

At completion of trenching rounded clean pea gravel will be placed into the trench to approximately one foot below the surface, to provide a continueous pathway for the flow of groundwater to the recovery sump. A geo-liner that will allow moisture to pass through but prevent fill material from passing through it will be placed above the pea gravel to support compacted AB fill. The compacted AB fill will be placed to within four inches of the surface. The surface will be asphalted to match the surface elevation of the pre-existing surface.

Recovery Sump Access

A concrete vault four feet long, by three feet deep and two and half feet wide will be installed into the recovery trench to access the recovery sump and contain (house) the groundwater pump and controller, and if necessary, any equipment that may be needed to treat the water prior to sewer discharge.

The access lid to the manway will be water tight, traffic rated and installed flush with the surrounding surface. The bottom of the vault will be of finished (smooth) concrete floor and water tight.

Sewer Discharge

Prior to any trenching activities, a sewer discharge permit will be obtained. The need for the sewer discharge prior to trenching is to handle water produced from dewatering during construction of the recovery trenches. Once the trenches are constructed and operating the sewer discharge permit will be needed to allow discharge of recovered water from the french drains/trenches, for the duration of the remedial action.

A four inch ABS pipe will run from the sump vault and connect into the sewer pipe for discharge of recovered groundwater. All connection fees, permits and inspections will need to be coordinated with East Bay Municipal Utility District (EBMUD).

If discharge to sewer is not available for this project, contingency costs for the following should be developed: 1) horizontal drilling and installing four inch conduit from the vault to former Desert Station 793 (DP793) treatment compound, 2) trenching along Brighton Avenue and Park Blvd. to the treatment compounds at DP793 and installing a four inch conduit, or 3) to run a four inch above ground steel conduit along the fence line from the vault to the treatment compound at DP793.

Electrical Utilities

To power the submersible pump to be installed in the sump, 120 volt 1 phase service must be supplied to the vault. Above ground electrical is situated above the vault with an utility pole near the placement of the vault. The details of acquiring a remote service will need to be discussed with PG&E in order to deliver the necessary electrical to the vault. If this in not an option, again a contingency plan as discussed above will need to be researched to deliver electrical service from DP793 to the vault utilizing 1) horizontal drilling, 2) trenching, or 3) above ground conduit.

Phase 4

DP793 Treatment Compound

The northwest corner of 4035 Park Blvd. has been set aside for a treatment compound, see Figure 10.

Recovery and infiltration wells and lateral have already been installed, see Figure 11.

To clean the soils that were not excavated, beneath the existing building, water with surfactant (TSP) (also oxygenants and nutrients may be added) is to be injected into R3 and recovered at R1 and R2, allowing some of the surfactant to continue along the sewer route from DP793 to Brighton Avenue, following the same natural or artificial course(s) as that of the TPHg, that has been delineated by the SPS surveys. The water recovered from R1 and R2 will be pumped to a 1000 gallon white poly tank for sparging to remove the majority of gasoline range hydrocarbons. The off gas will be treated by two 85 gallon activated carbon vapor scrubs in series, using a regenerative blower. The water will then be recycled as injection fluids to R3, see Schematic Figure 12.

To safe guard against overfilling the injection well R3, a high fluid level sensor will be placed into R3 at the six foot depth, also to guard against overfilling the 1000 gallon above ground tank a high level sensor will be placed at the mid-height of the tank. If either of these sensors are activated by high fluid levels, the pumping will be turned off and cannot be restarted until an inspection of the system is made.

An effort will be made to recycle all recovered fluids, but it may become neccessary to discharge some fluid to sewer, the sewer discharge permit will need to include these fluids along with the recovered waters along Brighton Avenue.

LIMITATIONS

This report is based upon the following:

A. The observations of field personnel.
B. The results of laboratory analyses performed by a state certified laboratory.
C. Referenced documents.
D. Our understanding of the regulations of the State of California, Alameda County and the City of Oakland.

Changes in groundwater conditions can occur due to variations in rainfall, temperature, local and regional water use, and local construction practices. In addition, variations in the soil and groundwater conditions could exist beyond the points explored in this investigation.

State Certified Laboratory analytical results are included in this report. This laboratory follows EPA and State of California approved procedures; however, WEGE is not responsible for errors in these laboratory results.

The services performed by Western Geo-Engineers, a corporation, under California Registered Geologist #3037 and/or Contractors License #513857, have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the State of California and the Oakland area. Our work and/or supervision of remediation and/or abatement operations, active or preliminary, at this site is in no way meant to imply that we are owners or operators of this site. Please note that known contamination of soil and/or groundwater must be reported to the appropriate agencies in a timely manner. No other warranty, expressed or implied, is made.

Sincerely,

REGISTERED GEOLOGIST JACK E. NAPPER No. 3037 STATE OF CALIFORNIA

George L. Converse
Geologist

Jack E. Napper
Ca. Reg. Geologist #3037

cc: Ms. Jennifer Eberie, HMS, Alameda County Health
(510)271-4530

TABLE 1

[redacted]ANALYTICAL RESULTS FRO[redacted] SAMPLES

[redacted]RT PETROLEUM STATION #793, SE[redacted] LATERAL INVESTIGATION

OAKLAND, CA

SAMPLE ID	DATE SAMPLED	SAMPLED BY	DEPTH BGS (FEET)	TPH GASOLINE (MG/KG)	BENZENE (MG/KG)	TOLUENE (MG/KG)	E. BENZENE (MG/KG)	XYLENES (MG/KG)	[redacted]
BH1-5'	05/01/96	WEGE	5.00	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH1-10'	05/01/96	WEGE	10.00	31	< 0.005	0.16	0.22	0.71	
BH2-5.5'	05/02/96	WEGE	5.50	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH3-5'	05/02/96	WEGE	5.00	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH3-8.5'	05/02/96	WEGE	8.50	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH3-10.5'	05/02/96	WEGE	10.50	< 0.2	0.009	< 0.005	< 0.005	0.021	
BH4-6.5'	05/02/96	WEGE	6.50	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH4-8.5'	05/02/96	WEGE	8.50	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH5-5'	05/02/96	WEGE	5.00	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
BH5-6.5'	05/02/96	WEGE	6.50	< 0.2	< 0.005	< 0.005	< 0.005	< 0.005	
AUGER #1	01/17/97	WEGE	0.90	<0.5	<0.005	0.017	<0.005	<0.01	0.14
[redacted]	[redacted]	WEGE	7.00	0.68	[redacted]	0.032	0.009	0.024	0.07
AUGER #3	01/17/97	WEGE	4.50	<0.5	<0.005	0.017	<0.005	<0.01	0.085

in sewer "backfill"

TPH-G = TOTAL PETROLEUM HYDROCARBONS AS GASOLINE, ANALYZED BY EPA METHOD 5030/GCFID

BTEX ANALYZED BY EPA METHOD 8020

< LESS THAN SYMBOL INDICATES THAT CONCENTRATIONS ARE BELOW STATED LABORATORY DETECTION LIMITS

TABLE 2

UNCERTIFIED WEGE LABORATORY RESULTS FROM SOIL AND WATER SAMPLES

DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION

4035 PARK BOULEVARD, OAKLAND, CA

SAMPLE LOCATION	DEPTH (FEET)	TPH [redacted]	BENZENE [redacted]	TOLUENE (PPM)	ETHYLB (PPM)	XYLENES (PPM)	D. OXYGEN (PPM)
[redacted] SAMPLES FROM HAND AUGERED SOIL BORINGS							
BH1 PURGE		45.065	24.166	14.601	2.180	16.025	
BH1 SAMP		61.267	39.003	22.021	2.912	18.814	2.4
BH2		0.078	<0.001	<0.001	<0.002	<0.007	
BH2 SAMP		0.053	<0.001	<0.001	<0.002	<0.007	
BH3 SAMP		5.000	1.361	0.580	0.524	4.505	7.1
BH5 SAMP		0.198	0.237	<0.001	<0.002	<0.007	1.3
[redacted] SAMPLES FROM SPS TEST HOLES							
TP2		0.128	0.004	<0.001	<0.002	<0.007	
TP3		0.031	<0.001	<0.001	<0.002	<0.007	
TP4		26.280	0.691	0.993	0.390	4.231	
TP5		0.043	<0.001	<0.001	<0.002	<0.007	
TP6		0.396	<0.001	<0.001	<0.002	<0.007	
TP8		0.191	0.025	0.019	<0.002	<0.007	
TP9		FLOATING PRODUCT					
TP14		46.495	7.991	1.516	1.503	11.681	
TP15		3.333	0.978	0.835	0.190	1.846	
TP16		0.239	0.015	<0.001	<0.002	<0.007	
TP18		0.105	0.006	<0.001	<0.002	<0.007	
[redacted]							
1	4.65	11.710	[redacted]	4.741	0.276	2.390	
2		16.100	[redacted]	0.682	0.362	2.236	
3	1.87	[redacted]					
4	4.3	0.576	[redacted]	0.144	0.016	0.120	
5	1.05	[redacted]					
6	3.2	[redacted]					
7	2.8	[redacted]					
8	NO WATER RECOVERED, HOLE DRY						
9	1.9	0.010	<.001	<.001	<.002	<.006	
10	HOLE COLLAPSED, NO WATER RECOVERED						
11	12.35	0.055	0.007	<.001	<.002	<.006	
12		0.860	[redacted]	0.165	0.010	0.056	
13	4.9	146.690	[redacted]	19.776	2.053	18.294	
14	5	[redacted]					
15	14.1	1.397	[redacted]	0.298	0.032	0.265	
16	10.6	1.250	[redacted]	0.005	0.028	0.006	
17	0.9	0.012	<.001	<.001	<.002	<.006	
18	3.5	0.587	<.001	<.001	<.002	<.006	
19	7.74	<0.006	<.001	<.001	<.002	<.006	
[redacted]OIL SAMPLES FROM HAND AUGERED SOIL BORINGS							
BH1-10	10	80.827	3.037	5.418	1.271	7.099	

Brighton file.

Brighton

Is this really ppm?

gw

TABLE 2

UNCERTIFIED WEGE LABORATORY RESULTS FROM SOIL AND WATER SAMPLES

DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION

4035 PARK BOULEVARD, OAKLAND, CA

SAMPLE LOCATION	DEPTH (FEET)	TFH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLB (PPM)	XYLENES (PPM)	D. OXYGEN (PPM)
BH2-5	5.5	<0.05	<0.001	<0.002	<0.003	<0.009	
BH3	8.5	2.275	0.130	<0.006	<0.008	<0.025	
BH3	10.5	4.572	0.186	<0.008	<0.011	0.207	
BH5	6.6	0.944	<0.005	<0.008	<0.010	<0.030	
SOIL SAMPLES FROM SPS TEST HOLES							
TP1	4.5	2.049	0.018	<0.014	<0.018	<0.057	
TP1	6.5	0.306	<0.002	<0.004	<0.005	<0.015	
TP1	8.5	0.369	<0.004	<0.007	<0.009	<0.026	
TP1	9.25	0.860	0.028	<0.005	<0.006	<0.018	
TP2	4.5	0.378	<0.003	<0.004	<0.006	<0.017	
TP2	6.5	0.955	<0.003	<0.005	<0.007	<0.002	
TP3	4.5	0.202	<0.004	<0.004	<0.005	<0.017	
TP3	9	0.918	<0.011	<0.018	<0.023	<0.069	
TP4	4.5	0.500	0.010	<0.005	<0.006	<0.019	
TP4	6.5	2.621	0.048	<0.006	<0.008	<0.024	
TP4	8.5	25.117	0.278	0.918	0.358	3.320	
TP5	5	0.370	<0.003	<0.005	<0.007	<0.021	
TP5	6	0.225	<0.004	<0.007	<0.009	<0.027	
TP5	8.25	1.454	0.027	0.113	<0.008	<0.025	
TP6	8.5	13.060	0.081	0.032	<0.007	0.499	
TP7	7	0.335	<0.005	<0.008	<0.010	<0.030	
TP8	8.5	139.276	1.445	3.524	1.117	9.964	
TP9	4.5	61.381	1.772	1.253	0.609	2.388	
TP9	6.5	94.504	3.339	5.194	0.881	5.652	
TP9	8.6	1394.525	21.732	98.261	15.274	129.890	
TP10	8.5	6.886	0.318	0.230	<0.008	0.214	
TP11	6.5	41.374	0.311	0.040	<0.013	<0.041	
TP11	8	1.728	0.004	0.024	<0.008	<0.024	
TP12	8.25	0.364	<0.003	<0.005	<0.006	<0.020	
TP13	9	0.471	<0.004	<0.007	<0.009	<0.026	
TP14	7	17.090	0.910	<0.005	<0.007	<0.020	
TP14	10	585.232	9.185	3.656	10.144	88.611	

TABLE 2

UNCERTIFIED WEGE LABORATORY RESULTS FROM [redacted] WATER SAMPLES
DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION
4035 PARK BOULEVARD, OAKLAND, CA

SAMPLE LOCATION	DEPTH (FEET)	TFH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLB (PPM)	XYLENES (PPM)	D. OXYGEN (PPM)
TP15	9	182.649	4.987	10.195	4.001	31.842	
TP16	8.5	1.040	0.011	<0.007	<0.008	<0.026	
TP17	8.5	0.363		<0.006	<0.008	0.024	
TP18	6.5	1.782	0.033	<0.008	<0.010	0.149	
TP19	8	0.851	0.016	<0.008	<0.010	<0.031	
TP20	7.5	0.567	0.017	<0.006	<0.008	<0.024	
TP21	8.25	0.883	0.018	<0.006	<0.007	<0.02233	
soil SPS JANUARY 15-17, 1997 Brighton							
2	5	38.800	4.500	7.460	0.810	7.230	
	10	8.100	0.670	0.800	0.070	0.610	
	15	7.500	1.590	0.090	0.080	0.370	
4	5	0.700	0.040	<.01	<.01	<.05	
	10	87.600	2.750	7.910	0.480	5.020	
5	10	1290.800	232.490	149.080	2.710	137.700	
6	5	880.500	18.360	71.130	10.660	103.780	
7	5	0.700	0.030	0.050	<.01	<.05	
	10	3171.500	20.770	114.140	9.470	46.030	
8	10	0.300	<.01	<.01	<.01	<.05	
	15	0.200	<.01	<.01	<.01	<.05	
9	5	4.000	0.070	<.01	<.01	<.05	
	10	26.600	0.390	0.750	0.220	3.930	
10	5	0.800	<.01	<.01	<.01	<.05	
	10	9.300	0.130	<.01	0.260	3.300	
	14	5.600	0.040	0.020	0.020	0.650	
11	5	<0.1	<.01	<.01	<.01	<.05	
	10	<0.1	<.01	<.01	<.01	<.05	
	15	0.200	<.01	<.01	<.01	<.05	
12	5	11.200	0.650	1.210	0.050	0.230	
	10	38.700	5.010	11.610	0.670	5.330	
	15	27.000	3.830	9.340	0.920	8.550	

