PHASE 1 REMEDIAL INVESTIGATION REPORT
MONTEREY APARTMENTS
SEATTLE, WASHINGTON

Contract No. C0089007

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ABSTRACT

Phase 1 of a remedial investigation (RI) was performed by Ecology and Environment, Inc. (E & E), under contract to the Washington State Department of Ecology (Ecology), to evaluate the nature and extent of petroleum contamination existing at the Monterey Apartments site, located in the Queen Anne District of the City of Seattle. Tenants of the Monterey Apartments noticed petroleum vapor odors in the building's basement-level units since 1978. In 1986, Ecology was notified of the problem and initiated a limited emergency response action. The investigators identified two local service stations as the most probable point sources for the leakage: Arnold's Mini Mart Texaco (currently operated as the Manhattan Express Texaco [Express]) and the Union Oil Company 76 Queen Anne Counterbalance station (Unocal). Both are located at the intersection of Queen Anne Avenue North and West Roy Street. The initial action resulted in the installation of 8 monitoring wells and 2 extraction wells. The extraction wells performed with limited success, and the pump and treat operations were discontinued in 1987. In March 1990, under the authority of the Model Toxics Control Act (MTCA), Ecology initiated an RI and feasibility study (FS) to investigate and begin mitigation of petroleum vapors persisting at the site that may be a threat to human health.

E & E reviewed available records on the site and performed a historical evaluation of the impacted properties. Phase 1 of the RI was performed in March and April of 1991. Groundwater sampling, aquifer testing, soil-gas surveying, terrain conductivity surveying, and other support tasks were conducted to evaluate and define the concentrations and distributions of petroleum constituents from the Express and Unocal service station facilities. Data pertinent to FS requirements also were gathered. The investigation results established that floating and residual petroleum persisting beneath the Express property is the point source for the vapors impacting the Monterey Apartments building and

that a groundwater petroleum contaminant plume extends generally westward, at least 300 feet beyond First Avenue West. Tank integrity tests performed at the Express facility indicated no evidence of current tank leakage, suggesting the spilled petroleum has persisted at least since the site was investigated in 1986. Hydrogeologically, transport and mobilization of the petroleum contaminants at the Express appear to increase measurably in response to meteorological precipitation events and to periods of seasonally high water table elevations. Soil and groundwater petroleum contamination were observed at the Unocal property, but it was not demonstrated that Unocal contributed to the Express spill. It was concluded after the Phase 1 RI that the shallow, perched groundwater system impacted by the petroleum releases is not likely to classify as a drinking water source, and that, in addition to petroleum contaminants, its quality is degraded due to elevated bacterial counts, hardness, and the presence of chlorinated organic solvents. The floating and residual petroleum contamination originating from the Express property represents a confined space, respiratory human health risk that will persist indefinitely, unless reduced or removed through remedial action.

1. INTRODUCTION

Ecology and Environment, Inc. (E & E), under Contract No. C0089007 to the Washington State Department of Ecology (Ecology), performed a Phase 1 remedial investigation (RI), as defined by the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation Chapter WAC 173-340 (February 28, 1991), at the Monterey Apartments site.

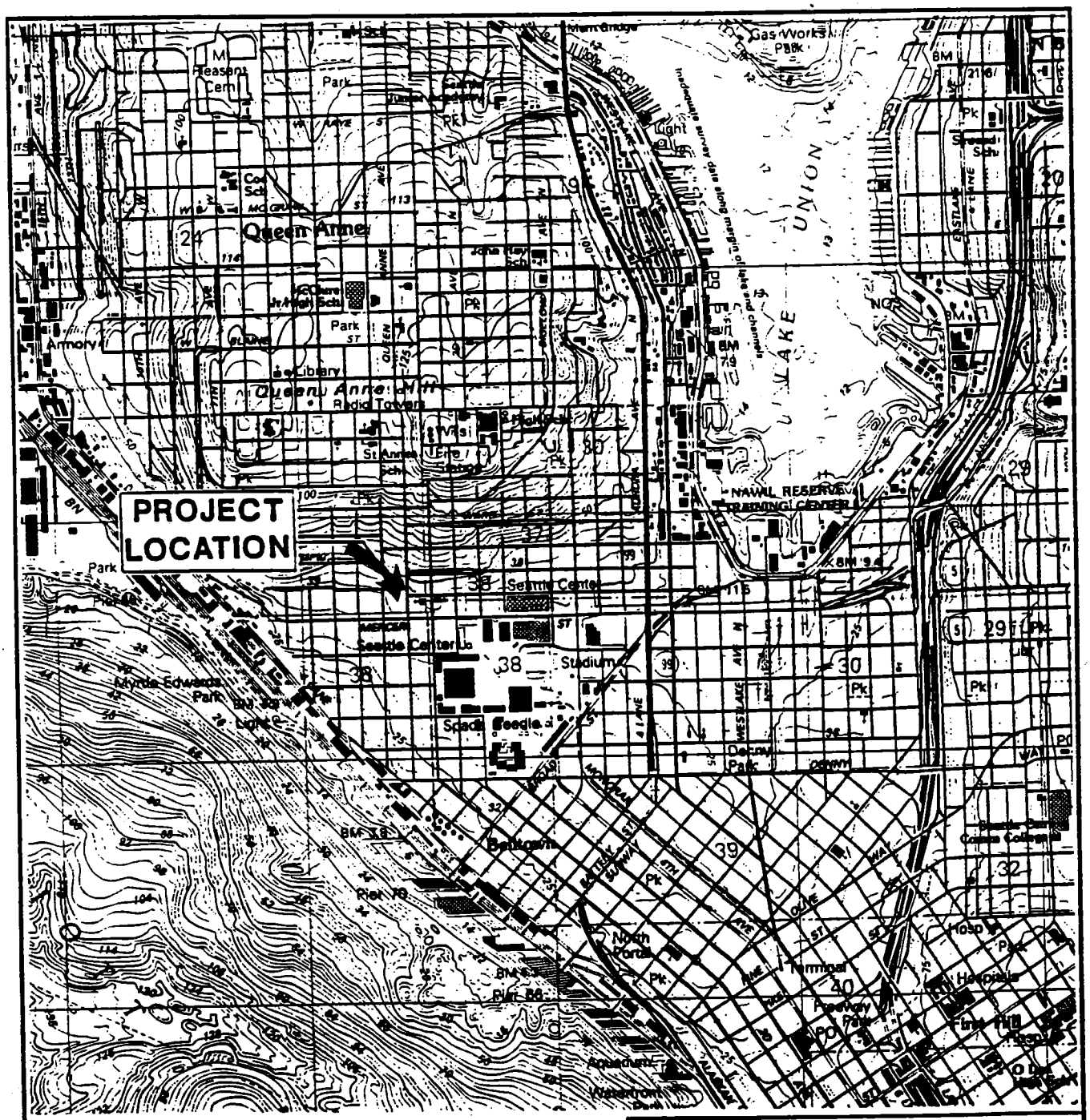
1.1 ENVIRONMENTAL CONCERNS

Under the authority of MTCA, Ecology selected the Monterey Apartments site as a facility requiring investigation and cleanup due to the potential threat to human health caused by a release of gasoline/diesel petroleum compounds from automotive service station underground storage tanks (USTs). The release created an ancillary subterranean organic vapor plume which has infiltrated residential occupant and utility spaces at two nearby apartment buildings (Monterey Apartments and Del Roy Apartments) resulting in both long- and short-term tenant evacuations.

The RI was initiated to assess the condition of the site and to prepare for design and installation of a cleanup action alternative to remove existing contaminants and eliminate, or adequately reduce, human health threats.

1.2 SITE DESCRIPTION AND HISTORY

The Monterey Apartments building is located at 622 First Avenue West, near the intersection of Queen Anne Avenue North and West Roy Street, in the City of Seattle, Washington (Figure 1-1). The site is located in a residential and commercial neighborhood in the Queen Anne District of northwest Seattle in the SE1/4 of section 25, Township 25 N., Range 3 E., of King County (USGS 1983).



BASE MAP REFERENCE:

SEATTLE NORTH AND SEATTLE SOUTH - 1983
U.S. GEOLOGICAL SURVEY AND NATIONAL OCEAN SURVEY
7.5 X 15 MIN. QUAD
1: 25,000 METRIC/TOPOGRAPHIC/BATHYMETRIC

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FIGURE 1-1
VICINITY MAP

MONTEREY APARTMENTS PHASE 1
REMEDIAL INVESTIGATION

DRAWN BY:	DATE:	PRJCT/JOB NO.	CAD DWG NO.
DCW	2-27-91	WB6120	0301LM.DWG

The site area investigated covered approximately 1 to 2 city blocks east, west, and south of the Queen Anne Avenue North and West Roy Street intersection. Located within the site area are two active gasoline/diesel petroleum product service stations, as well as several small retail businesses. The remainder of the site area is predominately residential apartments.

During previous investigation work performed under the direction of Ecology (Section 1.3), the following two service stations were identified as the most probable release sites:

- Manhattan Express Texaco (Express)
  631 Queen Anne Avenue North; and
- Union Oil Company 76 Queen Anne Counterbalance (Unocal)
  700 Queen Anne Avenue North.

Ecology directed E & E to investigate both service station facilities during the RI as probable point sources for the released petroleum impacting the area.

1.2.1 Lower Queen Anne Area Utility and Development History

Sewer Lines. City of Seattle Engineering Department Public Works records and maps show the existence of two pipe-sewer lines running north to south beneath Queen Anne Avenue North. A 12-inch pipe-sewer line installed prior to 1903 (Seattle Sewerage, Plan of Sewer and Side Connections on Queen Anne Avenue, September 1903, File Identification 33-43) runs approximately parallel to the north-south center line of the street (Appendix A). The plat shows a 6-inch side sewer originating from a portion of the Express property and extending eastward to connect with the 12-inch line. A second relief sewer line (15-inch diameter) was installed beneath Queen Anne Avenue in 1934 (City of Seattle Sewer Card No. 5359). The 15-inch line is positioned east of the street centerline and services several storm catch basins along the route, including the Unocal service station facility.

Direct measurements taken by City Engineering personnel on February 7, 1991, indicated that the 12-inch line is 14 feet below street surface

level, and the 15-inch line is 13 feet below street surface level. Both measurements were taken at manholes positioned at the foot of Queen Anne Hill on Queen Anne Avenue North, immediately north of the West Roy Street intersection.

Sewer card No. 5359 also indicated the presence of active side-sewer and catch basin lines servicing both the Express and Unocal facilities. After confirmation locator service work performed at the Express facility, service representatives were unable to confirm the routes reported on the card (see Section 3.3.5). The Unocal routes were investigated during an earlier study and were not investigated during the RI (GeoEngineers 1989).

Streetcar Counterbalance System. Two tunnels exist under Queen Anne Avenue North, between Lee Street and Mercer Avenue. The tunnels housed the tracks and 16-ton counterweights used to propel streetcars up and down the 17 percent grade of Queen Anne Hill from 1903 until 1940 (Seattle Post Intelligencer 1940). The surface tracks were removed in 1944. The tunnels span approximately 16 feet in combined width. The base of the tunnels extend 8.5 feet below street level, and are positioned so that the outer tunnel walls are approximately 12 feet inward of the east and west Queen Anne Avenue North Street curbs (Seattle Engineering File 20-51 Grading) (Appendix A). The tunnels also were constructed with a counterweight drain system to collect any subterranean water transported downhill through the tunnels. According to City Engineering records (File: 832-86), the counterweight drain was connected to, and discharged to, the 12-inch pipe sewer line near the Valley Street intersection.

In November 1969, the City of Seattle Engineering Department performed a walk-through inspection of the two counterbalance tunnels to assess the structural integrity of the tunnel system for possible service as a utility corridor. The inspection was documented by a file report from V.E. Ritz on November 21, 1969 (Appendix B). The inspectors reported that each tunnel was 5 feet wide by 4 feet high. The average depth of the tunnel system ceiling below street level was estimated at 4 feet. In general, the west tunnel was in better condition than the

east. An additional aspect of the inspection relevant to the Monterey RI was the inspection team's report of "strong sewer gas" odors near the West Roy Street intersection, suggesting that faulty sewer lines or other sources were potentially jeopardizing the quality of the shallow groundwater in the area.

Land Development. The Lower Queen Anne District has been developed since the late 1800s. The area surrounding the site has undergone only limited earth moving to accommodate grading and construction requirements (Phelps 1978). The three-story, 21-unit Monterey Apartment building reportedly was constructed in 1905 (Ecology 1989). Other significant structures within the site area, including the Del Roy, Lindberg, Chandler Hall, Marqueen, Northgate, and Alvena Vista apartments, are neighborhood landmarks, and have been present since at least the year 1936, based on aerial photographs (Walker & Associates, Inc., Identification No. W/01133).