TABLE 2
UNCERTIFIED WEGE LABORATORY RESULTS FROM SOIL AND WATER SAMPLES
DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION
4035 PARK BOULEVARD, OAKLAND, CA

SAMPLE LOCATION	DEPTH (FEET)	TFH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLB (PPM)	XYLENES (PPM)	D. OXYGEN (PPM)
13	5	311.800	3.110	25.360	2.080	20.150	
14	10	2.000	0.060	<.01	<.01	<.05	
	15	166.400	1.040	0.460	0.920	4.260	
15	5	58.500	0.830	0.780	0.690	6.360	
	10	248.900	6.800	2.470	1.860	17.030	
	15	8.100	0.780	1.510	0.160	1.170	
16	10	<0.1	<.01	<.01	<.01	<.05	
	15	2.800	0.490	0.010	0.010	0.030	
17	5	0.200	<.01	<.01	<.01	<.05	
18	7	105.400	1.240	3.830	1.150	8.700	
19	10	<0.1	<.01	<.01	<.01	<.05	
	15	<0.1	<.01	<.01	<.01	<.05	

VAPOR SAMPLES FROM SPS TEST HOLES

V1	2.5	<0.05	<0.001	<0.001	<0.001	<0.005

RESULTS FROM PID

TP2	7	1.902
TP3	6.5	1.319
TP6	4.5	1.037
TP6	7	3.262
TP6	8.5	24.594
BH1	5	<0.43
TP7	4.5	1.313
TP8	4.5	0.802
TP8	7	<0.35
TP10	4.5	<0.3
TP11	4.5	<0.4
TP11	6.5	21.108
TP12	4.5	<0.4
TP13	4.5	<0.4
TP13	6.5	0.659
TP14	4.5	0.588
TP14	6.5	36.769
TP15	4.5	1.365
TP15	6.5	<0.33
TP16	4.5	<0.30
TP16	6.5	<0.32
BH3	8.5	4.759
BH3	10.5	10.082

TABLE 2

UNCERTIFIED WEGE LABORATORY RESULTS FROM SOIL AND WATER SAMPLES

DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION

4035 PARK BOULEVARD, OAKLAND, CA

SAMPLE LOCATION	DEPTH (FEET)	TFH (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLB (PPM)	XYLENES (PPM)	D. OXYGEN (PPM)
BH4	8.5	<0.25					
BH5	2.5	<0.16					
BH5	8.5	<0.47					
V2	2.5	<0.05					

TFH = TOTAL FUEL HYDROCARBONS (GASOLINE RANGE)

PPM = MILLIGRAMS/KILOGRAM (SOIL) = MILLIGRAMS/LITER (WATER)

ETHYLB = ETHYLBENZENE

D. OXYGEN = DISSOLVED OXYGEN

< LESS THAN SYMBOL INDICATES THAT CONCENTRATION IS BELOW STATED LABORATO

TABLE 3

CERTIFIED ANALYTICAL RESULTS FROM WATER SAMPLES

DESERT PETROLEUM STATION #793, SEWER LATERAL INVESTIGATION

OAKLAND, CA

SAMPLE ID	DATE SAMPLED	SAMPLED BY	TPH GASOLINE (UG/L)	BENZENE (UG/L)	TOLUENE (UG/L)	E. BENZENE (UG/L)	XYLENES (UG/L)	MTBE
DP-SB1-W	08/21/90	RESNA	740000	110000	130000	13000	73000	
GW-SB-B	09/08/93	LEVINE/F	210000	42000	51000	37000	21000	
GW-SB-A	09/09/93	LEVINE/F	<50	<0.5	<0.5	<0.5	<2	
LF-1	09/13/93	LEVINE/F	<50	<0.5	<0.5	<0.5	<2	
BH1-WATER	05/01/96	WEGE	150000	32000	28000	3300	13000	
BH2-WATER	05/02/96	WEGE	< 50	2.2	2	< 0.5	< 2	
BH3-WATER	05/02/96	WEGE	39000	2300	1800	1500	7100	
BH5-WATER	05/02/96	WEGE	470	270	< 0.5	< 0.5	< 2	
[redacted]								
SHALLOW	[redacted]	WEGE	< 50	0.6	2	< 0.5	< 1	15
DEEP	[redacted]	WEGE	< 50	< 0.5	1	< 0.5	< 1	15
[redacted]	[redacted]	WEGE	[redacted]	[redacted]	35000	5800	24000	[redacted]

TPH-G = TOTAL PETROLEUM HYDROCARBONS AS GASOLINE, ANALYZED BY EPA METHOD 5030/GCFID

BTEX ANALYZED BY EPA METHOD 602

MTBE - Methyl tertiary-Butyl Ether

WEGE = WESTERN GEO-ENGINEERS

RESNA = RESNA INDUSTRIES

LEVINE/F = LEVINE-FRICKE

< LESS THAN SYMBOL INDICATES THAT CONCENTRATIONS ARE BELOW STATED LABORATORY DETECTION LIMITS

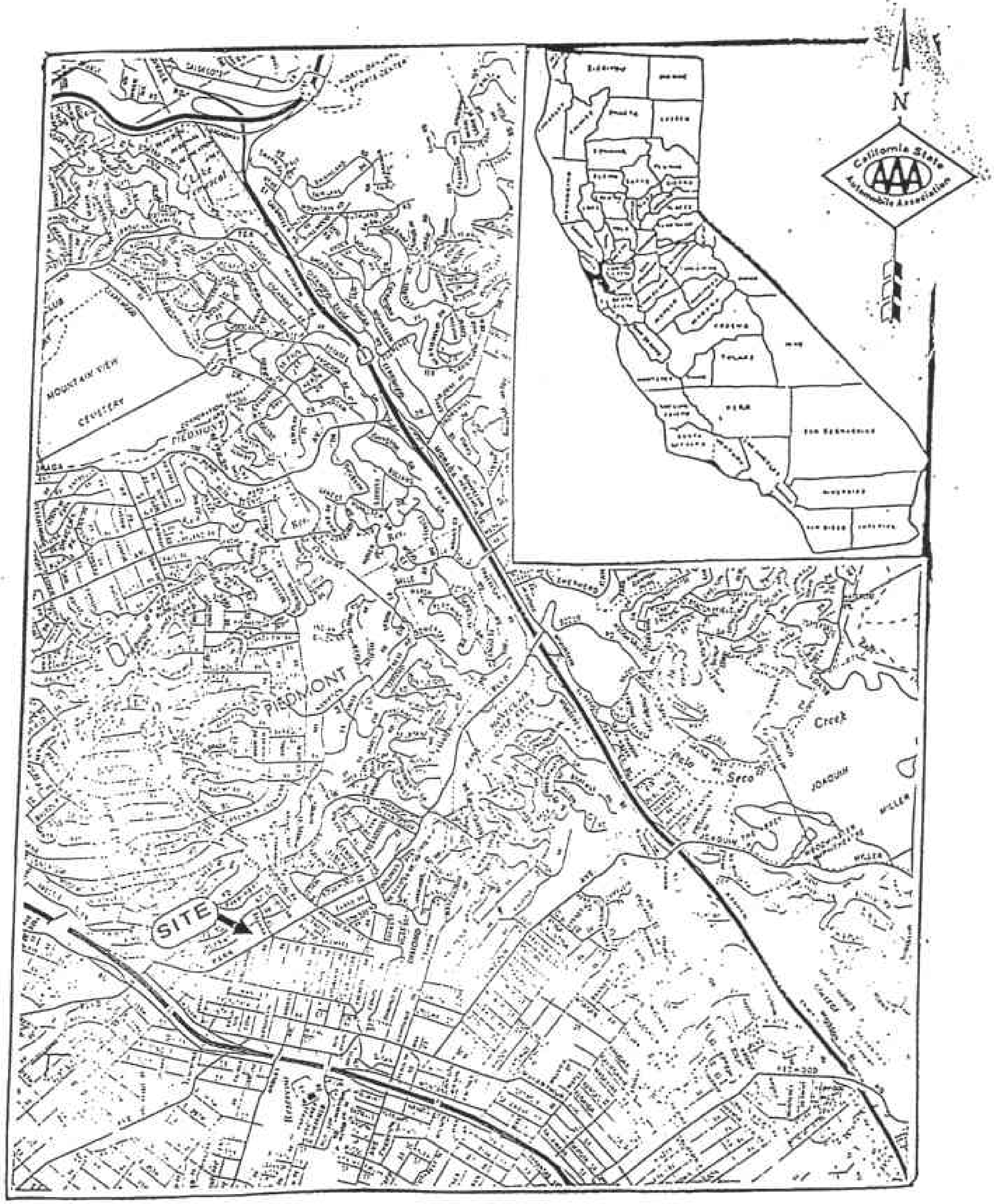


FIGURE 1

Location (AAA Map)

- WEGE- ESTERN
GEO-ENGINEERS

DESERT STATION #793
4035 Park Blvd.
Oakland, California

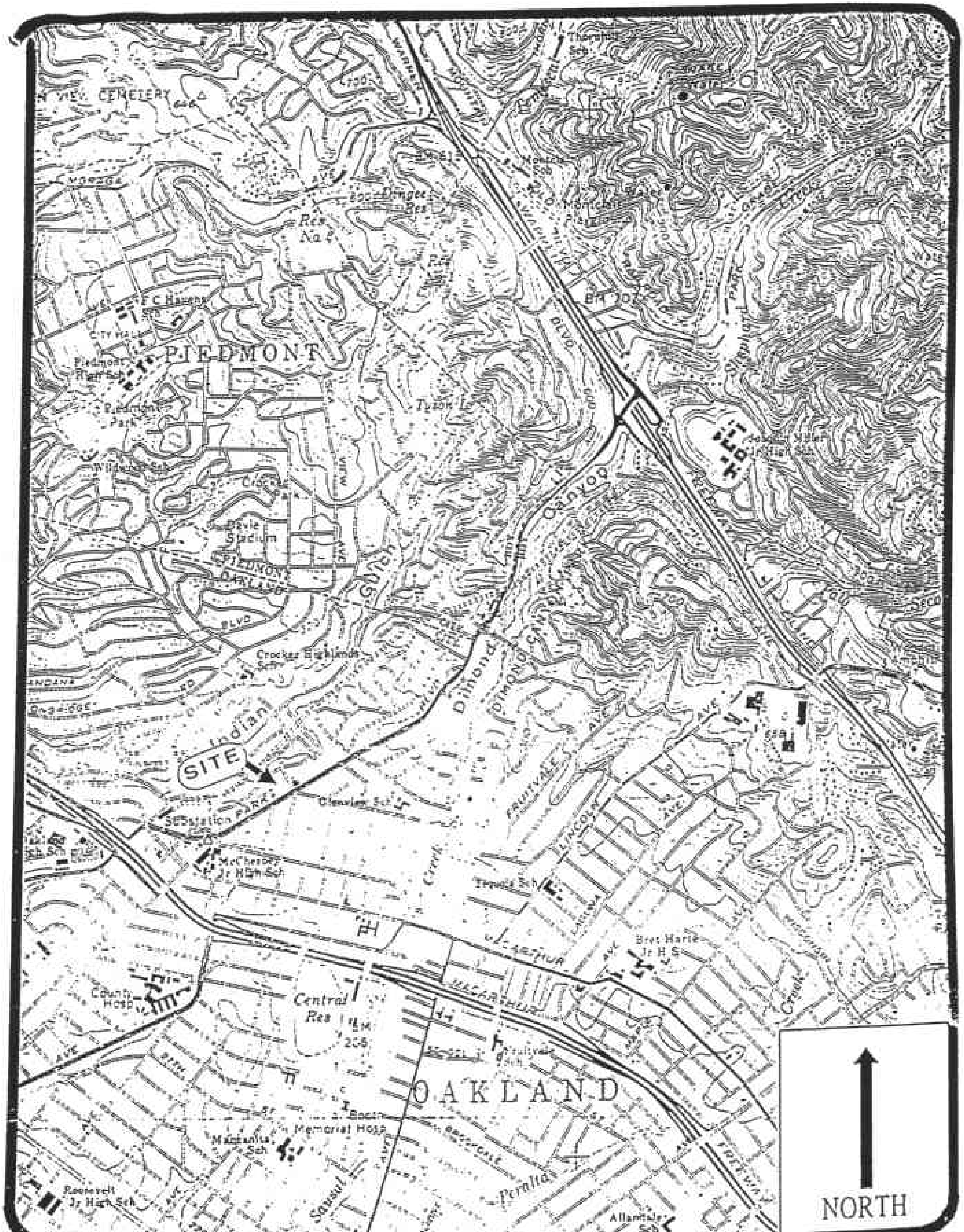
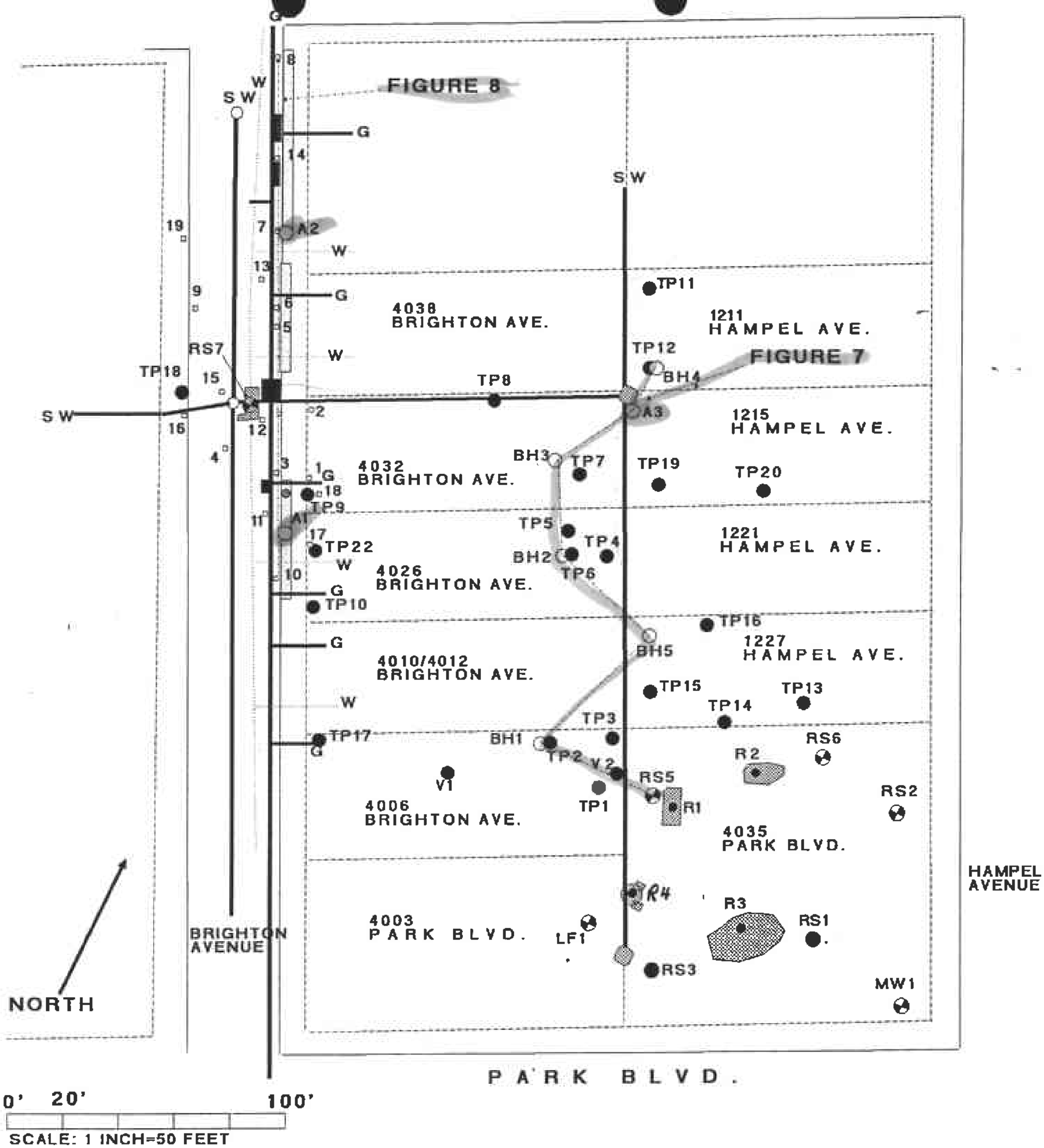