1.2.2 Gasoline Service Station Property Histories

Property history reports were prepared for both the Express and Unocal properties during the Phase 1 RI. Specifically:

- The property comprising the present Express service station facility (previously Arnold's Mini Mart) at 631 Queen Anne Avenue North; and
- The Unocal service station facility at 700 Queen Anne Avenue North

Property history searches were performed by Stewart Title Company of Washington, Inc. under contract to E & E. The searches were performed to assist in establishing the commercial and title histories of the properties to define land-use practices and gather ownership records for possible cost recovery measures by Ecology.

Property transactions were documented as early as the 1890s for both properties. The Express property appears to have been under the ownership or proprietorship of petroleum distribution firms since 1927, when the California Petroleum Corporation leased the property from E.H. Carrico. The Texas Company (later to become Texaco, Inc.) acquired the

deed to the property in 1954. The property was later deeded by Texaco, Inc. to William F. Arnold and Erma R. Arnold (Arnold's Mini Mart) in 1977. As of May 20, 1990, the last property transfer record posted was the deed transferring the property from the Arnolds to John and Young Hee Yoo on November 3, 1989.

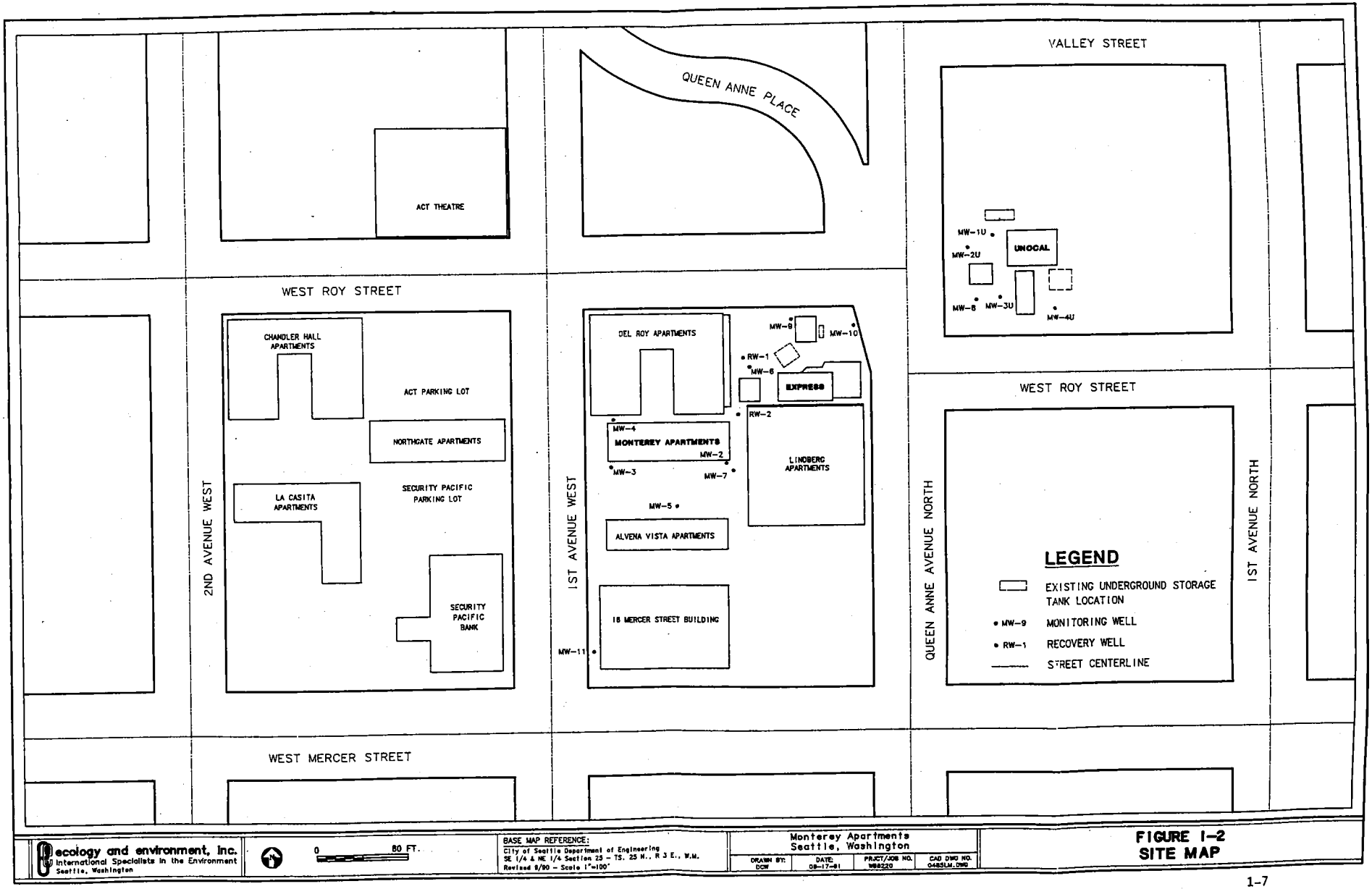
The property history report for the lots comprising the Unocal station indicated that the first apparent petroleum distribution facility use began in 1922 when a predecessor company of Unocal purchased the property from J. McFarland. Several petroleum related deeds and leases involving Union Oil Company of California were reported until 1987, when the current owner/operator, Union Oil Company of California obtained the property deed from Scarteen Corporation.

1.3 PREVIOUS SITE INVESTIGATIONS AND SPILL HISTORY

1.3.1 1986 Emergency Response Action

In September 1986, Ecology initiated action at the Monterey Apartments site following notice from the Seattle/King County Public Health Department that for approximately 8 years, residents of the Monterey Apartments building had experienced problems from gasoline odors along the building's west-side sublevel window wells and along a foundation footer drain catch basin located along the east side of the building (Figure 1-2). The problem was confirmed by inspections and supplemental reports from the Seattle City Fire Department which had responded to several gasoline odor complaints at the building since 1978 (Ecology 1989).

For the initial investigation, Ecology retained the services of Crowley Environmental Services (Crowley) and GeoEngineers, Inc. (GeoEngineers) to assess the situation. The assessment resulted in the installation of eight monitoring wells (MW-3 through MW-10) (Figure 1-2). The wells were positioned adjacent to the apartment building, on the Express property (referred to at that time as Arnold's Mini Mart), and on Unocal property, the latter two of which were established as the most probable spill sources. During that period, Ecology also directed the installation of gasoline vapor alarms in the lower units of the



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BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 - TS. 25 N., R 3 E., W.M.
Revised 8/90 - Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PROJECT/JOB NO.	CAD DWG NO.
DCW	08-17-91	W88220	0485LM.DWG

FIGURE 1-2
SITE MAP

Monterey Apartments building to monitor ambient conditions and to warn the tenants when unsafe vapor concentrations were present.

GeoEngineer's 1986 investigation report concluded that the Express (Arnold's Mini Mart) property, located on the same city block as the Monterey Apartments, had over a 2-foot thickness of fuel floating on the shallow groundwater beneath the site and immediately southwest of the station's main UST complex. The study also documented a lesser degree of soil and groundwater contamination beneath the Unocal property. Due to factors such as fuel appearance, characteristics, and monitoring well data, GeoEngineers concluded that while Unocal was impacting the local groundwater and soils, the Express facility (Arnold's Mini Mart) was the most probable source of the vapors impacting the Monterey Apartments building.

The study concluded that the Monterey Apartments building was being impacted by the gasoline vapors primarily because the foundation was constructed approximately 13 feet below ground surface (bgs) and, thus, was positioned close to petroleum floating on the water table. None of the residents of other multistory apartment buildings in the area reported odor problems; those buildings did not have foundation footers, or basement areas as deep as the Monterey Apartment building.

Ecology records indicate that in response to the study conclusions, Mr. Arnold, owner of Arnold's Mini Mart, retained Crowley to install a product recovery well on his property in November 1986. According to available Ecology field log notes, the well (RW-1) performed with poor recovery results. The recovery pump was shut down by December 1986. In April of 1987, Ecology retained Crowley and GeoEngineers to reinstall a recovery pump in RW-1. During this period, Ecology approved the installation of a second recovery well (RW-2) at a location near the northeast corner of the Monterey Apartments building. The two wells were used for recovery purposes until August of 1987 when operations were ceased again, due primarily to poor well performance.

Originally, Ecology estimated 5,000 to 8,000 gallons of petroleum fuel were released from the Express (Arnold's Mini Mart) facility

(Ecology 1989). The Ecology recovery effort conducted in 1987 reportedly recovered between 75 to 125 gallons.

1.3.2 1989 Unocal Investigation

In 1988, Unocal retained the services of GeoEngineers to conduct an assessment of the Unocal station property located on the northeast corner of the Queen Anne Avenue North and West Roy Street intersection (GeoEngineers 1989). In addition to monitoring well MW-8 installed by Ecology in 1986, GeoEngineers installed four additional 2-inch diameter wells (MW-1U through MW4U) on the property (Figure 1-2). Soils collected during the borehole construction were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) petroleum-derived components, as part of the study. The borehole depths ranged from 19 to 35 feet bgs. The water table ranged between approximately 7 to 12 feet bgs during measurements made in January of 1989.

GeoEngineers concluded that soils beneath the property were contaminated by gasoline-derived components. The property was determined by GeoEngineers to be located hydrogeologically upgradient of both the Arnold's Mini Mart and Monterey properties. However, the study also concluded that the conditions existing at the Unocal facility did not indicate a migration of released petroleum product toward the Monterey property. It was the opinion of the investigators that the release observed beneath the Arnold's Mini Mart and Monterey properties were unrelated to the Unocal situation. GeoEngineers supported their conclusion with the following factors:

- Perched groundwater system soils had an inherently low permeability;
- Monitoring well MW-10, which was in a mid-point position, did not show significant contamination;
- Orientation of known buried utility systems did not create migration avenues leading toward Arnold's Mini Mart; and
- Lack of similarity between the "unweathered" product observed at Arnold's Mini Mart and the "highly weathered" floating product observed from MW-8 at the Unocal property.

1.4 PURPOSE AND OBJECTIVE OF THE RI

Under MTCA, Ecology has the authority to perform a RI/feasibility study (FS) to assure the collection, development, and evaluation of sufficient site information to enable the selection of appropriate cleanup actions that will assure the protection of human health and the environment. The scope of each RI/FS is dependent on the specific information needs of the facility and cleanup action options under study, but must be sufficient to enable the selection of a cleanup action as defined under WAC 173-340-360.

Four objectives for the Phase 1 RI at the Monterey Apartments site were identified:

- Evaluate the extraction potential of floating petroleum product persisting atop the shallow water table beneath Express station at monitoring well MW-6;
- Evaluate the concentration, distribution, and estimated volume of petroleum contamination caused by the release of automotive petroleum fuels at the Express;
- Define the distribution, potential contribution, and migration routes of the Unocal petroleum leak, relative to the Express and Monterey properties; and
- Collect baseline data relevant to the FS, such as soil vadose zone impacts and groundwater quality parameters.

The specific activities designed to achieve the objectives were detailed in a Phase 1 RI Work Plan composed of a Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPjP), and Site Safety Plan (E & E 1991). The field sampling activities conducted for Phase 1 included the chemical analysis of both soil-gas and groundwater samples. The data, in addition to defining plume distribution, were collected to determine existing groundwater quality, and to provide baseline information appropriate to FS planning. Six primary field tasks were performed during Phase 1:

Field Task 1: Aquifer Testing;
Field Task 2: Monitoring Well Groundwater Sampling;
Field Task 3: Soil-Gas Survey and Groundwater Sampling;

Field Task 4: Terrain Conductivity Surveying;
Field Task 5: Sewer Line/Storm Drain Locating; and
Field Task 6: UST Tightness Testing.

The field tasks were performed and completed over the period from March 6 through April 19, 1991. This document reports the results of the field tasks completed.

2. SITE FEATURES AND CONDITIONS

The Monterey Apartments site is located at the base of Queen Anne Hill which has an approximate slope of 17 percent dipping southward. The effective surface drainage of the site area is to the west-southwest, with the majority of the runoff collected within catch basins distributed throughout the area and connected to the Municipality of Metropolitan Seattle (METRO) sewer treatment system.

The Express Station is located less than 300 feet northeast of the Monterey Apartments property. Monitoring wells (MW-6, MW-9, RW-2) positioned at and adjacent to the Express property contain petroleum product floating atop the shallow water table (E & E 1991). On-site monitoring wells and previous tank replacement activities at the Unocal facility have demonstrated the presence of both soil and shallow groundwater petroleum contamination beneath that property as well. The existence of relatively nondegraded floating petroleum similar to that documented at the Express has not been confirmed by previous investigations at the Unocal facility, although a darker, degraded floating petroleum product has been observed in MW-8 (GeoEngineers 1989; E & E 1990a; E & E 1991).

2.1 GEOLOGY

The Queen Anne District is underlain by a thick sequence of unconsolidated sediments deposited during the Vashon Stade of the late-Pleistocene Fraser Glaciation, the last glaciation to reach the central and southern Puget Lowland. In the Seattle area, this glaciation is recognized by deposits known as Vashon Drift. Vashon Drift is typically composed of a basal Lawton Clay member overlain by a younger Esperence Sand member, which in turn is overlain by Vashon Till. The Lawton Clay is a blue-gray clay unit with occasional sand and gravel lenses having a thickness of approximately 200 feet or more, while the

Esperence Sand is an approximately 150 foot thick sequence of sands and silts. Vashon Till is a hard, unsorted mixture of light-gray clay, silt, sand, and gravel, but includes small amounts of stratified sand and gravel, both within and overlying the till (Richardson et al. 1968). The stratigraphy of the recent surficial deposits found in the Seattle area is based on nomenclature derived by Mullineaux, Waldron, and Rubin (1965) using a sequence of sediments exposed in a cliff near Fort Lawton (Discovery Park) in northwest Seattle.

The Monterey Apartments site, as determined by drilling logs, is underlain by an average of 1 to 8 feet of construction-related fill material, overlying approximately 15 to 20 feet of sand, silty sand, and sandy silt (GeoEngineers 1986). These units lie above an undetermined thickness (greater than 23 feet) of gray, silty clay. A typical well log from the site (MW-6) shows a 10-foot thickness of surface fill material predominantly composed of brownish gray, sandy silt and silty sand underlain by 14 feet of brown sand and silt. This changes to a gray, silty sand, underlain by a hard gray, silty clay. The clay unit is probably the Lawton Clay member of the Vashon Drift, while the overlaying sand, silty sand, and sandy silt unit is stratigraphically similar to a basal portion section of the Esperence Sand, or transition zone sediment between the Lawton Clay and the lower Esperence Sand.

2.2 HYDROGEOLOGY

Existing monitoring wells at the site indicate that there is shallow groundwater beneath the Express at approximately 10 to 25 feet bgs (GeoEngineers 1986 and E & E 1990a). The saturated zone exists within the sand unit above the clay which locally acts as a basal confining unit to vertical groundwater flow, thereby creating a perched groundwater condition. The clay unit was encountered in five of the Express/Monterey Apartments monitoring wells and at each of the Unocal wells and is assumed to be continuous in the area. Unocal well MW-2U reportedly has a clay unit thickness of approximately 23 feet. No deep, exploratory monitoring wells or boreholes have been drilled locally to establish the actual thickness of the clay at the site. Groundwater elevations determined from well measurements made in the

field indicate that groundwater flow is to the west-southwest, in the direction of Puget Sound. This coincides with the expected direction generated from the local topography and geology of the site vicinity.

An average horizontal groundwater gradient between MW-8 and MW-3 of ± 0.05 ft/ft has been maintained in the perched system based on groundwater elevation measurements made in 1986, 1989, 1990, and 1991. Water-table elevations are relatively dynamic at the site, responding to the climatic seasons and major storm events, although groundwater flow direction and gradients appear to remain generally consistent (Section 4.1).

2.3 WATER USE

Public drinking water is supplied solely by the City of Seattle Water Department. No active drinking water or irrigation wells are known to exist in the lower Queen Anne District. Sewer Services are operated and managed by Seattle METRO.

2.4 LAND USE AND DEMOGRAPHICS

The lower Queen Anne District of Seattle is composed primarily of mixed residential and multiresidential housing units, and small retail businesses, as well as the Seattle Center art, sports, and recreation complex. Residential units most likely threatened by the petroleum release are the multistory apartment unit buildings which represent the development pattern of the area west and southwest of the Express facility. An estimate of the total population within a 1/4-mile radius of the Express is approximately 6,200 people, based on Puget Sound Council of Governments census tract figures for King County (PSCOG 1989).

2.5 NATURAL RESOURCES AND ECOLOGY

Lower Queen Anne District can be classified as a heavily developed urban sector within the City of Seattle. Since before the turn of the century, the area has undergone irreversible ecological alteration which has, for practical purposes, eliminated or drastically altered the

resources natural to the area. Damages at the Monterey Apartments site incurred by the release of petroleum are local in extent. An assessment of injury, destruction, or loss of fish, wildlife, or biota caused by the release has been determined by Ecology as inappropriate for this action. As a result, a Natural Resource Damage Assessment as defined by 42 U.S.C. was not conducted for the Monterey Apartments site.

3. RI ACTIVITIES AND RESULTS

In March 1990, E & E began work on the Monterey Apartments site by consolidating and assimilating existing records and files on the site and reviewing previous field activities. This task was followed by a historical review of the area (Section 1.2) and several initial field activities to evaluate site conditions. These activities occurred in July 1990 and included a pilot soil-gas study (Section 3.1) and the chemical analysis of floating petroleum products collected from two monitoring wells (Section 3.3). Information collected from these activities was used to plan and perform the Phase 1 RI, as defined in the Phase 1 RI Work Plan (E & E 1991). The Phase 1 RI field tasks, including aquifer testing, groundwater sampling, soil-gas surveying, terrain conductivity surveying, a sewer line search, and tank testing, were performed in March and April 1991 and are described in Section 3.3.

3.1 PILOT SOIL-GAS STUDY

In July 1990, as part of a pre-RI study, E & E conducted a limited pilot soil-gas sampling and analysis study at the site to assess the feasibility of applying the technique as an investigation tool for the RI. The study was performed in accordance with the approved Pilot Soil-Gas Study Sampling Analytical Plan, and resulted in the collection of soil-gas samples from six locations within the study area (E & E 1990b). The samples were obtained through hollow steel rods installed manually approximately 4 to 5 feet bgs. Following the required purge cycles, each soil-gas sample was collected in 6-liter Manchester Environmental Laboratory (Manchester) certified blank, fully evacuated, stainless steel Suma canisters. Purging and sampling flow rates between 900 and 1,400 milliliters per minute (mL/min) were typical. Seven soil-gas samples were submitted to Manchester for analysis of volatile

organic compounds as listed on the United States Environmental Protection Agency (EPA) Target Compound List (TCL). The analysis followed a modified EPA Method TO-14 as defined in the Pilot Soil-Gas Study Sampling Analytical Plan, and included the tentative identification of approximately 20 additional non-TCL compounds detected by gas chromatography/mass spectroscopy.

The locations of the pilot soil-gas study stations (SG-01 through SG-06) are shown in Figure 3-1. Detected TCL volatile compounds are listed in Table 3-1. Sample SG-07 was a quality assurance (QA) ambient air sample collected at the same location as SG-04. The sample was collected to monitor surface air concentrations relative to the soil-gas samples. The results of the pilot study were initially reported to Ecology in a trip report, dated September 11, 1990 (E & E 1990a). The laboratory analysis reporting sheets for the samples, as well as the E & E data validation report for the analysis, are provided in Appendix C.

The pilot soil-gas study results confirmed that significant concentrations of gasoline vapors were residing within the shallow vadose zone subsoils bordering the west and east margins of the Express property. In sample SG-01, BTEX components were detected at 226 µg/L at a depth of 5 feet bgs, and sample SG-05 reportedly had a total BTEX concentration of 1,740 µg/L at 4.5 feet bgs. In samples SG-02 and SG-03, located near the Monterey Apartment building, BTEX components were detected at concentrations approximately three orders of magnitude lower.

3.2 FLOATING PETROLEUM ANALYSIS AND WATER-TABLE MEASUREMENTS

As part of the E & E pre-RI study, depth to groundwater and floating product measurements were taken in July and September 1990, on monitoring wells MW-03, -04, -05, -06, -07, -08, -09, -10, RW-1, and RW-2. September 1990 static water level (SWL) measurements and observations are summarized in Table 3-2. Floating product was observed in four wells in September (MW-1, MW-8, RW-1, and RW-2). Floating product was measured in the same four wells during measurements collected in July.

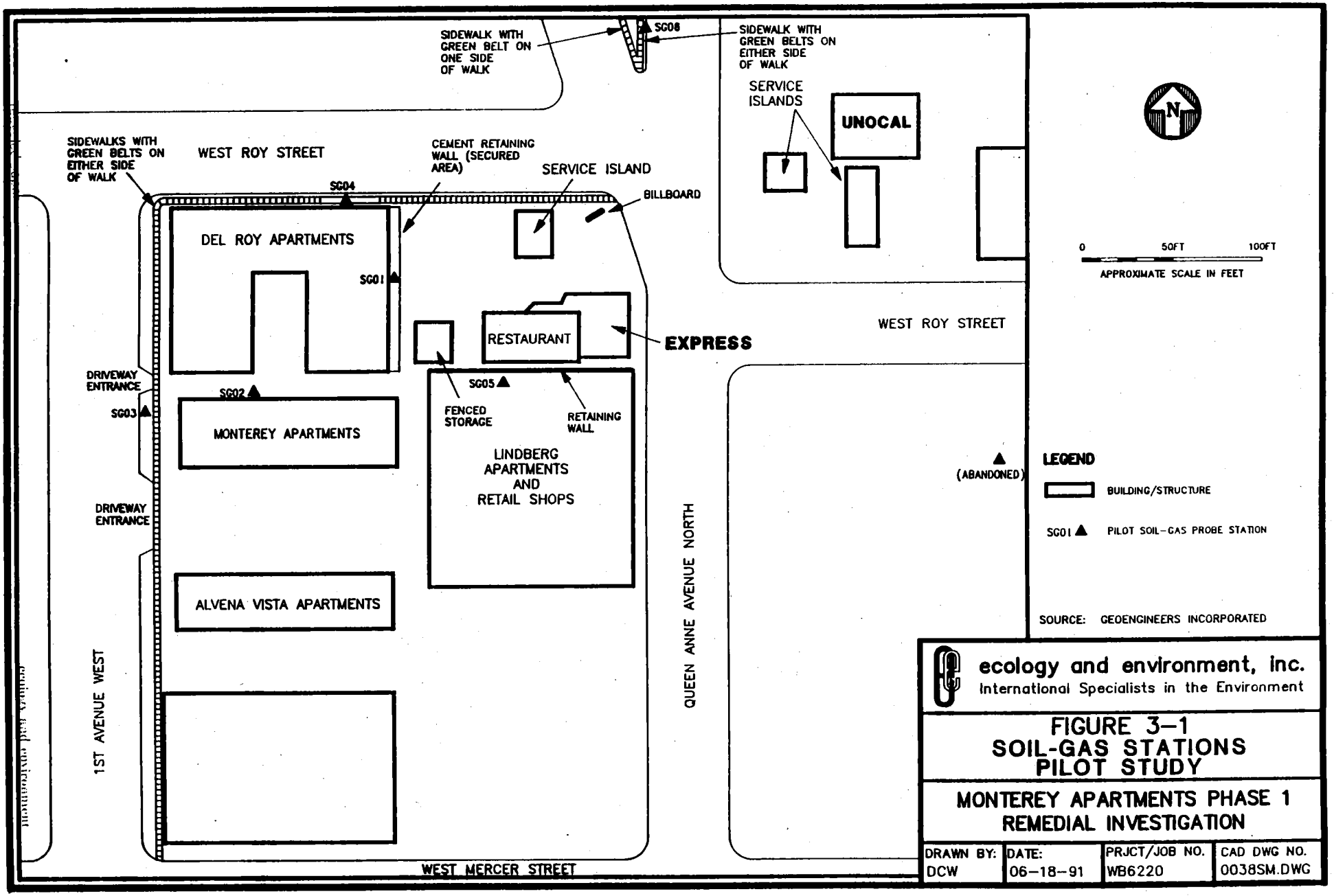

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FIGURE 3-1
SOIL-GAS STATIONS PILOT STUDY

MONTEREY APARTMENTS PHASE 1 REMEDIAL INVESTIGATION

DRAWN BY:	DATE:	PRJCT/JOB NO.	CAD DWG NO.
DCW	06-18-91	WB6220	0038SM.DWG

Table 3-1

SOIL-GAS PILOT STUDY
VOLATILE ORGANIC RESULTS
MONTEREY APARTMENTS SITE
July 1990

(µg/L)

Detected Analyte(1)(2)	SG-01		SG-02		SG-03		SG-04		SG-05		SG-06		SG-07 (Ambient Air)	
Trichlorofluoromethane	8.2	U	0.017	U	0.018	U	0.013	J	9.2	U	0.200	U	0.013	U
1,1-Dichloroethene	8.2	U	0.017	U	0.018	U	0.008	J	9.2	U	0.200	U	0.013	U
Benzene	150.		0.110	J	0.025	J	0.018	U	890.	J	0.400	J	0.013	U
Tetrachloroethene(PCE)	8.2	U	0.009	J	0.018	U	0.003	J	9.2	U	0.200	U	0.013	U
Toluene	13.		0.017	U	0.018	U	0.018	U	580.	J	0.200	U	0.013	U
Ethyl Benzene	22.		0.024		0.018	U	0.018	U	48.	J	0.200	U	0.013	U
Xylenes, Total	41.	J	0.058		0.018	U	0.018	U	222.	J	0.059	J	0.013	U
1,2,4-Trimethylbenzene	18.		0.055		0.013	J	0.019		9.2	U	0.200	U	0.013	U
1,3,5-Trimethylbenzene	24.		0.130	J	0.030		0.052		9.2	U	0.055		0.013	U
Sec-Butylbenzene	1.7	J	0.017	U	0.018	U	0.004	J	9.2	U	0.200	U	0.013	U
p-Isopropyltoluene	2.5	J	0.017	U	0.018	U	0.018	U	9.2	U	0.200	U	0.013	U
Isopropylbenzene	4.6	J	0.011	J	0.005	J	0.018	U	9.2	U	0.039	J	0.013	U
Propyl-Benzene	10.		0.019		0.018	U	0.018	U	9.2	U	0.088	J	0.013	U

(1) Tentatively identified compounds (TICs) identified in addition to the EPA target compound list (TCL) volatile organic analytes are presented on the laboratory analysis report found in Appendix C. All analysis performed by Ecology Manchester Environmental Laboratory.