FIGURE 2., USGS TOPOGRAPHIC MAP

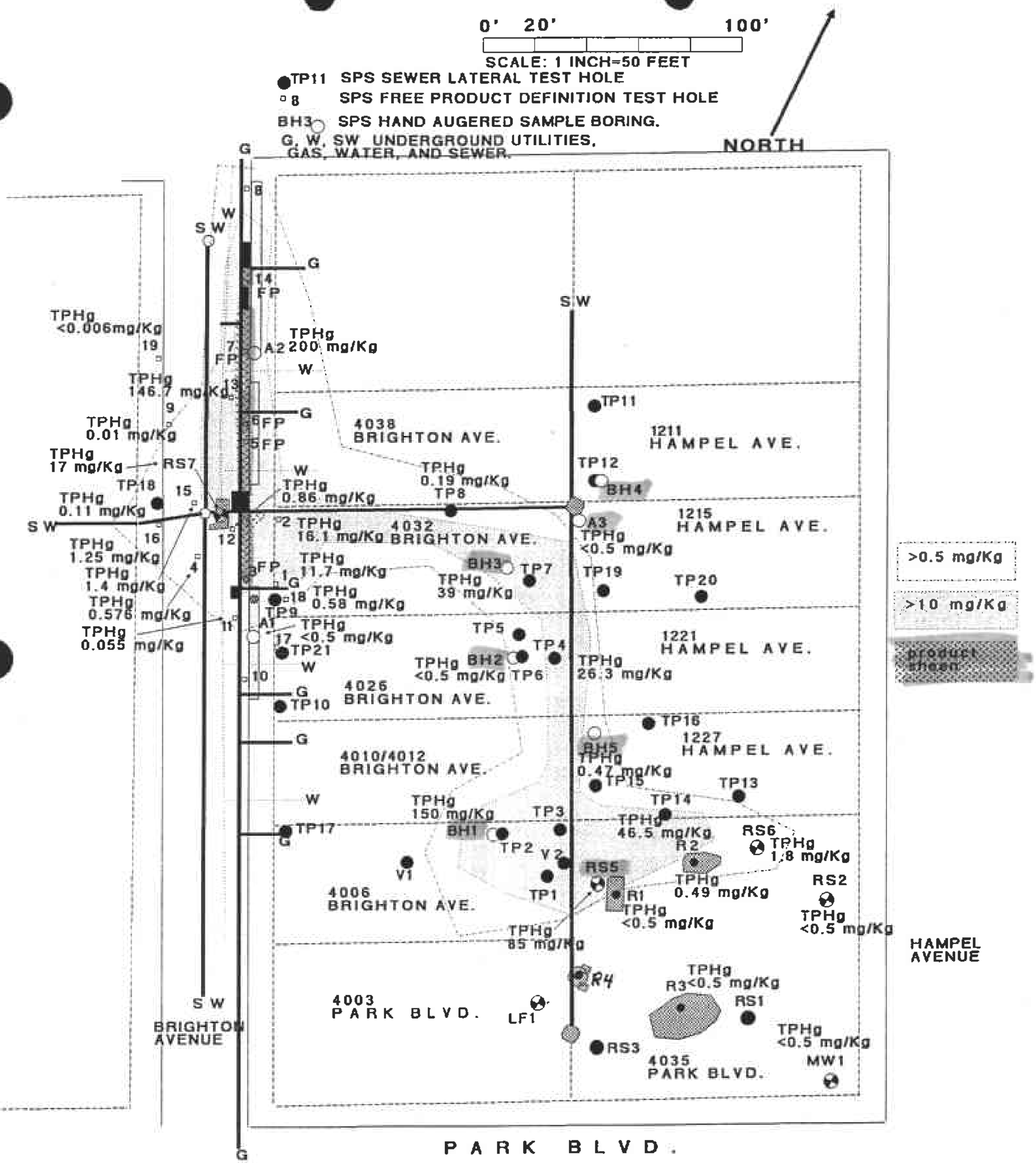


TP11 SPS SEWER LATERAL TEST HOLE
8 SPS FREE PRODUCT DEFINITION TEST HOLE
BH3 SPS HAND AUGERED SAMPLE BORING.
G, W, SW UNDERGROUND UTILITIES,
GAS, WATER, AND SEWER.

A1-A3
only A2 was contam.

FIGURE 3 1-17-97
SEWER AND FREE PRODUCT INVESTIGATION FOR DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA

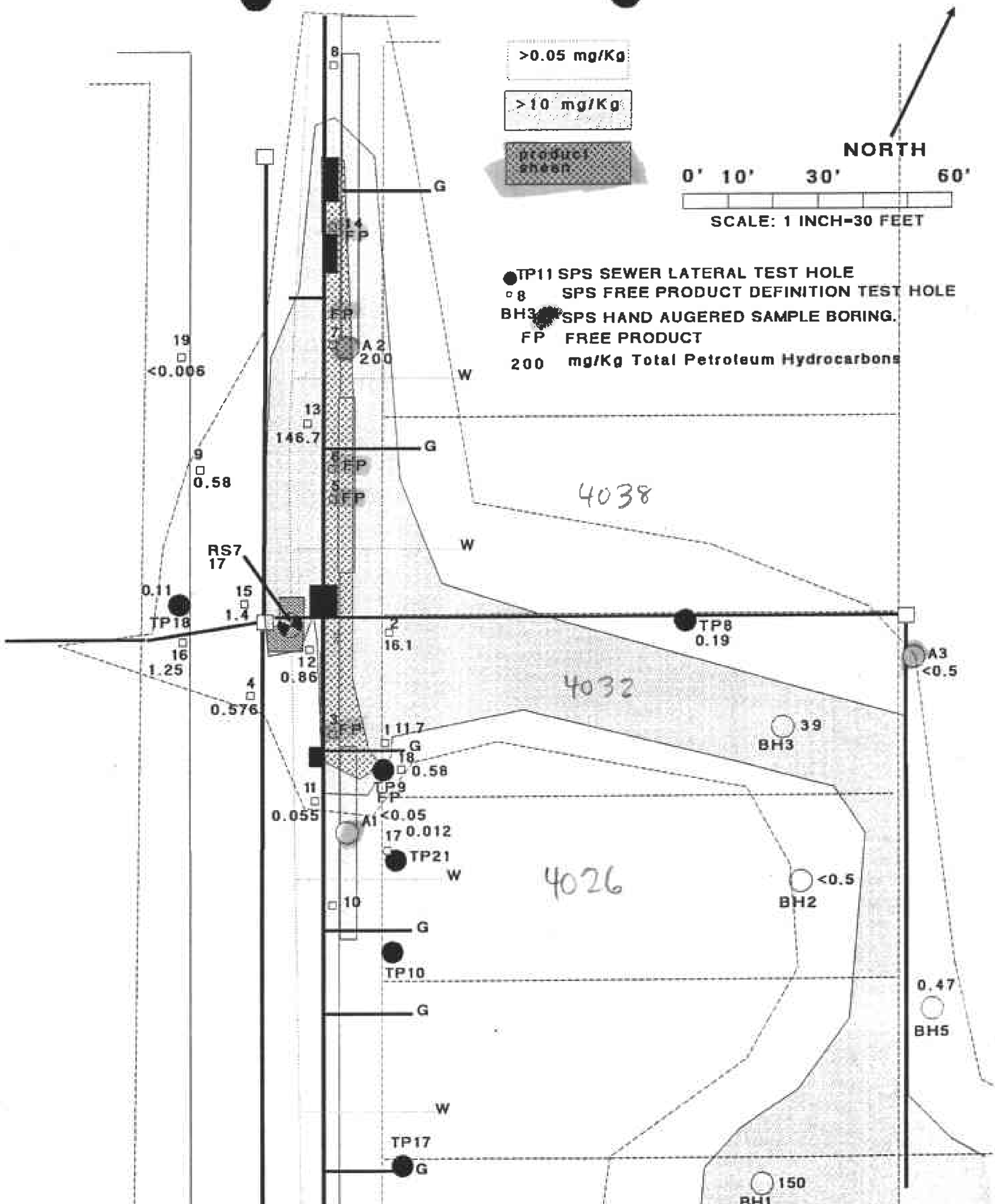
with
~~CROSS SECTION LOCATIONS.~~



TPHg 0.49 mg/Kg TOTAL PETROLEUM HYDROCARBONS GASOLINE

CONCENTRATIONS ARE FROM THE MAY, 1996 SPS, THE DECEMBER, 1996 QUARTERLY SAMPLING OF GROUNDWATER MONITOR WELLS AND THE JANUARY, 1997 SPS.

FIGURE 4 -GROUNDWATER PLUME SEWER AND FREE PRODUCT INVESTIGATION FOR DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA



TPHg 0.49 mg/Kg TOTAL PETROLEUM HYDROCARBONS GASOLINE

CONCENTRATIONS ARE FROM THE MAY, 1996 SPS, THE DECEMBER, 1996 QUARTERLY SAMPLING OF GROUNDWATER MONITOR WELLS AND THE JANUARY, 1997 SPS.

FIGURE 5 -GROUNDWATER PLUME SEWER AND FREE PRODUCT INVESTIGATION FOR DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA

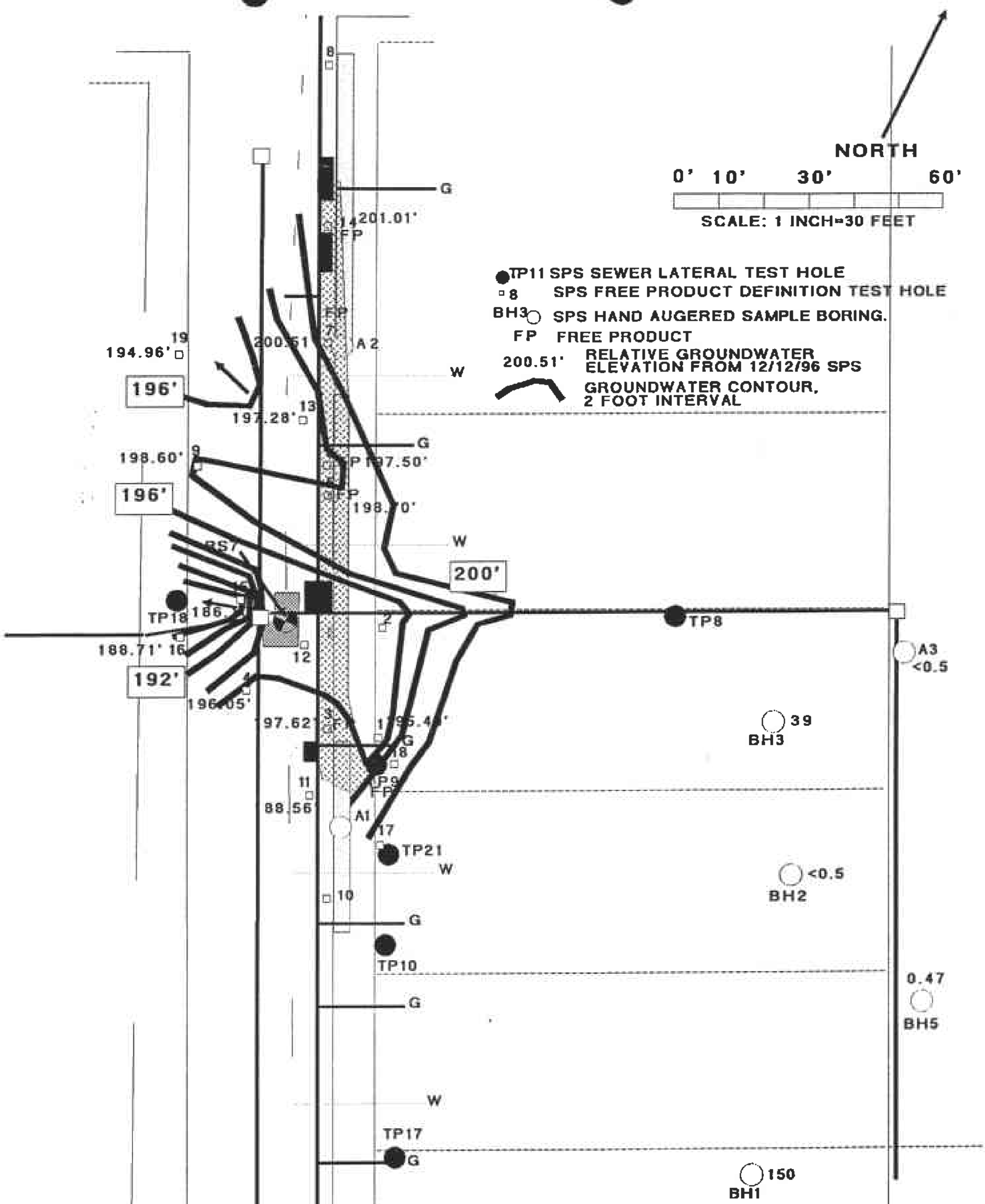


FIGURE 6 -GROUNDWATER ELEVATION 1/17/97

SEWER AND FREE PRODUCT INVESTIGATION FOR DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA

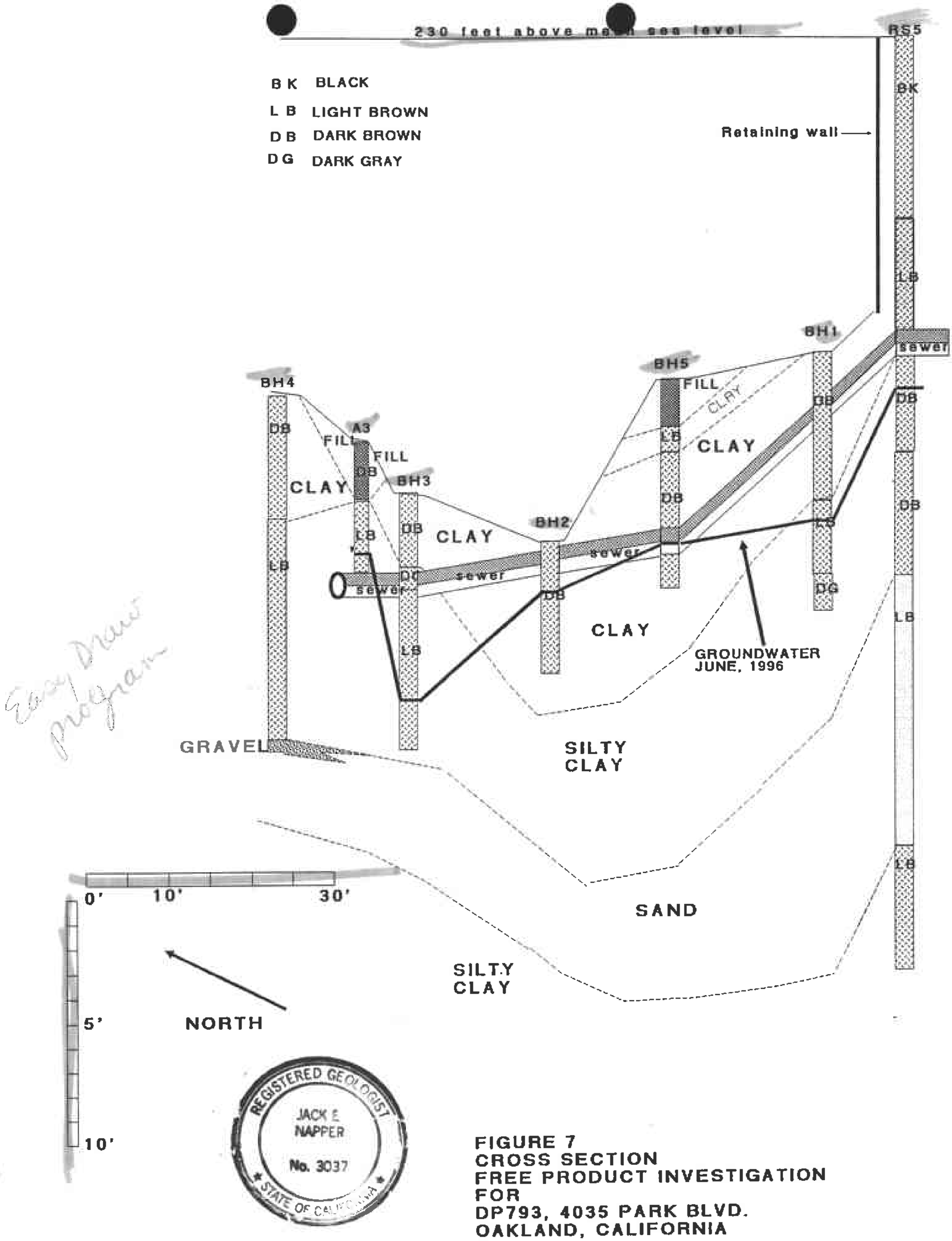
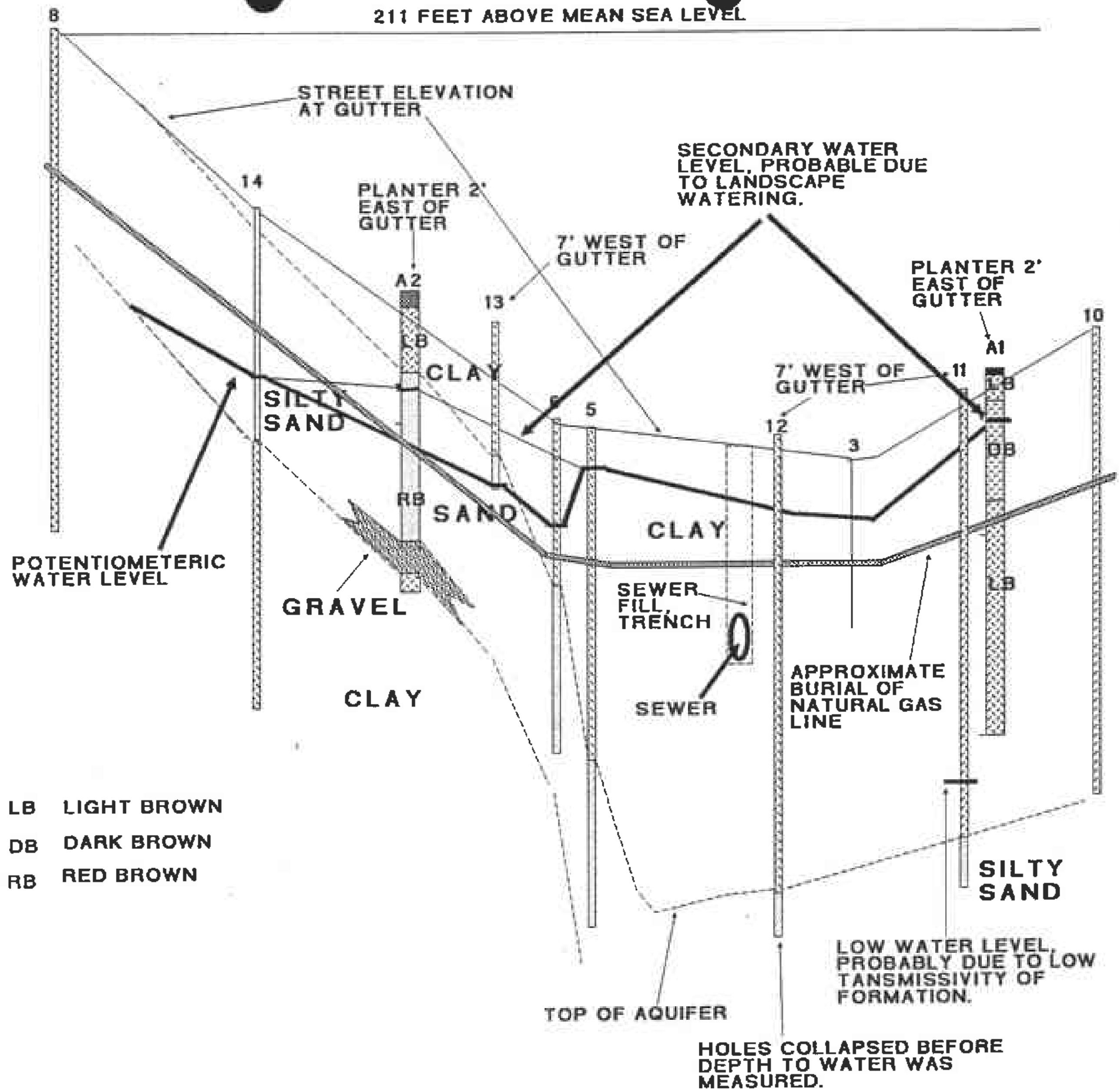
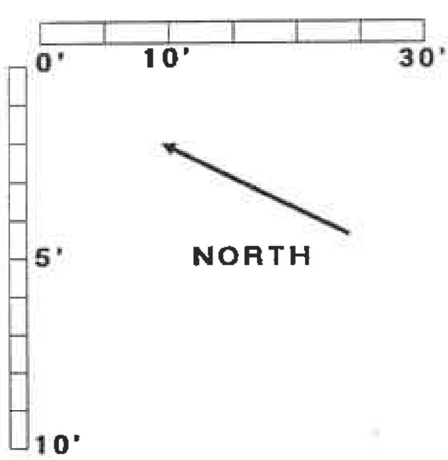


FIGURE 7
CROSS SECTION
FREE PRODUCT INVESTIGATION
FOR
DP793, 4035 PARK BLVD.
OAKLAND, CALIFORNIA

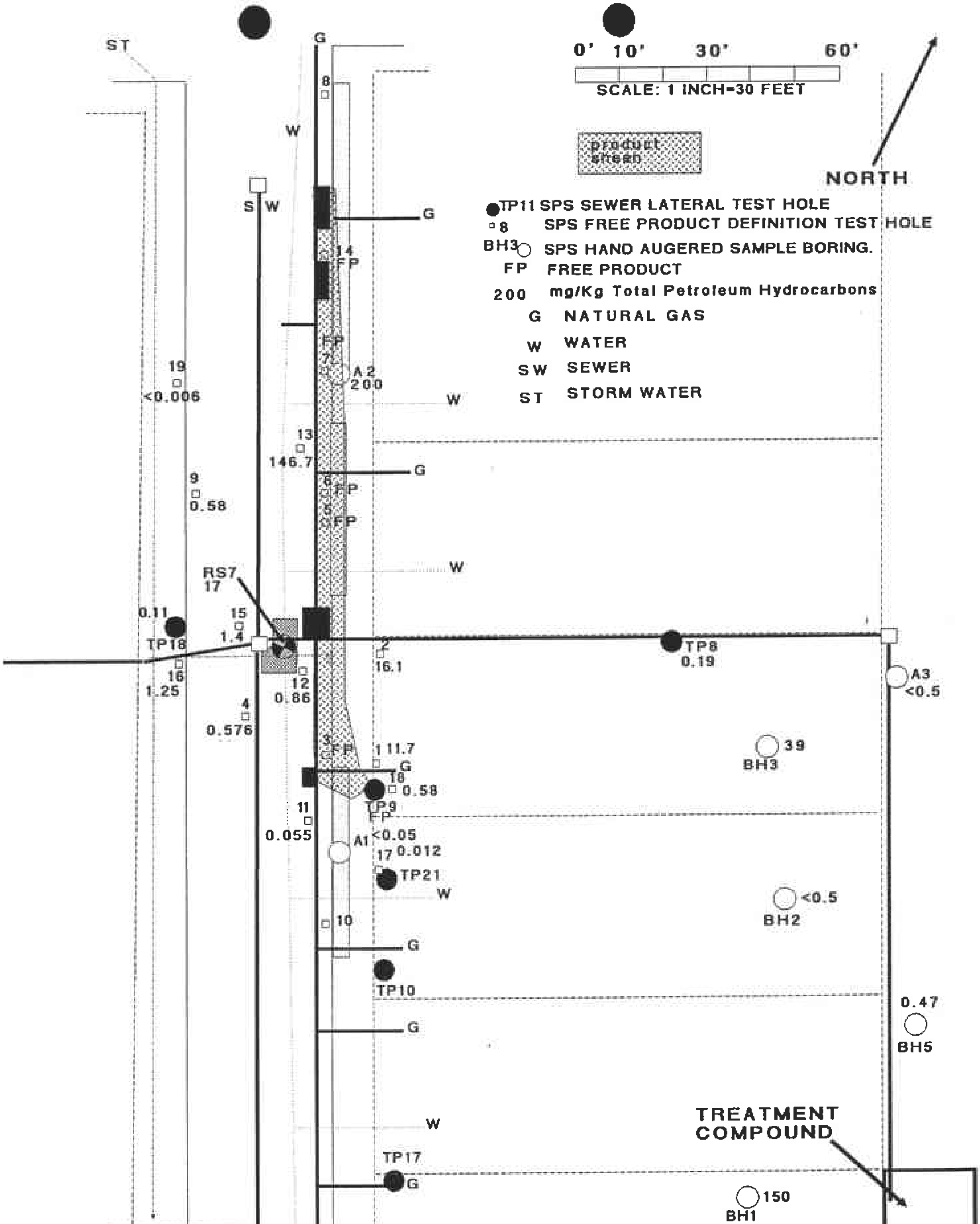




REGISTERED GEOLOGIST
JACK E. NAPPER
No. 3037
STATE OF CALIFORNIA

FIGURE 8
CROSS SECTION
FREE PRODUCT INVESTIGATION
FOR
DP793, 4035 PARK BLVD.
OAKLAND, CALIFORNIA

East gutter of Brighton Av.



TPHg 0.49 mg/Kg TOTAL PETROLEUM HYDROCARBONS GASOLINE

CONCENTRATIONS ARE FROM THE MAY, 1996 SPS, THE DECEMBER, 1996 QUARTERLY SAMPLING OF GROUNDWATER MONITOR WELLS AND THE JANUARY, 1997 SPS.

FIGURE 9 -FREE PRODUCT PLUME AND ASSOCIATION WITH UNDERGROUND UTILITIES DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA

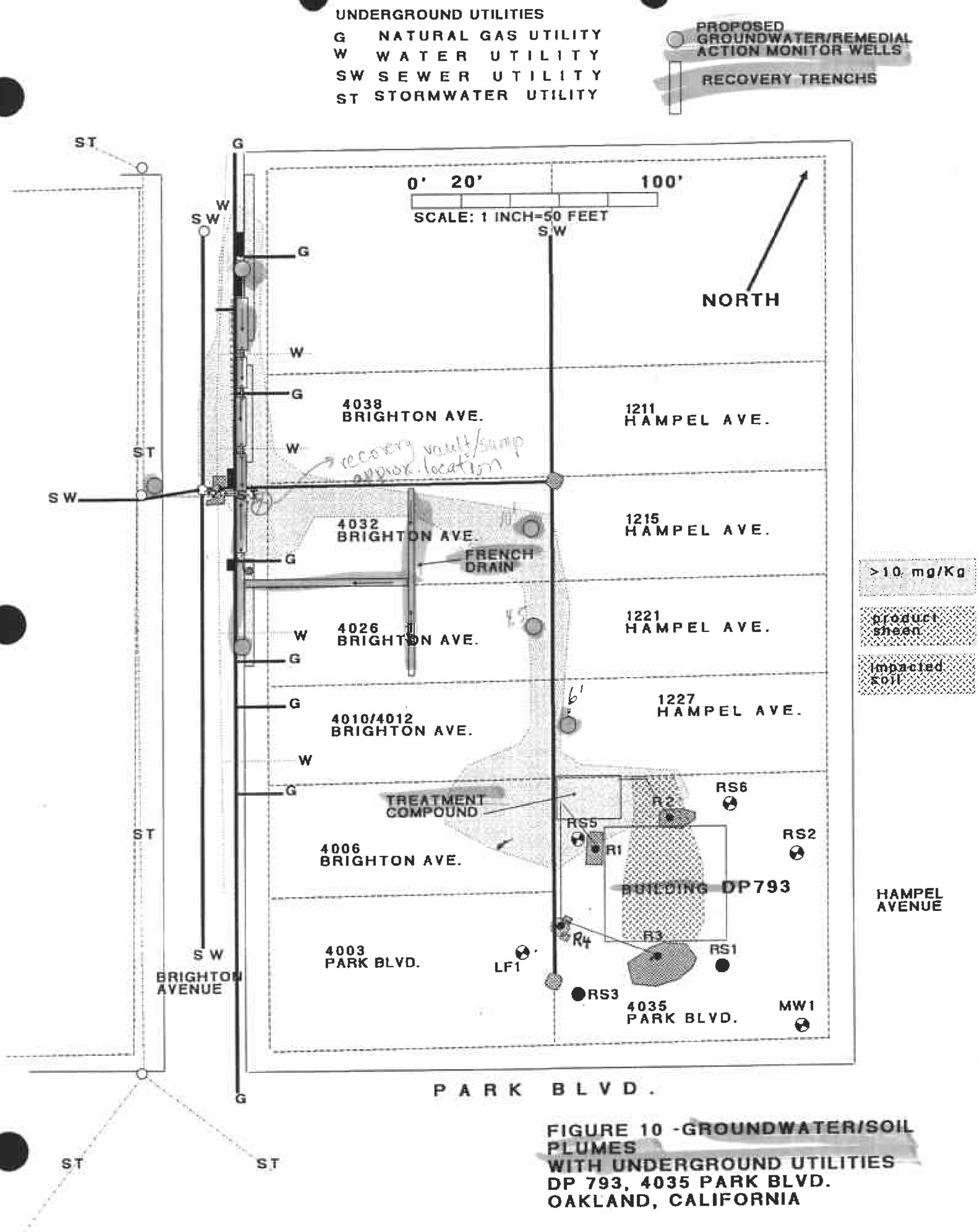
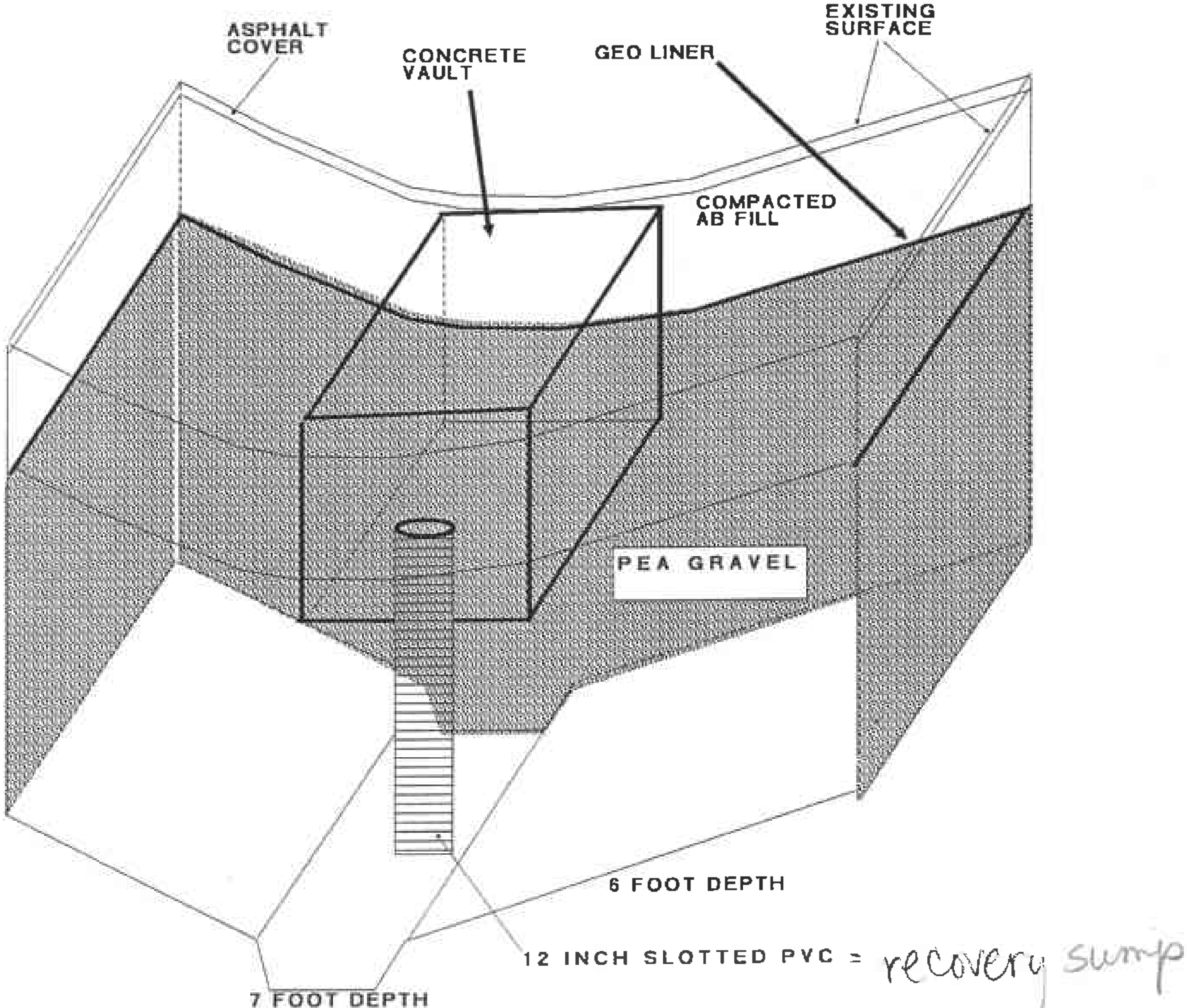


FIGURE 10 - GROUNDWATER/SOIL PLUMES WITH UNDERGROUND UTILITIES
DP 793, 4035 PARK BLVD.
OAKLAND, CALIFORNIA



CONCEPTUAL TRENCH WITH BACKFILL AND VAULT, ETC.

FIGURE 11 -CONCEPTUAL DIAGRAMS OF BRIGHTON AVENUE TRENCH AND RECOVERY VAULT

DP793, 4035 PARK BLVD.
OAKLAND, CALIFORNIA

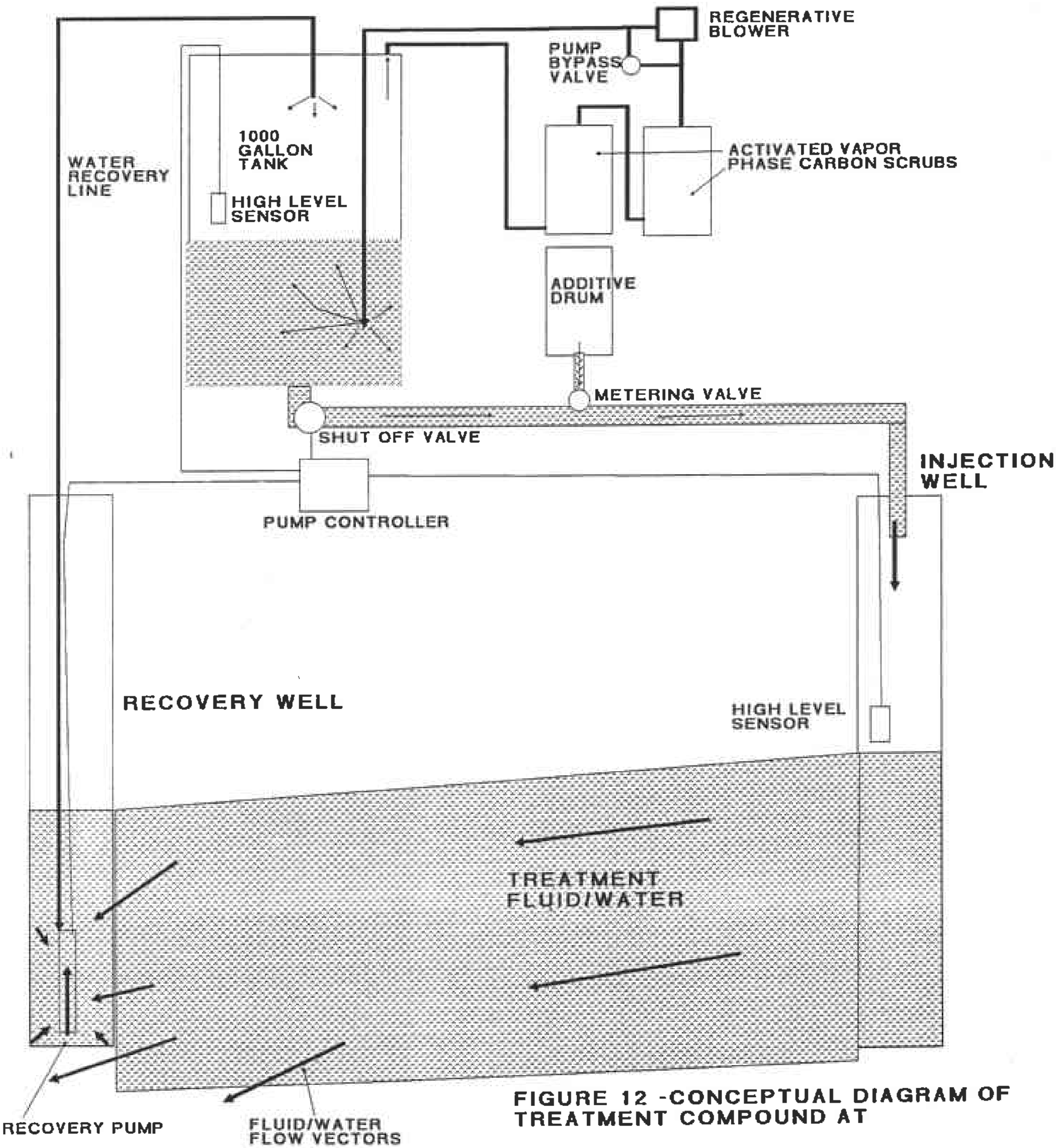


FIGURE 12 -CONCEPTUAL DIAGRAM OF TREATMENT COMPOUND AT

DP793, 4035 PARK BLVD. OAKLAND, CALIFORNIA

APPENDIX A

97-052

North State Environmental Analytical Laboratory

Chain of Custody/Request for Analysis

(415) 588-9652

Client: Western Geo-Engineers	Phone: (916) 668-5300	Report to: George Converse	Turnaround Time
Mailing Address: 1386 East Beamer St. Woodland, CA 95776		Billing to: WEGE	8 Hr / 24 Hr / 40 Hr / 5 Days X
Site Address: 4035 Park Boulevard, Oakland,		PO# / Billing Reference: DP# 793	Other
Sampler: D. Threlfall	Date: 1/17/97		

Sample ID:	Sample Description	Container # / type	Sampling Time/Date	TPH-D	TPH-G	BTEX	O+G	MTBE					Remarks
Auger #1 ~~0.2-0.9'~~	Soil	Sleeve	1/17/97 12:00		X	X		~~X~~					
Auger #2 6.5-7.0'	Soil	Sleeve	1/17/97 1:40		X	X		X					
Auger #1 water	water	2 VOAS	1/17/97 1630		X	X		X					
Auger #2 ~~water~~	water	2 VOAS	1/17/97 16~~35~~		X	X		X					
Auger #3 4.0-4.5'	Soil	Sleeve	1/17/97 1600		X	X		X	~~[illegible]~~				~~[illegible]~~
Auger #1 Shallow water	water	2 VOAS	1/17/97 1100		X	X		X					

Relinquished by: D. Threlfall	Date: 1-21-97 Time: 2:15p	Received by: [signature]		Yes / No
Relinquished by: [signature]	Date: 1-21-97 Time: 4:00 PM	Received by: Edward [signature]	Were samples Preserved ?	✓
Relinquished by:	Date: Time:	Received in lab by:	In good condition ?	✓

North State Environmental
Chemical Waste Disposal · Trucking · Consulting

CERTIFICATE OF ANALYSIS

Lab No:	97-052	Date Sampled:	01-17-97
Client:	Western Geo-Engineers	Date Analyzed:	01-22-97
Project:	DP # 793	Date Reported:	01-27-97

Gasoline Range Hydrocarbons by Method 8015 M
MTBE, Benzene, Toluene, Ethylbenzene and Xylenes by Method 8020

SAMPLE NO	CLIENT ID	ANALYTE	METHOD	RESULT
97-052-01	Auger #1	MTBE	8020	0.14 mg/Kg
	0.2-0.9'	Benzene	8020	ND
	SOIL	Toluene	8020	0.017 mg/Kg
		Ethylbenzene	8020	ND
		Xylenes	8020	ND
		Gasoline	8015M	ND
97-052-02	Auger #2	MTBE	8020	0.070 mg/Kg
	6.5-7.0'	Benzene	8020	0.024 mg/Kg
	SOIL	Toluene	8020	0.032 mg/Kg
		Ethylbenzene	8020	0.009 mg/Kg
		Xylenes	8020	0.024 mg/Kg
		Gasoline	8015M	0.680 mg/Kg
97-052-03	Auger #1	MTBE	8020	15 ug/L
	WATER	Benzene	8020	ND
		Toluene	8020	1.0 ug/L
		Ethylbenzene	8020	ND
		Xylenes	8020	ND
		Gasoline	8015M	ND
97-052-04	Auger #2	MTBE	8020	3300 ug/L
	WATER	Benzene	8020	24000 ug/L
		Toluene	8020	35000 ug/L
		Ethylbenzene	8020	5800 ug/L
		Xylenes	8020	24000 ug/L
		Gasoline	8015M	200000 ug/L
97-052-05	Auger #3	MTBE	8020	0.085 mg/Kg
	4.0-4.5'	Benzene	8020	ND
	SOIL	Toluene	8020	0.017 mg/Kg
		Ethylbenzene	8020	ND
		Xylenes	8020	ND
		Gasoline	8015M	ND

P.O.Box 5624 • South San Francisco, California 94083 • 415-588-2838 FAX 588-1950

North State Environmental
Chemical Waste Disposal · Trucking · Consulting

CERTIFICATE OF ANALYSIS

Lab No:	97-052	Date Sampled:	01-17-97
Client:	Western Geo-Engineers	Date Analyzed:	01-22-97
Project:	DP # 793	Date Reported:	01-27-97

Gasoline Range Hydrocarbons by Method 8015 M
MTBE, Benzene, Toluene, Ethylbenzene and Xylenes by Method 8020

SAMPLE NO	CLIENT ID	ANALYTE	METHOD	RESULT	
97-052-06	Auger #1	MTBE	8020	15	ug/L
	Shallow Water	Benzene	8020	0.60	ug/L
	WATER	Toluene	8020	2.0	ug/L
		Ethylbenzene	8020	ND	
		Xylenes	8020	ND	
		Gasoline	8015M	ND	

Quality Control/QualityAssuranceSummary-Soil

Analyte	Method	Reporting Limit	Blank	MS/MSD Recovery	RPD
MTBE	8020	0.005 mg/Kg	ND	71	1
Benzene	8020	0.005 mg/Kg	ND	98	17
Toluene	8020	0.005 mg/Kg	ND	101	19
Ethylbenzene	8020	0.005 mg/Kg	ND	103	23
Xylenes	8020	0.010 mg/Kg	ND	93	16
Gasoline	8015M	0.5 mg/Kg	ND	95	6

Quality Control/Quality Assurance Summary-Water

Analyte	Method	Reporting Limit	Blank	MS/MSD Recovery	RPD
MTBE	8020	0.5 ug/L	ND	86	5
Benzene	8020	0.5 ug/L	ND	97	12
Toluene	8020	0.5 ug/L	ND	100	12
Ethylbenzene	8020	0.5 ug/L	ND	101	15
Xylenes	8020	1.0 ug/L	ND	98	16
Gasoline	8015M	50 ug/L	ND	90	13