Data Qualifiers
J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.

Table 3-2.
GROUNDWATER ELEVATIONS
MONTEREY APARTMENTS SITE
September 1990
(feet)

Well Identification	Top of PVC Casing Reference Point Elevations[1]	Distance Between Top of PVC Casing and Ground Surface	Depth to Static Water Level[2] (Measured from top of PVC casing)	Calculated[3] Static Water Level Elevation	Observations
MW-2 (2-inch PVC)	—	—	—	—	Dry hole, unusable for for groundwater monitoring.
MW-3 (2-inch PVC)	100.51	0.25	11.48	89.03	
MW-4 (2-inch PVC)	102.08	0.33	12.87	89.21	
MW-5 (2-inch PVC)	102.92	0.30	13.49	89.43	
MW-6 (2-inch PVC)	113.38	0.33	21.95	91.43 (92.08)	Floating product; Thickness: 0.81 Ft.
MW-7 (2-inch PVC)	104.88	0.08	13.3	91.58	
MW-8 (2-inch PVC)	116.55	0.25	13.05	103.50 (103.62)	Floating product; Thickness 0.15 Ft.
MW-9 (2-inch PVC)	114.40	0.23	21.28	93.12	
MW-10 (2-inch PVC)	115.49	0.23	14.75	100.74	
RW-1 (8-inch PVC)	112.06	1.5	20.27[4]	91.79 (92.13)	Product layer detected; Estimated thickness 0.42 Ft.
RW-2 (8-inch PVC)	104.54	2.58	12.72	91.82 (91.85)	Thin product later; Thickness measured at 0.04 Ft.

(1) Elevations listed are based on a survey by GeoEngineers relative to assumed elevation point of 100 feet at a utility vault lid located on the sidewalk along the east side of 1st Avenue West, in front of the Alvena Vista Apartments.
(2) Measurements obtained using a product/water interface probe.
(3) Elevations presented in parentheses "()" are values adjusted for the presence of floating product using an assumed specific gravity of 0.80.
(4) Estimated measurement due to instrument interferences.

During the July event, two samples of floating product were collected from MW-6 and MW-8. The samples were submitted to the Ecology Manchester laboratory for hydrocarbon "finger print" identification by flame ionization detection, and inorganics screening by inductively coupled plasma. The resulting hydrocarbon identification and laboratory data report sheets are presented in Appendix D. The inorganic results are summarized in Table 3-3. The hydrocarbon identification evaluation concluded that the product found in MW-6 was only slightly degraded, and was composed of gasoline and a lesser amount of No. 2 diesel oil. The sample from MW-8 was observed to be composed of extremely weathered gasoline. The inorganics results showed that the MW-6 sample contained an estimated 1 mg/L lead, while the sample from MW-8 contained an estimated 707 mg/L of lead.

3.3 PHASE 1 RI

3.3.1 Aquifer Testing

An aquifer test of the shallow groundwater system underlying the Express property was performed by E & E on March 6, 1991, with subsequent site visits on March 7, 9, and 15, 1991. The testing was performed to establish aquifer hydraulic parameters of conductivity (K) and transmissivity (T) and to evaluate petroleum hydrocarbon recovery potential in and around MW-6. The test consisted of two parts: a product recovery test to determine the feasibility of installing a long-term product extraction pump, and a rising-head well test to estimate K and T of the shallow aquifer.

Both components of the test were accomplished by bailing MW-6, a 29-foot-deep, 2-inch polyvinyl chloride (PVC) monitoring well. Floating product was removed by repeated use of a clear PVC bailer to estimate product recovery potential. The aquifer test was performed following procedures outlined in the Monterey Apartments Phase 1 RI QAPjP (E & E 1991).

Product Recovery Test. The product recovery test began on March 6, 1991, after measuring the product thickness (11.88 inches) within MW-6. The well was bailed at a constant rate until less than 0.5 inches of

Table 3-3

FLOATING PETROLEUM INORGANIC SAMPLE RESULTS[1]
MONTEREY APARTMENTS SITE
August 1990

(mg/L)

Inorganic Analyte	Well Identification	
	MW-06[2]	MW-08[3]
Aluminum	0.50 U	<5
Antimony	0.50 U	<5
Arsenic	1.0 U	<5
Barium	0.50 U	NA
Beryllium	0.50 U	<5
Cadmium	0.50 U	<5
Calcium	1.0	NA
Chromium	0.50 U	<5
Copper	0.50 U	<5
Iron	0.50 U	17.6
Lead	1.0	707
Magnesium	0.50 U	<5
Manganese	0.50 U	<5
Mercury	NA	<0.1
Molybdenum	0.50 U	<5
Nickel	0.50 U	<5
Selenium	0.50 U	<5
Silica	NA	15
Silver	0.50 U	<5
Thallium	0.50 U	<5
Tin	0.50 U	NA
Titanium	0.50 U	<5
Vanadium	0.50 U	NA
Zinc	0.50 U	<5

(1) Laboratory analysis reports are presented in Appendix C. Data validation performed by Manchester Environmental Laboratory.
(2) Analysis performed by North Creek Analytical.
(3) Analysis performed by Sound Analytical Services, Inc. Values reported may be used as an indication of the presence of the analyte.

Data Qualifiers:
NA - Not analyzed.
U - Analytes listed were not present above the stated limit of detection.

product remained in the well. Following a 2-hour recovery at MW-6, a product thickness of approximately 4.68 inches was measured. The well was bailed again at a constant rate until a thickness of less than 0.5 inches of product remained. Product recovery tests were conducted at MW-6 again on March 7, 9, and 15 to observe product thickness and bail the well to the minimum product thickness (less than 0.5 inches). On March 7, 4.92 inches of product had re-entered the well, which was then bailed from the borehole until a 0.125-inch thickness was achieved. On March 9, 4.44 inches of product was measured in the well; no additional bailing was conducted. Product thickness was again measured on March 15; a product thickness of 10 inches was measured. No additional measurements or removal was performed. The total product recovered during the product recovery test was 1.12 gallons. The well was bailed a total of 41 times at approximately 1-minute intervals, resulting in an estimated product recovery rate of 0.027 gal/min, assuming constant conditions.

Rising-Head Test. On March 6, 1991, following the completion of the initial product recovery test, a rising-head aquifer test of MW-6 was performed. A data logger/transducer was installed in the well to record changes in the water level during drawdown and recovery periods of the rising-head aquifer test. Concurrent readings were collected at RW-1, located approximately 8 feet to the northwest, to monitor any drawdown influence from the removal of water from MW-6.

Drawdown was initiated at MW-6 by bailing approximately 20 gallons of water from the well, which achieved a drawdown of approximately 2 feet below the initial water level of 20.93 feet bgs. When bailing stopped, the resulting rising-head was monitored and recorded by the data logger/transducer. Two tests were conducted at the original static water level using this method. The test results were used to develop aquifer characteristic calculations. Readings at RW-1 showed no measurable drawdown influence from the bailing of MW-6.

Data obtained from the rising-head recovery test were analyzed by applying both the Bouwer-Rice method (1976) and a groundwater analysis program utilizing the Cooper *et al.* method (1967). An explanation of these commonly used methods and the assumptions associated with them is

contained in Krusemen and de Ridder (1990). Data and calculations from the test are contained in Appendix E.

Calculations performed using these methods yielded estimated hydraulic conductivities (K) on the order of 10^{-5} to 10^{-6} ft/sec, a range indicative of a silty sand aquifer (Freeze and Cherry 1979). A transmissivity (T) range of 1.30 to 4.83 ft^2/day also was calculated, using the relationship that T=Kb, where b is equal to the saturated aquifer thickness beneath the site. The assumed saturated thickness selected was 9 feet, established by the difference between the water level measured prior to testing and the depth marking the contact between the sand unit and underlying clay layer reported in the geologic well log for MW-6.

Interim Actions. Concurrent with the preparation of this RI report, an interim action installation of a Westinghouse Groundwater Recovery Flexible Axial Peristaltic (FAP) pump at MW-6 was initiated to extract petroleum hydrocarbons based on information obtained during the two aquifer tests. It is estimated that on a monthly basis a volume of petroleum (16 gallons) will be removed from MW-6. The system was installed on August 12, 1991 and is expected to operate for a minimum of 3 months.

3.3.2 Groundwater Sampling

Groundwater samples were collected by E & E during a period from March 26 until March 28, 1991 at the Monterey Apartments site. The groundwater sampling represented the first comprehensive sampling of the 14 existing wells in the Monterey Apartments site area. This sampling effort included wells on the Unocal, Express, and Monterey Apartments properties, as well as a 2-inch monitoring well located on the property of the 18 West Mercer Street building. For the purpose of the RI, this well has been given the designation MW-11 (Converse 1990) (Figure 1-2).

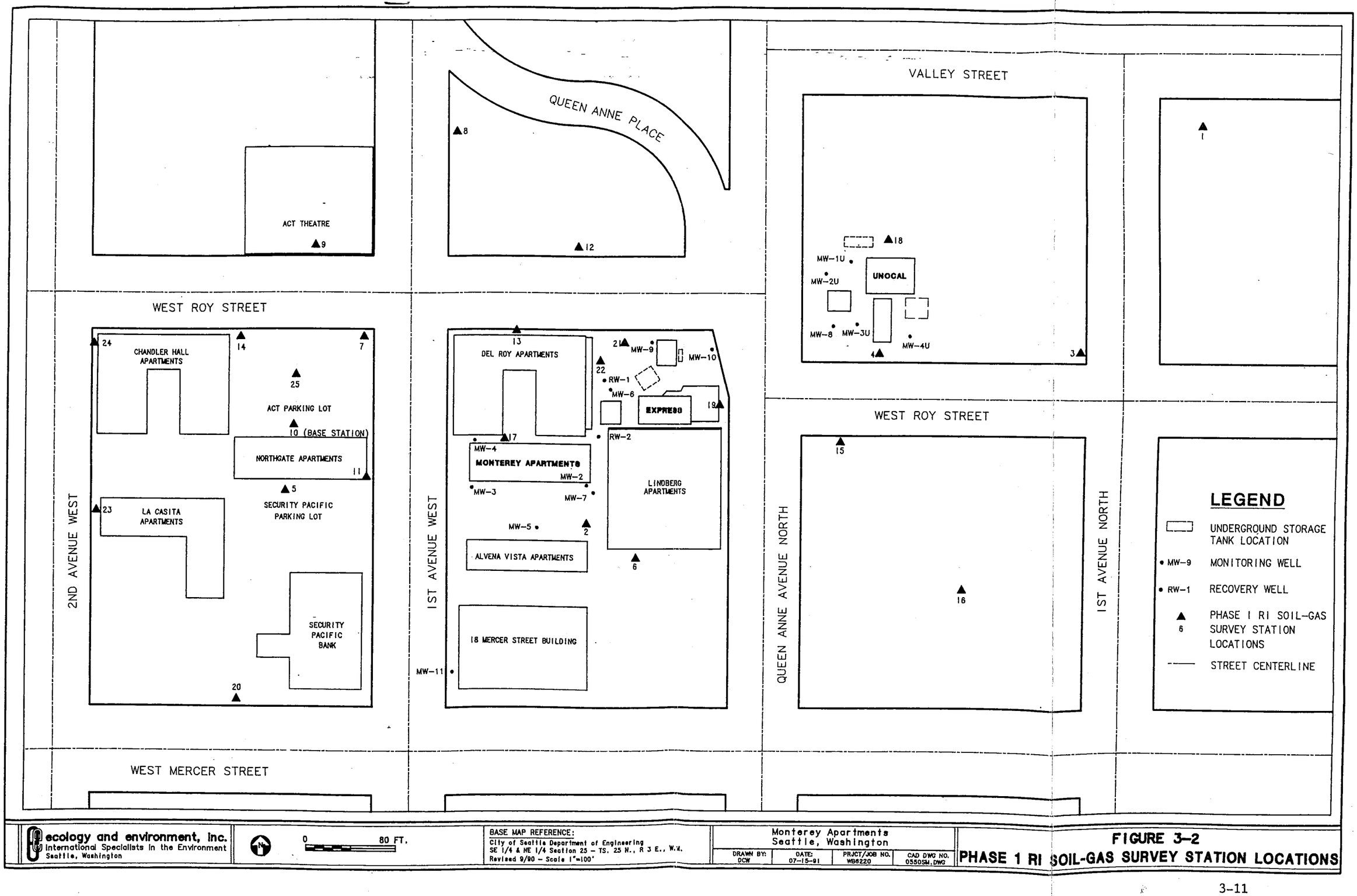
The samples from each of the wells were analyzed for selected volatile organic components of petroleum, including BTEX, ethylene dibromide (EDB), total petroleum hydrocarbons (TPH), and total lead (unfiltered sampling). Samples from two of the wells (MW-3 and MW-10) were analyzed for additional constituents: bacteriological coliform

indicators (due to concerns over possible sewage contamination), and biological parameters relevant to bioremediation prefeasibility evaluation. Wells MW-3 and MW-10 were selected as the sites for additional analyses because of their downgradient (MW-3) and upgradient (MW-10) positions relative to the Express property. These biologic and nutrient parameters included Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), heterotrophic bacterial population densities, and NH_3-N, PO_4-P, NO_3-N nutrients. In addition, MW-3 and MW-10 also were analyzed for selected inorganic ions to establish local groundwater geochemical conditions to evaluate State primary and secondary water quality standards of the perched groundwater.

Groundwater samples were also obtained from two temporary stations (Phase 1 RI soil-gas survey stations 5 and 25) of the soil-gas survey performed in early April 1991 during the Phase 1 RI field effort (Section 3.3.3 and Figure 3-2). These samples were analyzed for volatile TPH (VTPH) and BTEX.

The groundwater sampling analytical data, including field measurements, for the sampling effort are presented in Tables 3-4 through 3-9. Table 3-4 is a listing of components found in the groundwater that are common to petroleum hydrocarbon contamination. Tables 3-5 and 3-6 present water quality and inorganic analytes commonly used in the determination of State primary and secondary drinking water standards (WAC 173-200). Table 3-7 is a listing of field measurements collected during the groundwater sampling effort which were monitored during purging of the monitoring wells. Table 3-8 is a listing of other volatile organic constituents that were detected during the groundwater sampling. Table 3-9 is a listing of groundwater samples collected from two temporary stations during the soil-gas survey portion of the RI.

Data validation was performed by a qualified E & E chemist according to the methods described in the QAPjP (E & E, 1991). The groundwater samples collected from the Geoprobe (soil-gas) investigation were collected as field screening data and underwent less intensive evaluation due to the nature of the collection method utilized.



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International Specialists in the Environment
Seattle, Washington

0 80 FT.

BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 – TS. 25 N., R 3 E., W.M.
Revised 9/90 – Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PRJCT/JOB NO.	CAD DWG NO.
DCW	07-15-91	WB8220	0550SM.DWG

FIGURE 3-2
PHASE 1 RI SOIL-GAS SURVEY STATION LOCATIONS

Table 3-4

SELECTED PETROLEUM CONSTITUENTS
GROUNDWATER SAMPLING
MONTEREY APARTMENTS SITE
March 1991

	Benzene	Toluene	Ethylbenzene	Total Xylenes	Lead	EDB	TPH
	(µg/L)						(mg/L)
MW-2U	5 U	5 U	5 U	5 U	60	—	1.0 U
MW-4U	500 U	1,600 U	1,200	7,400	16	—	4
MW-3	3,700	1,600	740	3,500	74 J	0.01 U	3.6
MW-4	10,000	12,000	500	9,800	63	—	12
MW-5	5,300	1,300	900	4,600	29	—	6.6
MW-6	25,000	29,000	2,500	19,000	1,500	—	3,600
MW-7	280	510	130	1,100	24	—	7.1
MW-8	1,800	1,200	1,100	3,500	54	—	49
MW-9	1,600	2,900	250 U	3,100	160	—	69
MW-10	5 U	5 U	5 U	5 U	12 J	0.01 U	1.0 U
DW-1 (MW-10 Duplicate)	5 U	5 U	5 U	5 U	5 UJ	0.01 U	1.0 U
MW-11	5 U	5 U	5 U	5 U	11 J	—	1.0 U
RW-2	19,000	46,000	2,500	120,000	250	—	4,100
RB-1 (Rinsate Blank)	5 U	5 U	5 U	5 U	10 J	0.01 U	1.0 U
State Standards	5.0(1) 1.0(2)	40.0(1)	30.0(1)	20.0(1)	5.0(1) 50.(2)	0.01(1) 1.0(2)	1.0(1)

(1) MTCA (WAC 173-340) - Method A Compliance Cleanup Levels- Groundwater (February 28, 1991).
(2) State of Washington Primary and Secondary Groundwater Quality Standards, August 1990 (WAC 173-200)).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.
J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.
— Not analyzed.

Note: Groundwater Analytical Testing Performed at Analytical Services Center, Ecology and Environment, Inc.

Table 3-5

WATER QUALITY INDICATOR PARAMETERS
GROUNDWATER SAMPLING
MONTEREY APARTMENTS SITE
March 1991

(mg/L)

	Total Alkalinity	Alkalinity-Bicarbonate	Chloride	Chemical Oxygen Demand	Total Fluoride	Total Hardness	Ammonia-Nitrogen	Total Phosphorus	Sulfide	Total Dissolved Solids	Total Organic Carbon
MW-3	480	560	49	88	0.18	510	0.2 U	1.4	1.0 U	580	20
MW-10	260	260	81	26	0.1 U	490	.10	0.34	1.0 U	770	4.5
DW-1 (Duplicate MW-10)	250	250	77	31	0.1 U	510	0.19	0.88	1.0 U	770	31
RB-1 (Rinsate Blank)	1.0 U	2.1	21	5.0 U	0.1 U	1.0	0.2 U	.01 U	1.0 U	10. U	1.0 U
State Standards (1)	---	---	250	---	4.0	---	---	---	---	500	---

(1) State of Washington Primary and Secondary Groundwater Quality Standards (WAC 173-200).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.

Note: Groundwater analytical testing performed by Analytical Services Center, Ecology and Environment, Inc.

Table 3-5 Cont.

	Nitrite (mg-N/L)	Nitrate (mg-N/L)	Color (PE - Color Units)	Turbidity (NTU)	Biological Oxygen Demand (mg/L)	Total Coliform (#/100 ml)
MW-3	0.010 U	0.010 U	15	>200	19.5	10 U
MW-10	0.014	0.243	5	74.0	1.5	180
DW-1 (Duplicate MW-10)	0.011	0.214	5	79.0	1.5	180
RB-1 (Rinsate Blank)	0.010 U	0.010 U	5 U	0.6 UJ	1.0 U	2 U
State Standards(1)	---	10	15	1.0	---	1/100 ml

(1) State of Washington Primary and Secondary Groundwater Quality Standards (WAC 173-200).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.
UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

Note: Groundwater analytical testing performed by Analytical Resources Inc. Seattle, Washington.

Table 3-6

INORGANIC ELEMENTS
GROUNDWATER SAMPLING
MONTEREY APARTMENTS SITE
March 1991

(μg/L)

	Silver	Arsenic	Barium	Calcium	Cadmium	Chromium-total	Copper	Iron	Mercury	Potassium	Magnesium
MW-3	10 U	92	250	100,000	13	77	180	50,000	0.55	7,400	66,000
MW-10	10 U	21	98	120,000	5.0 U	17	16	15,000	0.20 U	6,400	46,000
DW-1 (Duplicate MW-10)	10 U	5.0 U	88	120,000	5.0 U	10 U	13	10,000	0.20 U	6,400	44,000
RB-1 (Rinsate blank)	10 U	5.0 U	20 U	500 U	5.0 U	10 U	20 U	75 UJ	0.20 U	700 U	500 U
State Standards	50.(1)	5.0(2)	1000.(1)	---	5.0(2)	50.(2)	1000.(1)	300.(1)	2.(2)	10 to 10,000(3)	---

(1) State of Washington Primary and Secondary Groundwater Quality Standards, August 1990 (WAC 173-200).
(2) MTCA (WAC 173-340) - Method A Compliance Cleanup Levels - Groundwater (February 28, 1991).
(3) Concentrations given do not represent standards. Concentrations given are typical (average) values observed in groundwater systems (Driscoll 1986).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.
UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

Note: Groundwater analytical testing performed by Analytical Services Center, Ecology and Environment, Inc.

Table 3-6 Cont.

	Manganese	Sodium	Lead	Selenium	Silicon	Zinc
MW-3	8,600	37,000	74 J	5 R	69,000	170
MW-10	3,200	63,000	12 J	5 R	23,000	80
DW-1 (Duplicate MW-10)	3,400	65,000	10 J	5 R	22,000	72
RB-1 (Rinsate blank)	10 U	500 U	5 UJ	5 R	140	10 U
State Standards	50.(1)	10,000. to 100,000.(3)	50.(1) 50.(2)	10.(1)	20,000. as SiO_2(3)	5000.(1)

(1) State of Washington Primary and Secondary Groundwater Quality Standards, August 1990 (WAC 173-200).
(2) MTCA (WAC 173-340) - Method A Compliance Cleanup Levels - Groundwater (February 28, 1991).
(3) Concentrations given do not represent standards. Concentrations given are typical (average) values observed in groundwater systems (Driscoll 1986).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.
UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.
R - Quality control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

Note: Groundwater analytical testing performed by Analytical Services Center, Ecology and Environment, Inc.

Table 3-7

FIELD MEASUREMENTS
GROUNDWATER SAMPLING
MONTEREY APARTMENTS SITE
March 1991

	Temperature(°C)	pH	Conductivity microSeimen (μS)/cm[1]
MW-2U (2-inch PVC)	14	6.53	278
MW-4U (2-inch PVC)	12	6.05	342
MW-3 (2-inch PVC)	14.5	6.51	730
MW-4 (2-inch PVC)	14	6.18	695
MW-5 (2-inch PVC)	14	6.85	691
MW-6 (2-inch PVC)	14.5	5.97	524
MW-7 (2-inch PVC)	14.5	6.96	440
MW-8 (2-inch PVC)	14	6.07	496
MW-9 (2-inch PVC)	14	6.06	843
MW-10 (2-inch PVC)	14.5	6.41	798
MW-11 (2-inch PVC)	14	7.17	624
RW-2 (2-inch PVC)	14	6.84	620

(1) 1μS is equivalent to 1 μmho/cm

Table 3-8

NONPETROLEUM ORGANIC CONSTITUENTS
GROUNDWATER SAMPLING
MONTEREY APARTMENT SITE
March 1991

(µg/L)

	Carbon Disulfide[1]	Acetone	Hexane[2]	1,2 Dichloroethene (Total) (DCE)	Trichloroethene (TCE)	Tetrachloroethene (Perchloroethylene [PCE])
MW-3	120. U	310. J	200. J	470.	67. J	29. J
MW-7	50. U	100. UJ	ND	50. U	170.	140.
MW-9	1600. J	500. UJ	ND	250. U	250. U	250. U
MW-10	5.0 U	10.0 U	7. J	5. U	5.0 U	5.0 U
DW-1 (Duplicate MW-10)	5.0 U	8.0 UJ	ND	5. U	5. U	5. U
RB-1 (Rinsate blank)	5. U	8. J	5. J	5. U	5.0 U	5. U
State Standards	---	---	---	---	5.[3] 3.0[4]	5.[3] 0.8[4]

(1) Suspected Laboratory Contaminant.
(2) Tentatively Identified Compound
(3) MTCA (WAC 173-340) - Method A Compliance Cleanup Levels - Groundwater (February 28, 1991)
(4) State of Washington Primary and Secondary Groundwater Quality Standards, August 1990 (WAC 173-200).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extractions volume, percent solids, and/or sample dilution.
J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.
UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.
ND - Not detected.

Note: Groundwater analytical testing performed at Analytical Service Center, Ecology and Environment, Inc.

Table 3-9

TEMPORARY MONITORING STATION GROUNDWATER SAMPLES[1]
MONTEREY APARTMENTS SITE
April 1991

(µg/L)

	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH as Gasoline
4/5/91					
ACT Theater Parking Lot (Station 25)	0.9 J	13.8	10.2	134	3,000
Security Pacific Parking Lot (Station 5)	5,040	12.3	42.1	41.2	7,400
Security Pacific Duplicate (Station 5)	3,850	15.0	51.8	50.9	7,030
4/19/91					
ACT Theater Parking Lot (Station 5)	0.5 U	1.0 U	1.0 U	1.4 J	0.05 U
Blank	0.5 U	1.0 U	1.0 U	1.0 U	0.05 U
Method Blank	0.5 U	1.0 U	1.0 U	1.0 U	0.05 U
State Standards	5.0[2] 1.0[3]	40.0[2]	30.0[2]	20.0[2]	1,000.[2]

(1) Samples collected from soil gas probes installed below the water table temporarily.
(2) MTCA (WAC 173-340) - Method A Compliance Cleanup Levels - Groundwater (February 28, 1991).
(3) State of Washington Primary and Secondary Groundwater Quality Standards, August 1990 (WAC 173-200).

Data Qualifiers:
U - The material was analyzed for, but not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.

Note: Groundwater samples analytical testing performed at Columbia Analytical Services, Inc. Bothell, WA.

Laboratory summaries of the analytical results, and of E & E data validation completed for the groundwater analyses, are contained in Appendix F.