ELAP Certificate NO: 1753

Reviewed and Approved:

Edward P. Murant for

John A. Murphy, Laboratory Director

P.O.Box 5624 • South San Francisco, California 94083 • 415-588-2838 FAX 588-1950

North State Environmental Analytical Laboratory

Chain of Custody/Request for Analysis

(415) 588-9652

Client: Western Geo-Engineers	Phone: (916) 661 5300	Report to: George Converse	Turnaround Time
Mailing Address: 1386 East Beamer St. Woodland, CA 95776		Billing to: WEGE	8 Hr / 24 Hr / 40 Hr / 5 Days [X]
Site Address: 4035 Park Boulevard, Oakland		PO# / Billing Reference: DP# 793	Other
Sampler: D. Threlfall	Date: 1/17/97		

ANALYSIS REQUESTED

Sample ID:	Sample Description	Container # / type	Sampling Time/Date	TPH-D	TPH-G	BTEX	O+G	[illegible]					Remarks
Auger #1 [illegible]	[illegible]	Sleeve	1/17/97 1200		X	X		X					
Auger #2 7.5-7.[illegible]	Soil	Sleeve	1/17/97 [illegible]		X	X		X					
Auger #1 [illegible]	Water	2 VOAs	1/17/97 1630		X	X		X					
Auger #2	Water	2 VOAs	1/17/97 1615		X	X		X					
Auger #3 [illegible]	Soil	Sleeve	1/17/97 400		X	X		X					[illegible]
Auger #1 Shallow water	Water	2 VOAs	1/17/97 1100		X	X		X					

Relinquished by: D Threlfall	Date: 1-21-97 Time: 2:15	Received by: [signature]		Yes	No
Relinquished by:	Date: Time:	Received by:	Were samples Preserved ?	✓	
Relinquished by:	Date: Time:	Received in lab by:	In good condition ?	✓	

APPENDIX B

-WEGE-
WESTERN GEO-ENGINEERS

PAGE 1 OF 1

BORING: [illegible]
DATE DRILLED: 1/17/97

▮ SAMPLE INTERVAL

▼ WATER

BORE HOLE LOG

PROJECT: DP 796 4035 PARK BLVD. OAKLAND, CA	GEOLOGIST: D. THRELFALL	SURFACE ELEVATION: 201.11' AMSL
LOCATION: VICINITY OF4026 BRIGHTON STREET	DRILLER: D. THRELFALL	TOTAL DEPTH: 11.0 FEET BGS
DRILLING CONTRACTOR: WESTERN GEO-ENGINEERS	DEPTH TO WATER: 1.5 FEET	CASING: TEMPORARY 2" PVC, .020 SLOTTED

REMARKS: BOREHOLE WAS DRILLED WITH 3" DIAMETER HAND AUGER. SOIL SAMPLES WERE COLLECTED AT 0.5 FOOT INTERVALS FROM BARRELL OF AUGER. WATER SAMPLES WERE COLLECTED WITH BAILER FROM UNCASED HOLE AT 2.0' BGS AND CASED HOLE AT 5.0'BGS

DEPTH (FT)	SAMPLE No.	PPM TVO VAPOR	CORE DESCRIPTION	GRAPHIC LOG	REMARKS
			ASPHALT PAVING		
	A1 0.2'-0.9'	740 PPM	CL YELLOW BROWN AND GREENISH BROWN MOTTLED CLAY, DAMP, YELLOW BROWN STREAKS ARE SILTIER, NO ODOR		
1.0		203 PPM	CL COLOR CHANGE TO DARK BROWN CLAY, NOT MOTTLED, SEWER ODOR		FIRST WATER ENCOUNTERED AT 1.5 FEET BGS
		117 PPM	CL DARK BROWN CLAY AND SILT WITH OCCASIONAL GRIT		
2.0		115 PPM	CL/ML DARK BROWN CLAY WITH REDDISH BROWN SILT, LOOSE		
		68 PPM	CL/ML MEDIUM BROWN CLAY WITH REDDISH BROWN SILT AND OCCASIONAL GRIT		
3.0		100 PPM	CL/ML SAME AS ABOVE		
		43 PPM	CL/ML SAME AS ABOVE		
4.0		84 PPM	CL YELLOW BROWN CLAY, STIFF, WITH REDDISH BROWN STREAKING, WHITE CALC INC		
		6 PPM	CL SAME AS ABOVE		BOREHOLE CASED AT 5.0 FEET, BGS, AND WATER SAMPLE COLLECTED WITH BAILER AFTER PURGING WATER IN CASING.
5.0					
6.0					BOREHOLE DEEPENED TO 11.0 FEET BGS AFTER COLLECTION OF WATER SAMPLE.
7.0			CL YELLOW BROWN STIFFF CLAY CONTINUES TO TOTAL DEPTH AT 11.0 FEET BGS, BECOMING SLIGHTLY LESS STIFF WITH DEPTH		
8.0					
9.0					
10.0					
11.0					TOTAL DEPTH 11.0 FEET BGS

REGISTERED GEOLOGIST
JACK E. NAPPER
No. 3037
STATE OF CALIF

-WEGE-
WESTERN GEO-ENGINEERS

BORING: [redacted]
DATE DRILLED: 1/17/97

▌ SAMPLE INTERVAL

▼ WATER

BORE HOLE LOG

PROJECT: DP 796 4035 PARK BLVD. OAKLAND, CA	GEOLOGIST: D. THRELFALL	SURFACE ELEVATION: 203.31' AMSL
LOCATION: VICINITY OF4032 BRIGHTON STREET	DRILLER: D. THRELFALL	TOTAL DEPTH: 9.0 FEET BGS
DRILLING CONTRACTOR: WESTERN GEO-ENGINEERS	DEPTH TO WATER: 2.9 FEET	CASING: TEMPORARY 2" PVC, .020 SLOTTED

REMARKS: BOREHOLE WAS DRILLED WITH 3" DIAMETER HAND AUGER. SOIL SAMPLES WERE COLLECTED AT 0.5 FOOT INTERVALS FROM BARRELL OF AUGER. WATER SAMPLES WERE COLLECTED WITH BAILER FROM CASED HOLE.

DEPTH (FT)	SAMPLE No.	PPM TVO VAPOR	CORE DESCRIPTION	GRAPHIC LOG	REMARKS
		8.7 PPM	ML MEDIUM BROWN TOPSOIL FROM PLANTER		
			CL MEDIUM BROWN CLAY, STIFF, MOTTLED WITH BLACK STREAKS, NO ODOR		
1.0		8.0 PPM	CL YELLOW BROWN CLAY, STIFF, MOTTLED WITH GREENISH STREAKING, NO ODOR		FIRST WATER ENCOUNTERED AT 7.1 FEET BGS. WATER LEVEL REACHED EQUILIBRIUM AT 2.9 FEET BGS WITHIN 15 MINUTES
		4.3 PPM	CL SAME AS ABOVE		
2.0			CL REDDISH BROWN STIFF CLAY WITH GRAY GREEN STREAKING, NO ODOR		
		4.3 PPM	SP REDDISH BROWN FINE SAND AND SILT WITH MINOR CLAY, LOOSE, NO ODOR ▼		
3.0			SP SAME AS ABOVE		
			SP SAME AS ABOVE		
4.0		9.0 PPM	SP SAME AS ABOVE		
			SP SAME AS ABOVE		BOREHOLE CASED AT 9.0 FEET, BGS, AND WATER SAMPLE COLLECTED WITH BAILER AFTER PURGING WATER IN CASING.
5.0			SP SAME AS ABOVE		
		80 PPM	SP REDDISH BROWN FINE SAND WITH GREY GREEN MOTTLING, LESS SILT AND CLAY THAN ABOVE, PETR. ODOR		
6.0	A2 6.5'-7.0'	230 PPM	SP SAME AS ABOVE WITH STRONG PETROLEUM ODOR		
7.0			SP SAME AS ABOVE		
		420 PPM	SP/G MEDIUM SAND AND GRAVEL, STRONG PETROLEUM ODOR		
8.0			SP/G SAME AS ABOVE		
		350 PPM	CL RED AND GREEN MOTTLED CLAY WITH SOME FINE SAND		TOTAL DEPTH 9.0 FEET BGS
9.0					

REGISTERED GEOLOGIST
JACK E. NAPPER
No. 3037
STATE OF CALIFORNIA

-WEGE-
WESTERN GEO-ENGINEERS

BORING: A3
DATE DRILLED: 1/17/97

▌ SAMPLE INTERVAL
▼ WATER

BORE HOLE LOG

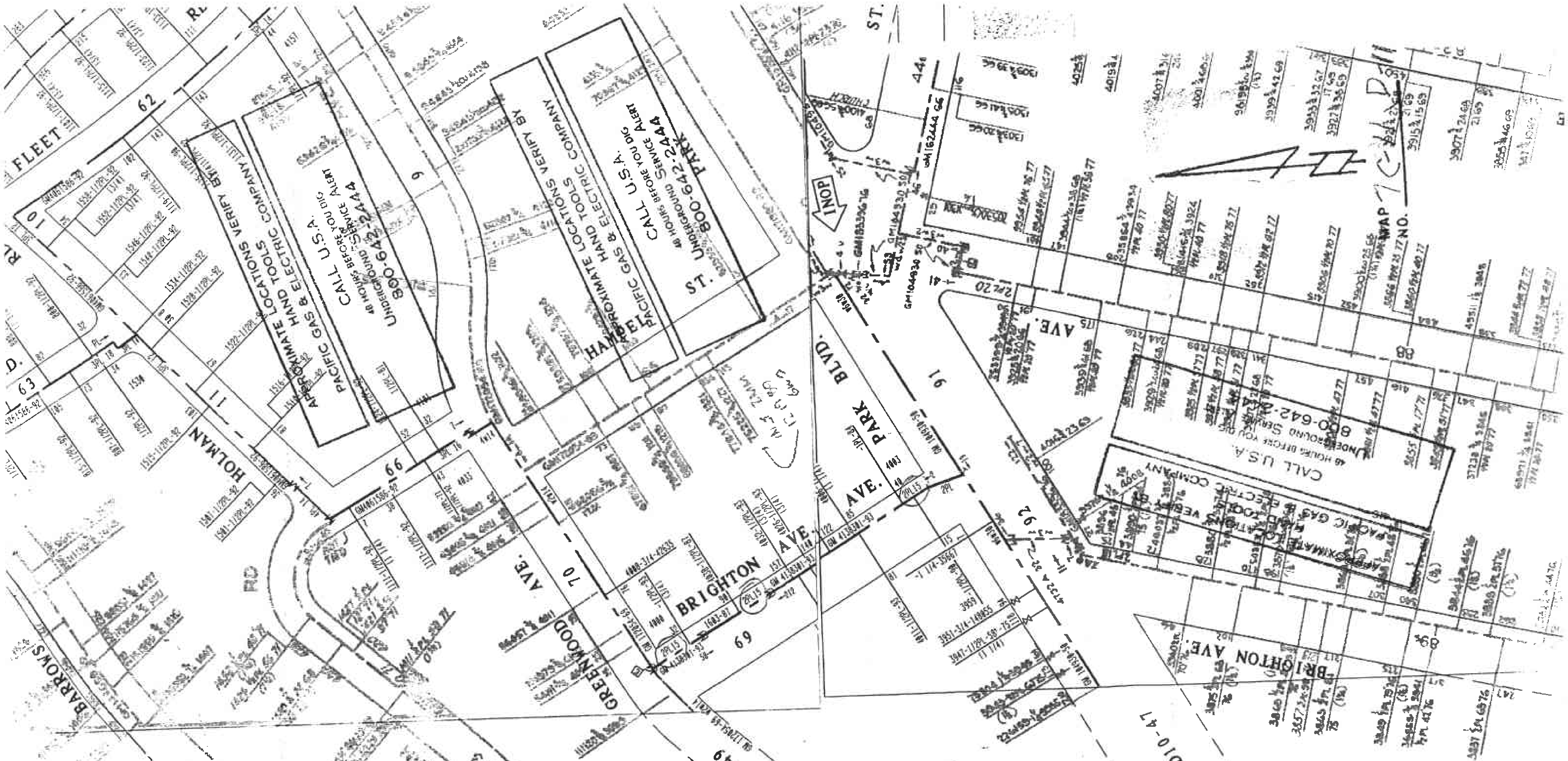
PROJECT: DP 796 4035 PARK BLVD. OAKLAND, CA	GEOLOGIST: D. THRELFALL	SURFACE ELEVATION: ~214' AMSL
LOCATION: BACKYARD OF 1215 HAMPEL STREET	DRILLER: D. THRELFALL	TOTAL DEPTH: 5.3 FEET BGS
DRILLING CONTRACTOR: WESTERN GEO-ENGINEERS	DEPTH TO WATER: 4.5 FEET	CASING: NONE

REMARKS: BOREHOLE LOCATED 6 FEET SOUTH AND 1.5 FEET EAST OF SEWER MANWAY. BOTTOM OF MANWAY IS 7.0 FEET BGS. BOREHOLE WAS DRILLED WITH 3" DIAMETER HAND AUGER. SOIL SAMPLES WERE COLLECTED AT 0.5 FOOT INTERVALS FROM BARRELL OF AUGER.

DEPTH (FT)	SAMPLE No.	PPM TVO VAPOR	CORE DESCRIPTION	GRAPHIC LOG	REMARKS
1.0		4.3 PPM	ML/CL DARK BROWN SILT AND CLAY, NO ODOR		FIRST WATER ENCOUNTERED AT 4.5 FEET BGS. INSUFFICIENT WATER ENTERED BOREHOLE TO COLLECT WATER SAMPLE
2.0					
		3.0 PPM			
3.0			CL MOTTLED DARK BROWN AND YELLOW BROWN CLAY WITH SILT, NO ODOR		
4.0	A3 4.0'-4.5'	2.8 PPM			
		2.8 PPM	CL SAME AS ABOVE WITH TRACES OF WATER ▼		
5.0					TOTAL DEPTH 5.3 FEET BGS AUGER ENCOUNTERED SEWER LINE
6.0					

REGISTERED GEOLOGIST
JACK E. NAPPER
No. 3037
STATE OF CALIFORNIA

APPENDIX C



ATT: DAVE

2" PLASTIC (PE) GAS LINE, APPROX 36" TO 48" OF COVER ON PIPE. TRENCH IS BACK FILLED WITH RIVER BED SAND & RED ROCK.

APPENDIX D

SOIL PROBE SURVEY (SPS)
QUALITY ASSURANCE/ QUALITY CONTROL.