3.3.3 Soil-Gas Survey

A field screening soil-gas survey was performed at the site during the period from March 20 to April 5, 1991. The survey was accomplished using a Geoprobe Model 8-A, truck-mounted, hydraulic-percussion RAM system to drive 1-inch O.D. probe rods into the subsurface. The work was performed in accordance with the requirements of the Phase 1 RI Project Work Plan (E & E 1991). The probes were driven to depths from 3 to 19 feet bgs. The typical sample collection depth was approximately 5 feet.

Soil-gas screening was accomplished in the field using a portable photoionization detector (PID). Analytical laboratory samples were collected on Tekmar adsorbent media contained in Carbotrap 300 Multi-Bed Thermal Desorption Tubes. Flow rates were measured during purging and sampling using an in-line rotometer. Vacuum-induced pumping flow rates of 50 mL/min to 250 mL/min were applied. The Tekmar samples were submitted to Columbia Analytical Services for BTEX and VTPH analyses following SW-846 Method 8020 and a modified Method 8015, respectively. The samples were analyzed on a rapid 30- to 48- hour turnaround basis to assist with field decision making, but were later evaluated for quality by E & E according to data validation criteria defined in the QAPjP (E & E 1991). The data validation report for the soil-gas data can be found in Appendix G.

At the completion of the project, 25 Geoprobe station locations had been drilled within a two-block radius from the intersection of Queen Anne Avenue North and West Roy Street (Figure 3-2). The program involved PID screening of multiple stratigraphic intervals at numerous stations during the study to evaluate potential migration pathways and concentration gradients within the soil vadose zone. Laboratory samples were preferably collected at a depth of approximately 5 feet bgs, but varied depending on PID screening results, soil texture, and water

content. Twenty three of the station locations were selected to collect the soil-gas adsorbent tube samples for laboratory analysis.

Limitations. Several environmental conditions existed during the soil-gas survey which strongly influenced the organic vapor concentrations detected at the probe stations. Soil-gas sensing techniques for plume migration study are based on the migration of indicator organic compounds having appropriate partition coefficients and degradation characteristics which would result in vapor phases entering the vadose zone (Environmental Research Center 1987). The physical dispersion of vapors in soil is often influenced by four principal soil parameters: organic content, porosity/permeability, moisture content, and temperature. Dispersion will generally be greatest when soil organic content is low, porosity/permeability are relatively high, moisture content is low, and soil temperature is relatively warm. Organic content and porosity/permeability are, for practical purposes, considered constant at the site, while moisture content and temperature depend on ambient weather conditions.

At the Monterey Apartments site, the parameters of organic content and porosity/permeability were acceptable for survey applications, based on drilling logs and a pilot study (Section 3.1). As mentioned previously, the survey was performed from March 20 to April 4 during a winter period of seasonally low soil temperatures and seasonally high soil moisture conditions. Between April 1 and 4, a severe winter storm resulted in more than 4 inches of rain, exceeding the monthly average and establishing a new local record for the month. Winter conditions at the site resulted in poor vapor detection conditions complicated by storm-induced mobilization of the contaminants in groundwater (Section 4.2).

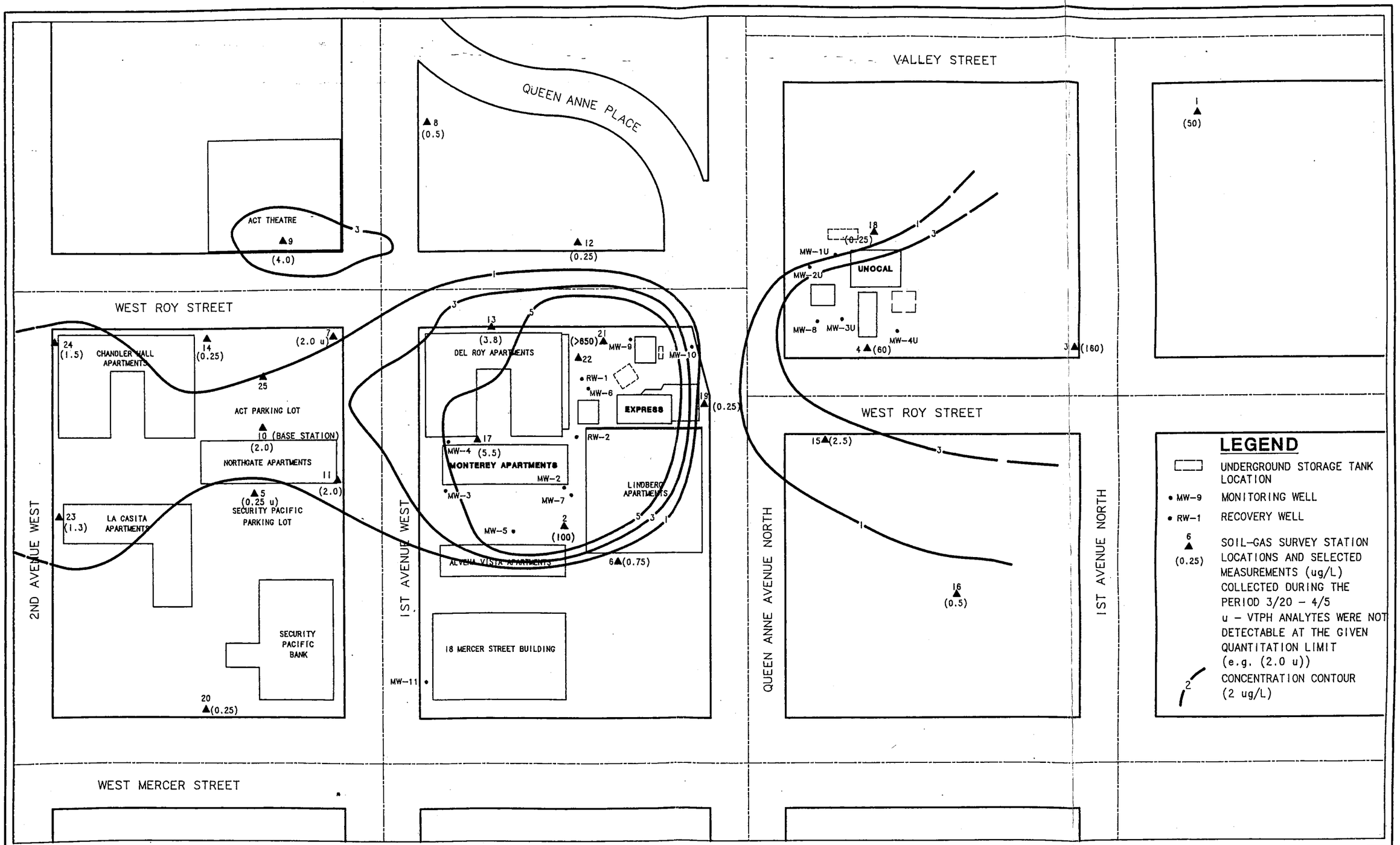
Base Station Monitoring. As part of the survey, a base station was selected and sampled daily to monitor trends during the study due to environmental changes such as those discussed above. The station selected for this purpose was station 10, located in a parking lot on the southwest corner of 1st Avenue West and West Roy Street (Figure 3-2). The base-station monitoring data suggested that the April storm event caused an increase in detectable vapors, most likely due to

increased mobilization of residual contaminants residing upgradient of and closer to the spill source.

Analytical Results. Environmental variables which existed throughout the soil-gas field screening survey created complex sampling conditions. Figure 3-3 represents a composite VTPH concentration contour map composed of sample station data collected prior, during, and following the April storm event. As was demonstrated by the soil-gas base station data, the shallow hydrogeologic system existing within the study area is dynamic and the petroleum vapors detected appeared to have been influenced by the event. Temporary groundwater monitoring station samples collected using the Geoprobe drilling unit also demonstrate the variability of contaminant concentrations at fixed stations in the study area (Section 4).

The soil-gas VTPH map suggests a westward vapor migration component has moved from the Express property and has extended outward past Second Avenue West. For Unocal, the data suggest that either a contaminant migration component has moved from Unocal toward the east, or that additional undefined source(s) of volatile petroleum compounds exist east to northeast of Unocal. The existence of such additional point sources cannot be ignored considering the long-term urban, multiuse history of the Queen Anne District.

Evaluation of BTEX analytes from the soil-gas analytical results data was difficult due to the low concentrations of these individual gasoline components detected in the soil at numerous locations during the study period. During the study, BTEX quantitation limits ranged between 0.8 µg/L to 0.005 µg/L. Estimated concentrations below this range were reported for selected samples. As the survey progressed, sample volumes were modified, generally increased, to improve detection limits and analytical reliability. Project objectives and budget limitations precluded resampling of stations for the purpose of collecting larger sample volumes to achieve lower detection limits. A summary of the BTEX and VTPH results for the soil-gas sampling stations is presented in Table 3-10. The BTEX data did confirm the continued persistence of those fuel components extending west to southwest of the Express property outward to at least Second Avenue West.



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BASE MAP REFERENCE:
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Seattle, Washington

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FIGURE 3-3
SOIL-GAS CONCENTRATION MAP - VTPH

Table 3-10

SOIL-GAS SORBENT TUBE ANALYTICAL RESULTS
MONTEREY APARTMENTS SITE
March/April 1991

(µg/L)

Sample No. (Station No.)	Sample Date	Sample Description	Sample Volume	Sample Depth (Ft. bgs.)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	VTPH (µg/L)
MA001SG (2)	3-25-91	Parking Lot, SE Corner	50 mL	12	0.36 J	2.0 U	0.4 U	0.8 U	100
MA003SG (1)	3-26-91	101 Valley	200 mL	8	0.04 J	0.5 U	0.06 J	0.25	50
MA004SG (3)	3-26-91	NW Corner W. Roy and 1st Ave. N.	100 mL	8	0.2 U	1.0 U	0.07 J	0.4 U	160
MA005SG (4)	3-26-91	Unocal, along N. side of Roy St. at tree	50 mL	8	0.4 U	.04 U	0.4 U	0.8 U	60
MA006SG (5)	3-27-91	Security Pacific Parking Lot- north-end, center 20' S. of Northgate Apts.	200 mL	5	0.1 U	0.1 U	0.1 U	0.2 U	5
MA007SG (6)	3-27-91	Mercer St. Alley Parking lot directly south of Lindberg Apts.	200 mL	6	0.1 U	0.5 U	0.1 U	0.06 J	50
MA008SG (7)	3-28-91	ACT parking lot, NE corner	500 mL	3	0.04 U	0.04 U	0.04 U	0.08 U	2
MA009SG (8)	3-28-91	Top of 1st Ave W. east side next to old house	2,000 mL	5.5	0.004 J	0.008 J	0.004 J	0.025	0.5
MA010SG/A (9)	3-28-91	W. Roy St. 50' west of intersection with 1st Ave. North side, in front of ACT Theater	1,000 mL	3	0.016 J	0.018 J	0.008 J	0.033 J	1.0
MA013SG (10)	3-28-91	ACT Theater Parking Lot- south side - center (Base Station)	1,000 mL	4	0.022	0.030	0.051	0.25	2.0

Table 3-10 - Cont.

Sample No. (Station No.)	Sample Date	Sample Description	Sample Volume	Sample Depth (Ft. bgs.)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	VTPH (µg/L)
MA014SG (11)	3-28-91	1st Ave W. - west side Northgate Apts. greenbelt. Directly across from Monterey Apts.	1,000 mL	4.5	0.009 J	0.045	0.035	0.16	2.0
MA015SG (12)	3-29-91	W. Roy St.- north side, between QA Ave. and 1st W. in front of Shah Safari	4,000 mL	5	0.0073	0.0058	0.008	0.034	0.25
MA016SG (13)	3-29-91	W. Roy- south side, in front of Del Roy Apts.	4,000 mL	5	0.0055	0.042	0.010	0.048	3.8
MA017SG (6)	3-29-91	Alley Parking- Mercer St., south of Lindberg	4,000 mL	5	0.0053	0.012	0.0053	0.018	0.75
MA018SG (14)	3-29-91	W. Roy St. south side at NW Corner of ACT parking lot	4,000 mL	5	0.005 U	0.0035 J	0.0045 J	0.020	0.25 U
MA020SG (15)	4-1-91	W. Roy St., south side. Across from Unocal (second tree)	4,000 mL	5	0.005 U	0.0023 J	0.0045 J	0.013	2.5
MA021SG (16)	4-1-91	MarQueen lower parking access- Parking drive accessed off Mercer	4,000 mL	3.5	0.005 U	0.0053 J	0.0028 J	0.0098 J	0.5
MA022SG (10)	4-1-91	ACT Parking Lot- south side - center (Base Station)	1,000 mL	4	0.02 U	0.02 U	0.02 U	0.024 J	1.0 U
MA024SG (17)	4-1-91	Monterey/Del Roy Alley	2,000 mL	5	0.042	0.030	0.037	0.085	5.5
MA025SG (7)	4-2-91	ACT Parking Lot - NW Corner (open pipe)	4,000 mL	4.5	0.003 J	0.0028 J	0.0038 J	0.013	0.25 U
MA026SG (5)	4-2-91	Security Pacific Parking Lot - North side - center	4,000 mL	5	0.0028 J	0.002 J	0.002 J	0.008	0.25 U
MA027SG (18)	4-2-91	720 QA Willis Apts - Directly behind Unocal	4,000 mL	8	0.0035 J	0.0043 J	0.0025 J	0.0085 J	0.025 U

Table 3-10 - Cont.

Sample No. (Station No.)	Sample Date	Sample Description	Sample Volume	Sample Depth (Ft. bgs.)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	VTPH (µg/L)
MA028SG (10)	4-2-91	ACT Parking Lot - South side - center (Base Station)	1,000 mL	4	0.006 J	0.02 U	0.02 U	0.024 J	1.0 U
MA029SG (19)	4-2-91	Manhattan Express - QA Ave. Greenbelt	4,000 mL	5	0.0013 J	0.0028 J	0.025 J	0.012	0.25 U
MA030SG (20)	4-2-91	Mercer SE (at tree) North side -immediately west of Security Pacific	4,000 mL	5.5	0.005 U	0.0023 J	0.005 U	0.005 J	0.25 U
MA032SG (21)	4-3-91	Manhattan Express - North of triple tanks (Directly through pipe)	2,000 mL	5	> 90	> 12	1.3	3.3	> 650
MA034SG (10)	4-4-91	ACT parking lot (Base Station)	1,000 mL	4	0.055	0.11 J	0.17	0.64	23
MA035SG (10)	4-4-91	ACT parking lot (Base Station)	1,000 mL	4	0.11	0.39 J	0.14	0.89	6
MA039SG (10)	4-5-91	ACT parking lot (Base Station)	1,000 mL	4	0.041	0.025	0.059	0.32	2
MA040SG (23)	4-5-91	2nd Avenue West East side, mid block (open pipe) 610 LaCasita	4,000 mL	6	0.0048 J	0.038	0.022	0.11 J	1.3
MA042SG (24)	4-5-91	2nd Avenue West and Roy St., SE corner	4,000 mL	5	0.014	0.19	0.18	0.059 J	1.5

Qualifiers:

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and/or sample dilution.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

3.3.4 Terrain Conductivity Survey

On March 15, 1991, E & E personnel conducted a terrain conductivity survey of the Express service station using a Geonics EM-31D conductivity meter to evaluate subsurface conditions present at the site. The information gathered from the survey was used in conjunction with the sewer-line search (Section 3.3.5) to evaluate subsurface features, particularly two cement underground fuel tanks reportedly located on the eastern edge of the Express property, and to establish soil-gas sampling locations on the Express property. Operational procedures for the conductivity survey are contained in the Monterey Apartments Phase 1 RI QAPjP (E & E 1991).

For initial assembly and setup of the EM-31D, background areas were selected to calibrate and system-check the instrument in areas likely to be free of subsurface anomalies and to obtain background conductivity readings. Two background areas were selected, one in the ACT Theatre parking lot at the southwest corner of the intersection of West Roy Street and 1st Avenue West, and the other in the parking lot located between the Monterey Apartments and the Alvena Vista Apartments (Figure 3-4).

Background readings were obtained during traverses of the two background areas. Averaged results for the two areas are shown in Table 3-11. The readings indicated the areas were composed of essentially undisturbed materials and that conductivities decreased slightly with increasing investigative depth.

A standard field conductivity reading consists of the acquisition of four individual reading positions per station. This is accomplished by rotating the transmitting and receiving coils of the EM-31D horizontally and vertically relative to the ground surface and then reorienting the transmitter/receiver boom 90 degrees to record a second series of horizontal and/or vertical position readings. The rotation position of the EM-31D defines the instrument's depth of exploration and allows subsurface anomalies or structures to be detected and evaluated based upon comparison of the two readings obtained (vertical or horizontal). The general depth of penetration in the vertical dipole position is 6 meters (diminishing response with depth), while the horizontal position

ACT THEATRE

WEST ROY STREET

CHANDLER HALL APARTMENTS

BACKGROUND AREA #1

1 2 3 4

ACT PARKING LOT

NORTHGATE APARTMENTS

LA CASITA APARTMENTS

SECURITY PACIFIC PARKING LOT

SECURITY PACIFIC BANK

1ST AVENUE WEST

DEL ROY APARTMENTS

MW-4

MONTEREY APARTMENTS

MW-2

MW-3

MW-7

BACKGROUND AREA #2

1 2 3

MW-5

ALVENA VISTA APARTMENTS

18 MERCER STREET BUILDING

MW-11

① ② MW-9 ③ MW-10

⑥ ④

⑤ RW-1

MW-6

EXPRESS

RW-2

LINDBERG APARTMENTS

INFERRED CEMENT TANK EDGE

MW-1U

MW-2U

UNOCAL

MW-8 MW-3U MW-4U

WEST ROY

QUEEN ANNE AVENUE NORTH

LEGEND

- EXISTING UNDERGROUND STORAGE TANK LOCATION
- MW-9 MONITORING WELL
- RW-1 RECOVERY WELL
- NEGATIVE CONDUCTIVITY READING RESPONSE ZONE
- ⑥ EXPRESS CONDUCTIVITY STATION
- 1 2 3 BACKGROUND CONDUCTIVITY TRANSECT
- STREET CENTERLINE

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Seattle, Washington

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FIGURE 3-4
TERRAIN CONDUCTIVITY SURVEY STATION MAP

Table 3-11

**AVERAGED BACKGROUND TERRAIN CONDUCTIVITY MEASUREMENTS
MONTEREY APARTMENTS SITE
March 1991**
(mmhos/m)

Measurement Location	Horizontal Coil Positions		Vertical Coil Positions	
	North-South	East-West	North-South	East-West
Act Theatre Parking Lot	19.6	19.5	15.5	15.6
Monterey Apartments	33.0	34.0	20.6	20.3

is approximately half of the depth penetration (3 meters). Orientation readings that are similar to one another indicate a relatively homogeneous material present within the area of measurements. Readings markedly different from one another may be evidence of vertical and/or aerial conductivity variations, thereby indicating a change in the geology, or the presence of a subsurface feature.

A preliminary traverse of the Express property was attempted, and it was determined that because of the presence of overhead power lines, subsurface utilities, steel USTs, piping, and other site structures, a standard station-by-station traverse survey could not be successfully performed. By systematically evaluating areas relatively clear of interferences, conductivity readings could be recorded which accurately reflected the subsurface conditions at the Express property.

Measurements were attempted at several locations on the Express property (Figure 3-4). The results obtained from six stations not biased by surface interferences are shown in Table 3-12.

Table 3-12

EXPRESS TERRAIN CONDUCTIVITY MEASUREMENTS
MONTEREY APARTMENTS SITE
March 1991
(mmhos/meter)

Station Number	Horizontal Coil Positions		Vertical Coil Positions	
	North-South	East-West	North-South	East-West
1	38	33	36	24
2	76	30	72	26
3	44	35	66	30
4	130	125	50	50
5	66	66	38	34
6	50	48	29	28

At least two locations (5 and 6) provided an indication of undisturbed soils to make them useful soil-gas survey drilling (Geoprobe) points. Two of the locations yielded pronounced fluctuations in readings, possibly induced by subsurface disturbances or structures: in the middle of the entrance driveway along West Roy Street; and (2) near the entrance to the Express building where negative reading responses were recorded. The negative reading anomaly located in front of the Express entrance correlates loosely with the termination of the sewer line search performed (Section 3.3.5) and may indicate the location of a septic tank or associated piping. Reading fluctuations observed in the southeast corner of the pavement area may indicate the presence of two cement USTs reported in this part of the Express property.

3.3.5 Sewer Line/Storm Drain Location Survey

On March 6, 1991, E & E personnel supervised a sewer line and storm drain location search conducted by Jim Dandy locator services of Seattle. The survey was to be used to determine locations of sewer lines serving the Express property and the locations of catch basin discharge lines. The information obtained was also used in conjunction

with the conductivity survey to assess subsurface features and assist in the selection of soil-gas survey stations on the Express property.

An Aqua Tronics, Inc., Model A6 transmitter/receiver cable snake tool was fed into the sewer lines and discharge lines in an attempt to locate their positions relative to surface and subsurface features. As the transmitter unit was inserted into the line, a receiver unit was used to locate the position of the transmitter from the surface, and the position was marked with spray paint to show the relative surface position.

The location of the sewer line serving the Express property was never accurately determined outside of the Express building. An interpretation by the locator service indicated that the snake was meandering beneath the building through a convoluted pipe matrix, or within a septic tank.

Two outdoor catch basins also were investigated during the search, one in the northwest corner of the parking lot (northwest catch basin) and the other within the secured fence area in the southwest corner of the Express property (southwest catch basin). The northwest catch basin was observed to have been altered from its original reported route, running north to discharge directly onto West Roy Street via a pipe emerging from the curb. The southwest catch basin discharge line was traced directly toward the concrete pad which marks the position of currently used USTs. Upon reaching the cement pad, the piping paralleled the length of the cement pad's southeast edge while proceeding toward the northeast. At the southeast corner of the cement pad, the line terminated, at an approximate depth of 10 feet bgs, presumably broken or separated. Disruption of the piping during past UST installation and excavation may have damaged the piping.

The sewer and discharge line search was used effectively in selecting approximate soil-gas sampling positions relative to these subterranean obstacles. Determining the exact location of the property's sewer line was not possible because of the complicated route observed beneath the building which prevented the snake from full advancement. The northwest catch basin discharge line location was determined accurately, and the southwest basin discharge line was traced

for a limited distance across the Express site until it terminated beneath the ground surface.

The previously assumed positions of the sewer and catch basin discharge lines according to City Engineering card plats could not be validated, but may have accurately portrayed conditions in the past (Appendix A).

3.3.6 Tank Histories and Integrity Tests

Express Tanks. Available records indicate that the regular and unleaded gasoline tank systems in use at the Express property were installed in 1967. The existing premium tank system was reportedly installed in 1971. These three tanks are located adjacent to each other in the southwest portion of the facility, near monitoring well MW-6. The existing diesel tank system reportedly was installed in 1982 and is located immediately east of the service island.

In 1987, the regular, unleaded, and super unleaded gasoline tanks underwent retrofitting. The entire interiors of the tanks were lined with epoxy by Tank Liners, Inc. It would seem appropriate that associated ancillary equipment, such as the product lines, would have been replaced during this period; however, no records have been located to validate this.

Abandoned or replaced tanks include a premium gasoline tank reportedly removed and replaced by the current super unleaded gasoline tank in 1971, and two abandoned cement tanks reportedly located in the northeast corner of the property. The current super unleaded tank is positioned at the same location as the removed premium tank. The cement tanks were reportedly installed in 1922 and abandoned in-place with sand fill in 1967 when the steel tank systems were installed (Ecology 1989). The current diesel tank was preceded by a 4,000-gallon diesel tank installed in 1954 and replaced in 1982, at the same location by the current diesel tank (Ecology 1989).

On March 14, 1991, integrity tests were performed at the Express property by Tanknology Corporation International (Tanknology). The testing was accomplished using the nonvolumetric Vacutect Precision Tank

Test System and routine 50 pounds per square inch (psi) line pressure tests. The tests were performed on the four active UST systems at the facility:

- One 10,000-gallon regular tank (regular tank);
- One 10,000-gallon regular unleaded tank (unleaded tank);
- One 6,000-gallon super unleaded tank (super tank); and
- One 6,000-gallon diesel tank (diesel tank).

Initially, tank vent pipes were identified and sealed. Eight pipes were identified extending out of the roof to the Express building's northwest corner. Three of those pipes served the regular, unleaded, and super tank systems. The terminus of the remaining five were not defined, and it was assumed that they had serviced abandoned systems on site. The vent pipe for the diesel tank was located on the roof of the dispenser service island canopy.

John Bogle served as the licensed Washington State testing supervisor (license # W000722) for Tanknology. The tests were performed in compliance with applicable Washington State UST regulations (WAC 173-360-345 and -350). All four tanks were tested successfully; however, not all of the associated product delivery lines could be properly tested without risking damage to pumps or lines. The Tanknology tightness test results summarized below are documented formally in a final report by Tanknology presented in Appendix H.

Regular Tank System. The regular tank tested tight. The delivery line could not be pressure tested properly because of faulty check valving associated with the product delivery pump (Red Jacket brand). As a result, the delivery line was integrated into the tank vacuum test to detect any major leakage. No obvious line leakage was identified, but the vacuum testing approach does not satisfy regulatory testing requirements for piping and can only be interpreted as preliminary. While performing the tests, the testing team observed that the tank was missing a drop tube and that the delivery pump was being operated without any leak detection accessories as required under existing regulations. Fill dirt and pea gravel surrounding the pump system made access and visual inspection difficult.