EQUIPMENT

LABORATORY EQUIPMENT

Western Geo-Engineer's mobile laboratory is equipped with a Shimadzu dual column, research grade, Flame Ionizing Detector (FID) chromatograph. The laboratory also employs a Photovac 10S50 Photo Ionizing Detector (PID) chromatograph and a Baseline FID total volatile organic analyzer. Other primary analytical instruments include a Hach DR2000 Spectrophotometer and an Ultraviolet (UV) light box for observing hydrocarbon fluorescence.

Secondary analytical tools include precision balances, 20X dissecting microscopes, liquid test kits (resistivity, pH, chloride, nitrate, dissolved oxygen, sulfate, ferrous iron, calcium, H_2S) soil or core test kits (lithology, sieve analysis), and one or more handheld vapor or oxygen/vapor detectors.

The mobile laboratory also includes a computer and printer, a refrigerator for sample storage, a ventilated hood box, a temperature controlled electric pan or hot plate to equilibrate soil and water for headspace analysis, health and safety reference material, personal safety equipment, DOT approved traffic warning signs and vests, traffic cones, fire extinguishers, survey equipment for preliminary site surface surveys, and a stabilized 6.5 KW electric generator. Air temperature and relative humidity metering equipment, a barometer, and a wind speed indicator are also carried in the laboratory when weather conditions could alter the results of vapor surveys.

DRILLING EQUIPMENT

The primary drilling equipment is a Hilti electric hammer which is used to drive graduated diameters (one inch to 1/2 inch) and lengths (4 - 20 ft.) of solid drill steel rod to the desired sampling depths. Several types of threaded tubular steel rod are used for extending SPS test holes below depths of 20 feet. Surface holes through blacktop or concrete are first drilled with a Hilti rotary drill bit. Several types and sizes of surface casing can be installed to prevent surface caving of unconsolidated materials. The retrieval of the drilling rods is accomplished with a portable gasoline powered hydraulic ram puller.

Secondary drilling equipment includes a set of graduated diameter hand augers to enlarge SPS test holes or drill additional holes for the collection of certified soil samples.

SAMPLING EQUIPMENT

SOIL:

The primary soil sampling equipment used during the SPS is a graduated set of WEGE designed sampling rods equipped with an inner retractable plunger and threaded, replaceable 1/2 inch X 1 inch brass sample sleeves. The 1/2 inch diameter sampling rods are available in 5 foot to 20 foot lengths. A flexible version of the sampling rod is capable of collecting discrete "undisturbed" soil samples from depths from 20 to 30 feet.

WATER:

One quarter inch diameter polyethylene tubing is used to collect ground water samples from the SPS test holes. Water is drawn through the tubing with a vacuum produced by either a 60 CC disposable syringe or larger handpowered vacuum pump. The water is collected either directly in a pre-cleaned and weighed 40 CC VOA vial via a water drop out trap or transferred from the disposable 60 CC syringe to the 40 CC VOA vial. Deeper water is similarly drawn into a miniature ball seat bailer.

VAPOR:

One quarter inch diameter polyethylene tubing is used to collect vapor samples from the SPS test holes. Ambient air in the tubing is displaced with a disposable 60 cc syringe. A 1 cc disposable syringe is used to collect the vapor sample from the polyethylene tubing.

METHODS AND PROCEDURES

DRILLING AND SAMPLING OF TEST HOLES

The SPS test holes are created by driving the graduated steel rods to the desired sampling depth with an electric hammer. The test hole locations and sampling depths are either determined prior to the start of the SPS or by the laboratory director during the course of the SPS as the analytical results from the previous test holes are recorded. After the desired sampling depth has been reached, the solid or tubular drill steel is removed from the ground with the hydraulic puller and the desired samples are collected.

SOIL:

Relatively undisturbed soil plugs are collected from the base of the test hole with the WEGE designed sampling rod. The inner plunger of the sampling rod is placed in the closed position while the rod is guided down the test hole. This prevents the inadvertent collection of soil from other portions of the test hole. When the sampling rod has been installed at the base of the test hole the inner plunger is withdrawn to the open position and the sampling rod is pressed into the base of the test hole with hand power. The sample rod is removed from the hole and the 2 to 5 gram soil plug that has been collected in the brass sleeve is ejected into a pre-cleaned and pre-weighed 40 ml VOA vial by closing the inner plunger of the sampling rod. In most cases the soil plug does not come into contact with the gloves or hands of the sampling technician. The VOA vial is immediately capped, labeled with location and depth, and delivered to the on-site mobile laboratory.

Only a limited log of the materials encountered during the SPS is possible to produce, and only special conditions or events are recorded.

GROUND WATER:

Ground water is collected from the SPS test holes with the aid of disposable one quarter inch diameter polyethylene tubing connected to a 60 CC syringe. The tubing is worked down the test hole until it reaches the surface of the ground water. Depth to ground water is determined by trial evacuations of air with the syringe until vacuum resistance is noted when the tubing encounters the top of the water. The depth to water is recorded from one foot markings on the poly tubing. A water sample is then collected from just below the top of water by creating a vacuum with the 60 CC syringe. Approximately 20 CC of water are decanted from the tubing and/or disposable syringe into a 40 CC VOA vial. In some cases the VOA vial is placed in line with the vacuum syringe via extra tubing and rubber stopper as a water dropout container and the water sample is collected directly. The VOA vial is immediately capped, labeled with location and depth, and delivered to the on-site mobile laboratory.

SOIL VAPOR:

One quarter inch diameter polyethylene tubing is used to collect vapor samples from the SPS test holes. The tubing is inserted into the test hole until it is located just off bottom. A disposable 60 cc syringe is used to evacuate at least 110% of the air volume from the tubing, and thereby replacing it with a vapor sample from the base of the test hole. Once the tubing has been evacuated, a disposable one cc syringe is used to collect the vapor sample by inserting the needle of the syringe into the flexible tubing that connects the 60 cc syringe to the polyethylene tubing and extracting one cc of vapor sample from the polyethylene tubing. The vapor sample is then injected directly into the appropriate analyzer.

DECONTAMINATION OF DRILLING AND SAMPLING EQUIPMENT

The drive rods and small diameter soil samplers are flame sterilized with a propane torch. If site conditions makes flame sterilization unsafe, then the equipment is cleaned with a solution of TSP. The small brass sample sleeves are cleaned, then boiled prior to reuse.

The sample bottles, polyethylene tubing, and syringes are used once and then discarded.

The hand auger equipment is cleaned between each hole with TSP, and the resulting waste water is containerized.

MOBILE LABORATORY ANALYSIS OF SPS SAMPLES

ANALYSIS FOR TOTAL FUEL HYDROCARBONS:

The VOA vials containing the soil and ground water samples are reweighed and the net sample weight is recorded. The vials are placed in a water bath at 180°F and maintained at that temperature for at least 15 minutes prior to analysis. A 0.2 CC vapor sample is then collected from the headspace of the vial with a disposable syringe and injected into the sample port of the dual column chromatograph, with special valving to separate the hydrocarbon compounds into two distinct chromatograms (<C10 and >C10). The resulting chromatograms are compared with chromatograms produced from standards of known concentration to determine the hydrocarbon vapor concentration. The standards consist of three different concentrations: low, medium and high. The actual concentration varies according to compound or compound mixture. The hydrocarbon vapor concentration determined from the soil sample is adjusted for the net sample weight to determine the hydrocarbon concentration in the soil sample. Chromatograms from the headspace of the water samples are compared with chromatograms of standard samples of similar volume and known concentrations to directly determine the analyte concentrations in the water sample.

Vapor samples, i.e. vapor samples from the Soil Vapor phase of the SPS, are reduced to 0.2 cc and injected directly into the chromatograph without preheating.

The calibration verification samples are run daily, both for TPHg and for the individual compounds of interest.

Three point calibrations are run monthly or when the verification samples indicate that there is too much variation from the current calibration.

ANALYSIS FOR HYDROCARBONS > C+20:

In order to detect heavier hydrocarbons (> C^{+20}), indicating the presence of motor oil, gear oil, grease, transmission fluids, etc., the SPS soil plug is first prepared by injecting 3 CC of pentane with a syringe into the capped 40 ml VOA vial that contains the soil sample. The soil plug and pentane mixture are shaken for 30 seconds and then allowed to stand for 30 minutes to one hour. The soil and pentane mixture is then inspected in a light-tight glove box under white light and UV light for hydrocarbon fluorescence. The color and strength of the pentane "cut" and cut fluorescence are noted for each sample. If known oil and grease range contaminants are present in the soil, standards of known concentration are prepared from similar petroleum products that have been dissolved in a 3 CC pentane solution. The standards are then observed under UV light for color and strength of cut fluorescence and these relative values are compared with observations made on the soil samples to determine the concentrations of the oil and grease range hydrocarbons in the samples.

COLLECTION OF SOIL AND WATER SAMPLES FOR CERTIFIED ANALYSIS

DRILLING AND COLLECTION OF SOIL SAMPLES

In order to confirm the results of the SPS, soil and water samples may be collected from hand augered soil borings for certified laboratory analysis.

Normally, soil borings are drilled with a three inch diameter hand auger. If other size holes are needed, 4.5 and 7.5 inch diameter augers are available.

Soil samples are collected by hand driving a slide hammer sampling device containing one 2" x 6" brass sleeve into the bottom of the augered hole. If the volume of sample recovery from the hand driven sampling device is inadequate, the soil sample is collected directly from the bucket of the auger at specified intervals. The soil samples are collected from the auger bucket in 2 inch X 6 inch brass sleeves.

Small portions of the soil samples (1-4 grams) that are collected from the hand auger bucket are placed in pre-weighed 40 ml VOA vials for analysis in the WEGE mobile laboratory for comparison with the certified laboratory results.

The geologist maintains a log of the materials encountered while augering the soil borings.

PRESERVATION OF SOIL SAMPLES

After field screening, the sample sleeve ends are sealed with aluminum foil and further protected with plastic caps. The samples are labeled with ID#, location, depth, date, time, sampler's initials, and analyses to be performed. The samples are placed in an ice chest at 4°C and delivered with accompanying chain of custody documentation to a certified laboratory for analysis.

COLLECTION OF WATER SAMPLES FOR CERTIFIED ANALYSIS

In order to collect water samples for certified laboratory analysis, machine slotted two inch diameter PVC casing is placed in the augered boreholes upon completion to create temporary ground water monitoring wells.

The water in the well casings of the temporary wells is then depleted with a disposable polyethylene bailer. The water level in a temporary well is allowed to return to its initial elevation prior to sampling. Water samples are collected with a disposable polyethylene bailer and decanted with no headspace into two 40 ml VOA vials containing 0.5 ml HCL as a preservative. A water sample is also decanted into a sealed 250 cc glass container for dissolved oxygen measurements. The water samples are labeled and preserved as described above for the soil samples.

ADDITIONAL SPS PROCEDURES AND ANALYSES

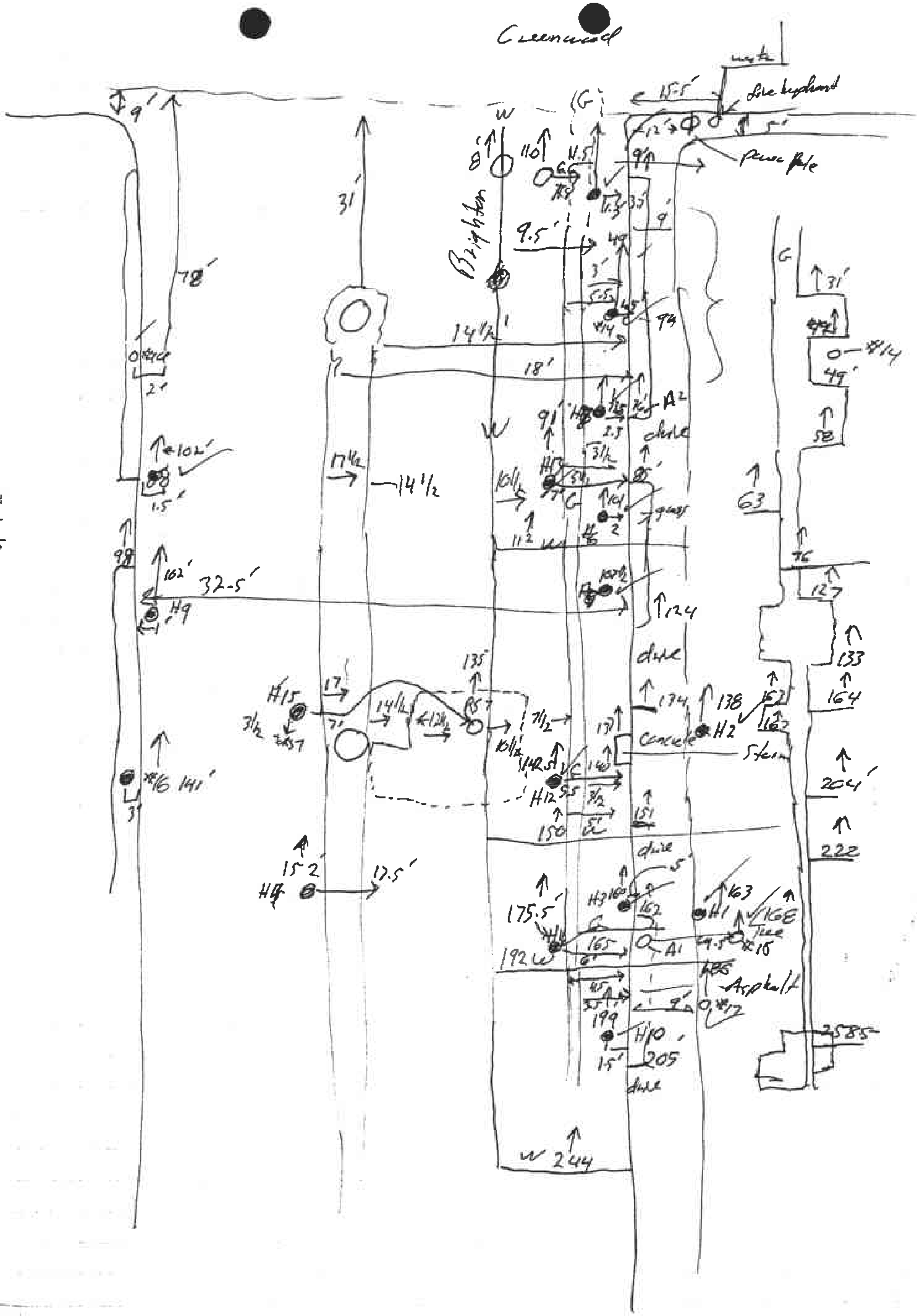
ANALYSIS OF WATER SAMPLES FOR DISSOLVED OXYGEN CONCENTRATIONS

Water samples collected from temporary wells during a SPS are analyzed within 5 minutes of collection time for concentrations of dissolved oxygen in the WEGE mobile laboratory using a Hach Spectrophotometer Model 2000. In addition to dissolved oxygen, further natural attenuation can be documented using the Hach Spectrophotometer for quantifying: Nitrate (NO_3), Sulfate (SO_4^{-2}) and Ferrous Iron (Fe^{+2}). Details of the HACH methods and procedures for a particular analyte are included in a supplemental appendix.

SLUG TESTS

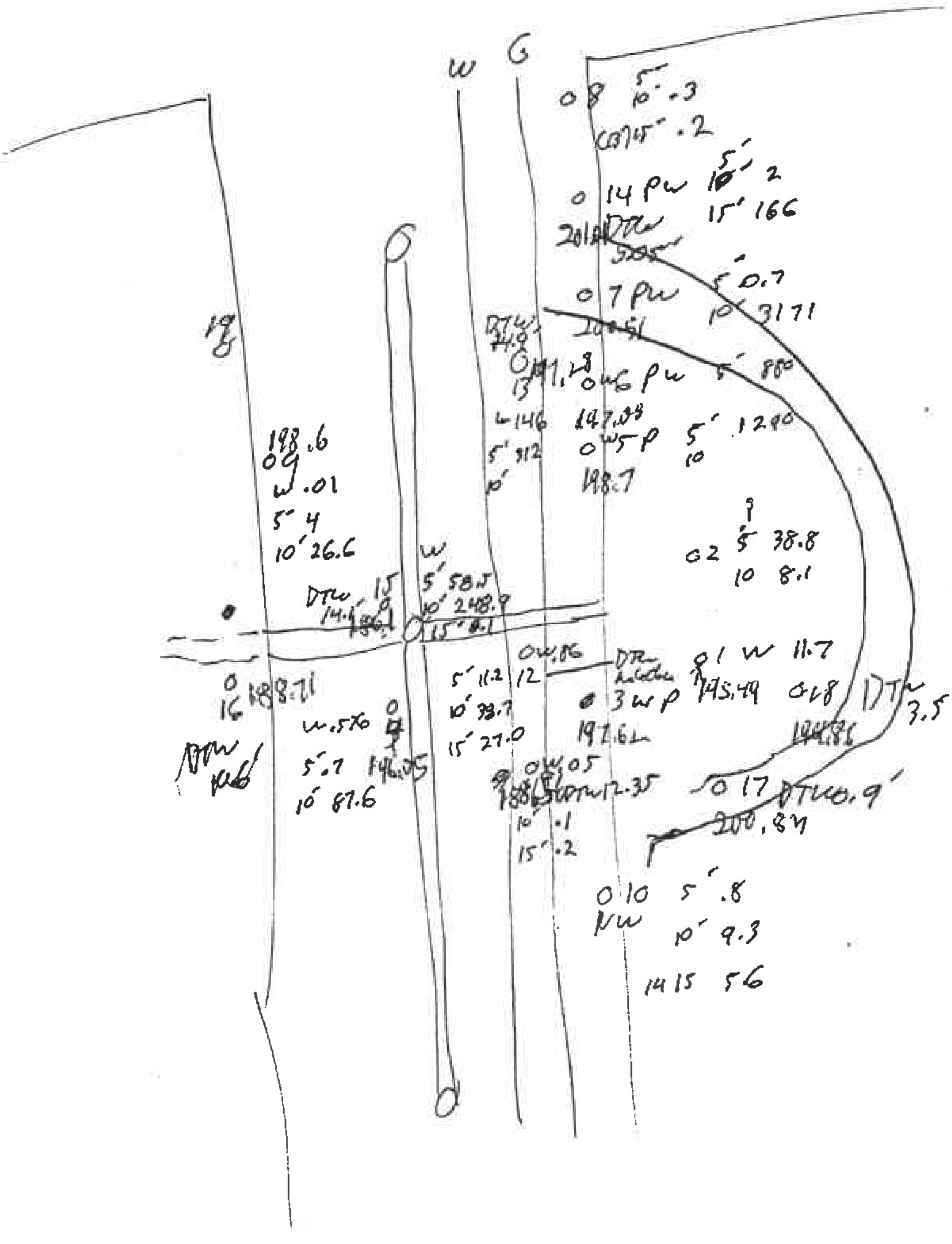
Once the ground water elevation has stabilized in the temporary well it is possible to perform a slug test in order to determine Hydraulic Conductivity (K).

To perform a slug test, either a pressure transducer is placed in the well or resistivity probe and a stop watch are used to measure the ground water depth over time. A bailer of water is extracted from the water column and periodic measurements of depth to water are recorded along with elapsed time since extraction until the water level had returned to its initial elevation. The measurement are either done automatically by the pressure transducer or by hand with the resistivity probe and stop watch.

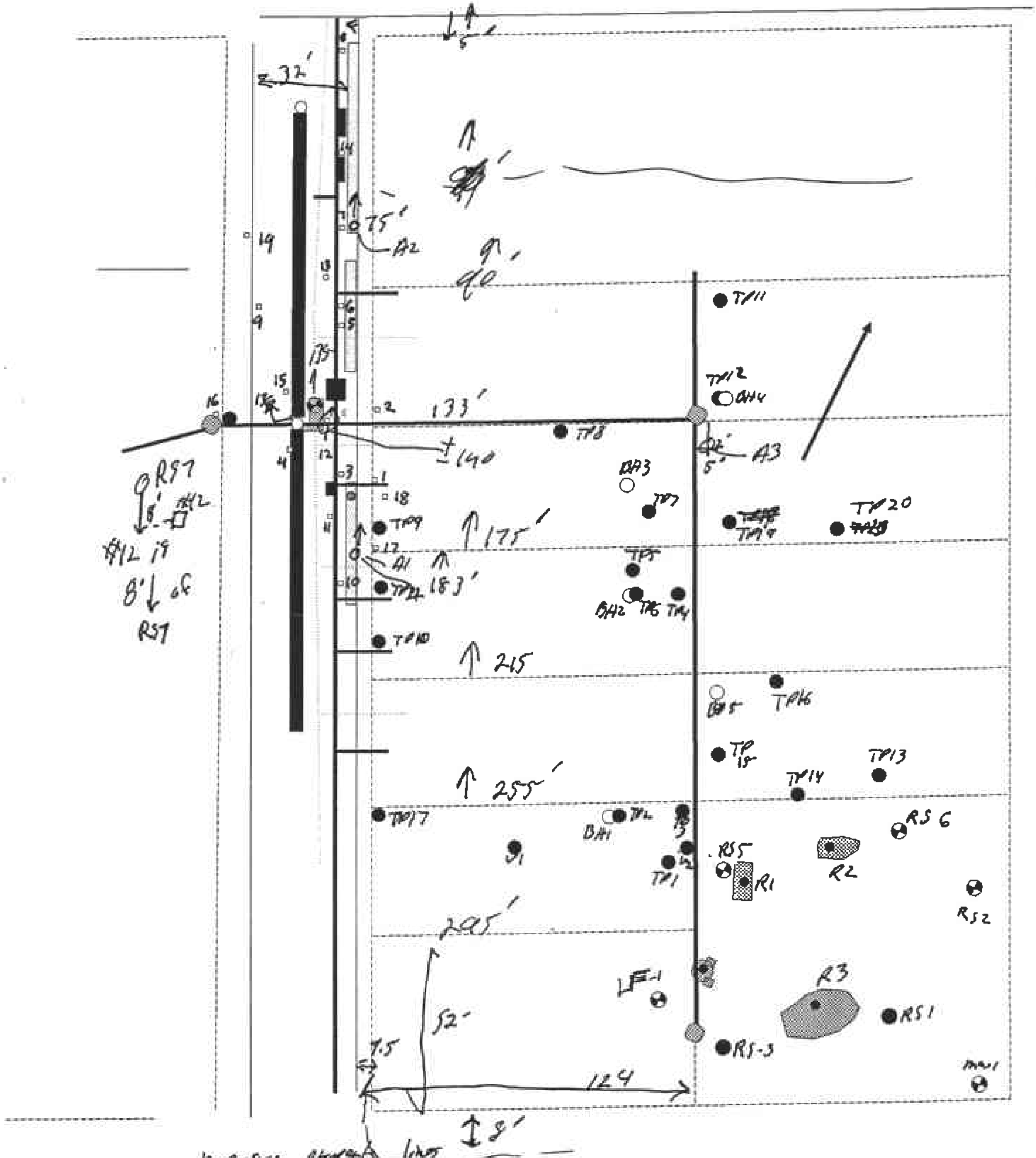

Greenwood
fire hydrant
power pole
Brighton
drive
concrete
Storm
Asphalt
W 244

6.01
2.5
.5

St	Backsite	Foresight	Instrument	Elevation
25.7 lid	9.78'		209.78	200.00
#1		9.64		200.14
		10.30		199.48
#3		10.29		199.[illegible]
#4		9.43		200.35
#5		10.03		199.75
#15		9.58		200.20
#6		9.08		200.70
#13		7.60		202.18
#7		6.47		203.31
#19		7.08		202.70
#9		9.28		200.50
#16		10.47		199.31
#10		7.16		202.62
A1		8.67		201.11
#17		8.05		201.73
#18		6.42		203.36
#11		8.84		200.9K
#12		10.15		199.63
lid	11.61		211.61	200.00
[illegible]		8.33		203.28
#7		8.30		203.31
Nos 2		5.60		206.01
#14 / #8		0.07		211.54



W
G
0 8
CB 7
0 14 PW
15' 166
0 7 PW
0 6 PW
0 5 P
198.7
198.6
0 9
W .01
5' 4
10' 26.6
DTW 15
5' 58.5
10' 248.9
15' 8.1
0 2
5 38.8
10 8.1
0 1 W 11.7
0 3 W P
197.62
0 18
17 DTW
3.5'
0 16
188.71
5' 11.2
10' 33.7
15' 27.0
5' .7
196.05
10' 87.6
0 W .05
0 17 DTW 0.9'
200.87
0 10 5' .8
NW
10' 9.3
14 15 56



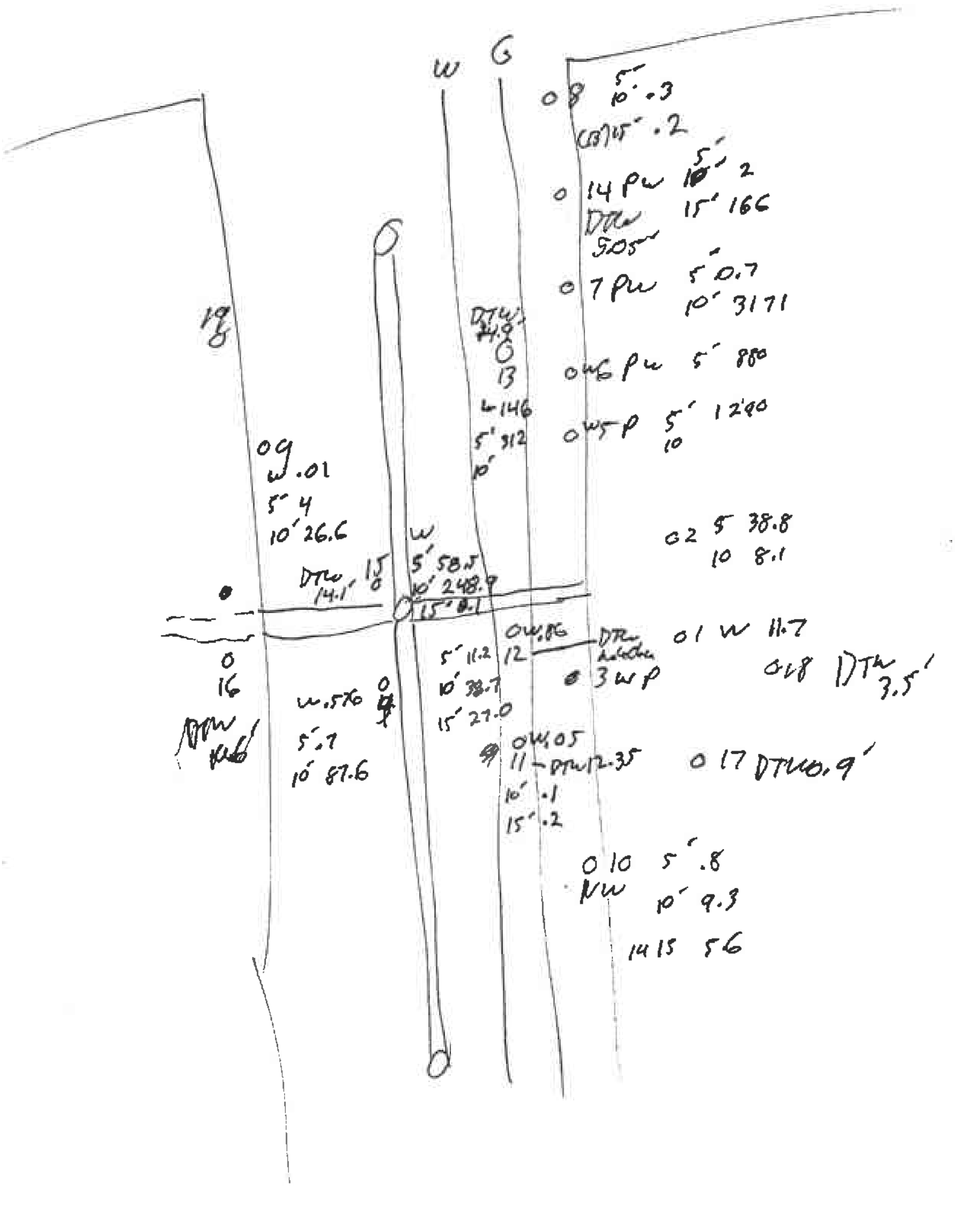
Measure property lines

Sewer lateral

Street width

curb sidewalk east side

etc.


W
G
0 8 5' 10' .3 15' .2
0 14 PW 5' 10' 2 15' 166
DTW 5.05'
0 7 PW 5' 0.7 10' 3171
0 W6 PW 5' 880
0 W5 P 5' 1240 10
DTW 74.9
0 13
W 146
5' 312
10'
19
09
W .01
5' 4
10' 26.6
0 2 5 38.8 10 8.1
DTW 14.1'
15
W
5' 58.5
10' 248.9
15' 8.1
0W.86
12
5' 11.2
10' 38.7
15' 27.0
0 1 W 11.7
0 18 DTW 3.5'
3 W P
0
16
W.576
5' .7
10' 87.6
0W.05
11 - DTW 12.35
10' .1
15' .2
0 17 DTW 0.9'
0 10 5' .8
NW 10' 9.3
14 15 56

St	Backsite	Foresight	Instrument	Elevation
RS-7 1.d	9.78'		209.78	200.00
#1		9.64		200.14
#2		10.30		199.48
#3		10.29		199.49
#4		9.43		200.35
#5		10.03		199.75
#15		9.58		200.20
#6		9.08		200.70
#13		7.60		202.18
#7		6.47		203.31
#19		7.08		202.70
#9		9.28		200.50
#16		10.47		199.31
#10		7.16		202.62
A1		8.67		201.11
#17		8.05		201.73
#18		6.42		203.36
#11		8.84		200.94
#12		10.15		199.63
RS7-1.d	11.61		211.61	200.00
~~#7~~ #7		8.33		203.28
Aug 2		8.30		203.31
#14		5.60		206.01
#8		0.07		211.54