Unleaded Tank System. The unleaded tank tested tight. The delivery line could not be pressure tested properly because of faulty check valving associated with the product delivery pump (Red Jacket brand). As a result, the delivery line was integrated into the tank vacuum test to detect any major leakage. No obvious line leakage was identified, but this approach does not satisfy regulatory pipe testing requirements and can only be interpreted as preliminary. While performing the tests, the testing team observed that the tank was missing a drop tube and that the delivery pump was being operated without any leak detection accessories as required under existing regulations. Fill dirt and pea gravel surrounding the pump system made access and visual inspection difficult.

Super Tank System. The super tank did not test tight. The upper one quarter of the tank failed, suggesting ullage-related leakage in the tank air space. The problem was most likely associated with the vent pipe or other tank top fittings. Product was not present at the level where leakage was identified. As with the previous tank systems, the delivery line could not be pressure tested properly because of faulty check valving associated with the product pump (Wayne brand). As a result, the delivery line was integrated into the tank vacuum test to detect any major leakage. No obvious line leakage was identified, but as was mentioned previously, this testing approach does not satisfy regulatory testing requirements and can only be interpreted as preliminary. While performing the tests, the testing team observed that the tank system delivery pump was being operated without leak detection accessories. Again, fill dirt and pea gravel surrounding the pump system made access and visual inspection difficult.

Diesel Tank System. The diesel tank tested tight. The delivery line was pressure tested successfully on this system. The product pump was a Red Jacket brand. As was the case with the previous systems, the team observed that the tank system delivery pump was being operated without any leak detection accessories.

Current Washington State UST regulations (WAC 173-360) contain well defined compliance requirements and schedules for petroleum UST owners/operators which apply directly to the Express facility. Compo-

nents of these regulations include requirements for permitting, release detection, record keeping, repairing, financial responsibility, closure, and site assessment.

The Compliance Schedule (WAC 173-360-330) requires that tanks installed prior to 1970 must apply leak detection or inventory control practices as defined in WAC 173-360-335. Inferred in these tank requirements is the installation of drop tubes to permit proper filling of regulated tanks.

Pressurized piping of any age must follow leak detection practices as defined in WAC 173-360-350. The piping requirements include annual pressurized pipe testing and the installation of automatic line leak detectors.

The pressurized product lines for the regular, unleaded, and premium tanks at the Express station could not be tested properly on March 14, 1991. Leaking pump check valves could not be sealed to complete the pressure tests for these systems. Additional efforts to secure sealing would have jeopardized the integrity of the aging pumps and associated fittings. Also, limited excavation work may have been required to expose pipe joints.

Unocal Tanks. According to Unocal records, all of the existing tanks at the Unocal facility were installed in 1986, and are steel/ fiberglass composite designs. The tanks present are:

- Two 12,000-gallon gasoline tanks;
- One 550-gallon heating oil tank; and
- One 550-gallon waste oil tank.

These tanks were installed in 1986 by Unocal and replaced older tanks which were removed. The existing gasoline tanks are located in the southeast quarter of the property, east of the main service island. The oil tanks are located along the north edge of the property, immediately west of the sales building. The previous locations and inventory of tanks prior to 1966 is unclear. Records and general arrangement plans obtained by Ecology from Unocal show that prior to 1966, the service station and islands were located at the property's southwest corner (near MW-8) and a lube pit existed along the east edge of the property.

In 1966, the facility was reconstructed and the current structures were built. Following the 1966 reconstruction, steel USTs were installed and located at positions similar to the current gasoline tanks. Fiberglass reinforced plastic (FRP) lines were installed in 1979, replacing galvanized steel lines installed in 1966. The steel tanks were replaced by the current composite tanks in 1986. Tank integrity and line testing reportedly was performed in 1978 on the steel tanks. Using a 5 psi, 45-minute pressure test approach, the tanks tested tight. Using a 30 psi, 30-minute pressure test, the piping tested tight. These testing techniques would not be acceptable under current regulatory standards. For the current systems, Petrotite 50 psi line tests were performed in December 1990, and were determined to be tight.

4. INTERPRETATION AND DISCUSSION OF INVESTIGATIVE RESULTS

The discussion in this section addresses contaminant conditions existing within the context of the local hydrogeologic system and the characteristics of the spilled petroleum persisting beneath the ground surface. Discussion is limited to conditions observed in the perched water table groundwater system, and does not address deeper, confined aquifer zones which may exist within or below the clay unit. No monitoring wells of a depth below 35 feet bgs exist in the study area.

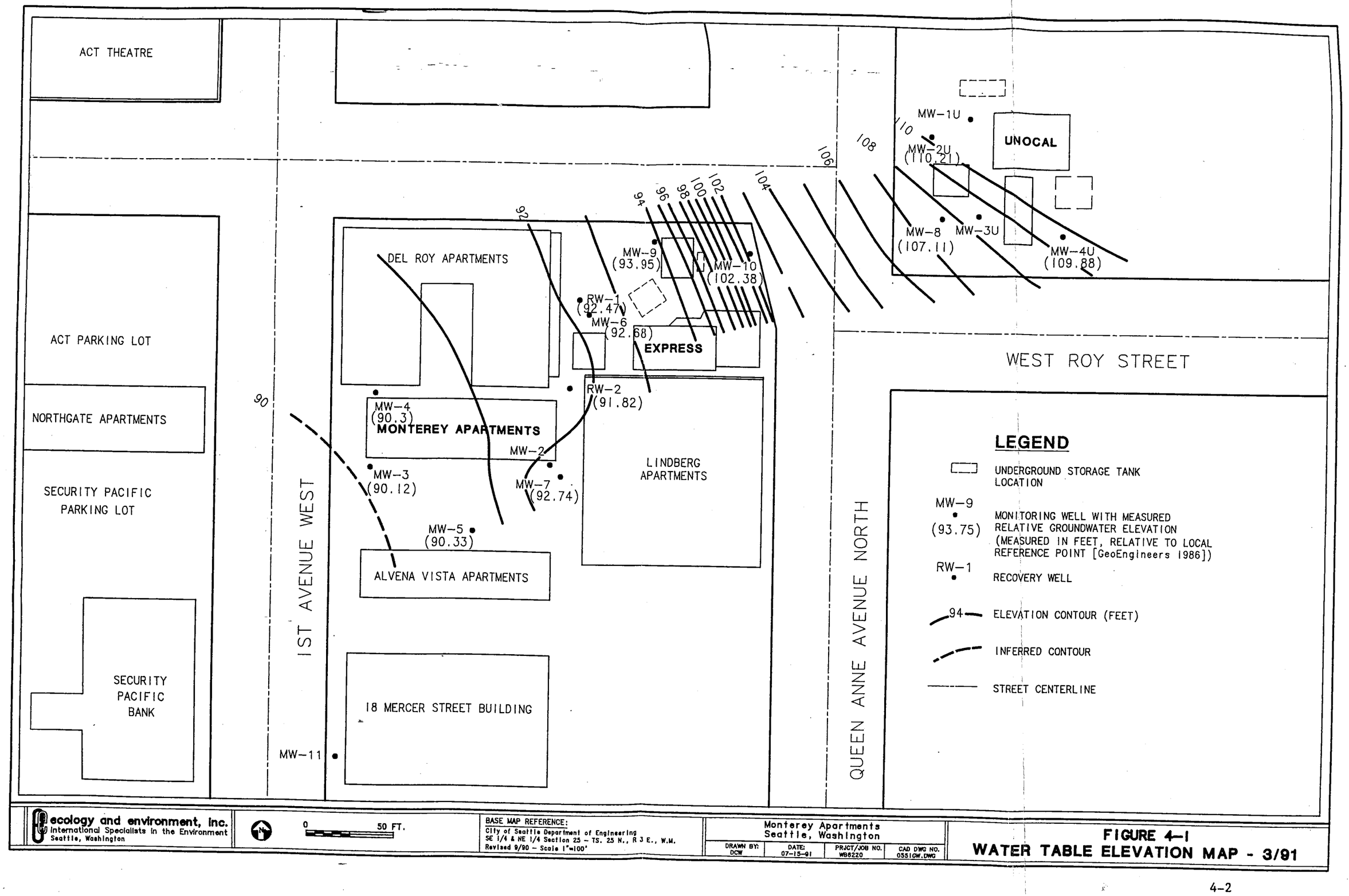
4.1 SITE HYDROGEOLOGY

4.1.1 Flow Characteristics

A water table elevation map from measurements obtained during the March 1991 groundwater sampling effort is shown in Figure 4-1. Table 4-1 presents the groundwater measurements obtained during the same groundwater sampling event. At the time of measurement, groundwater flow was in a west-southwest direction toward Puget Sound. This same flow direction has been determined by previous investigation measurements since 1986 (GeoEngineers 1986, 1987; E & E 1990a, 1991). Comparison of the September 1990 (Table 3-2) and the March 1991 groundwater elevation data indicate that groundwater flow directions are consistent for different seasons of the year.

The September 1990 data are representative of the early fall season, before the late fall and winter precipitation events begin to occur on a regular basis. At this time, a greater petroleum thickness was found in wells MW-6 and RW-1, perhaps relating to a greater exposure of petroleum-contaminated soil with the screened intervals.

The March 1991 data are representative of a seasonally wet period, after winter precipitation has occurred. Water table elevations are higher by 1 to 3 feet, and petroleum thickness in the wells is relatively less in MW-6 and RW-1. MW-9 and RW-2, however, exhibit greater petroleum thicknesses than in September (1 and 2 inches, respectively).



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BASE MAP REFERENCE:
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Monterey Apartments
Seattle, Washington

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DCW	07-15-91	W86220	0551GW.DWG

FIGURE 4-1
WATER TABLE ELEVATION MAP - 3/91

Table 4-1

GROUNDWATER ELEVATIONS
MONTEREY APARTMENTS SITE
March 1991

(feet)

Well Identification	Ground Surface Elevation	Distance from Ground Surface to TOC	Depth to SWL (measured from TOC)	Actual Product Thickness	Equivalent[1] Water Thickness for Product	Resulting Calculated SWL
MW-3	100.76	.28	10.36	0.	---	90.12
MW-4	102.38	.30	11.78	0.	---	90.30
MW-5	103.21	.30	12.58	0.	---	90.33
MW-6	113.71	.33	21.22	.67	.52	92.68
MW-7	105.33	57	12.02	0.	---	92.74
MW-8	117.31	.22	10.11	.167	.13	107.11
MW-9	114.65	.22	20.61	.167	.13	93.95
MW-10	115.75	.23	13.14	0.	---	102.38
MW-11[2]	---	---	11.7	0.	---	---
MW-1U[3]	118.33	.32	---	---	---	---
MW-2U	117.69	---	7.08	0.	---	110.21
MW-3U[3]	117.48	.49	---	---	---	---
MW-4U	117.51	---	7.17	0.	---	109.88
RW-2	104.54	2.57	10.21	.08	.06	91.82
RW-1	112.06	1.5	18.09	Sheen	---	92.47

(1) Based on specific gravity of 0.80.
(2) Monitoring well at 18 Mercer Street building property. No elevation data available.
(3) Well lid could not be loosened to permit measurements or sampling.

TOC - Top of Casing
SWL - Static Water Level

An average hydraulic conductivity on the order of 10^{-5} to 10^{-6} ft/sec and a transmissivity range of 1.3 to 4.8 ft^2/day has been determined for the aquifer at MW-6 (Section 3.3.1). These values are indicative of a silty-sand aquifer, which is confirmed by the geologic logs of the monitoring wells installed in the area.

4.1.2 Groundwater Geochemistry

Results obtained from the groundwater sampling event confirmed that contamination of the groundwater has occurred. Inorganic water quality parameter results from unfiltered samples collected at two locations (MW-3 and MW-10) indicate elevated levels of total hardness (as $CaCO_3$) (490 and 510 mg/L), total dissolved solids (TDS) (580 and 770 mg/L), total coliform (180/100 mL for MW-10), arsenic (92 and 21 µg/L), cadmium (13 µg/L for MW-3), total chromium (17 and 77 µg/L), iron (50 and 15 mg/L), manganese (8.6 and 3.2 mg/L), and lead (74 and 12 µg/L J). The elevated concentrations of lead, cadmium, chromium, and arsenic are likely attributable to petroleum product contamination of groundwater since the values are readily distinguishable from observed well concentrations located upgradient of the Express contamination (i.e., MW-10).

Total hardness, TDS, color, iron, and manganese are indicative of groundwater classified as a Type II water, which is a slightly alkaline, fresh water (<1000 mg/L TDS), in which calcium and magnesium are the dominant cations and carbonate is the dominant anion. These waters are considered hard or very hard (Freeze and Cherry 1979). Type II waters are primarily a result of carbonate-mineral dissolution under open or partially open system carbon dioxide conditions. Cation exchange processes are commonly a modifying influence. Calcium and sulfate concentrations rarely exceed 100 mg/L because minerals, such as gypsum, anhydrite, and halite are generally absent. The effects of dissolution of primary silicate minerals such as feldspars and micas are largely obliterated by the much larger cation and bicarbonate concentrations from calcite and dolomite (Freeze and Cherry 1979).

The elevated total coliform count from MW-10 is likely due to the location of the well relative to Queen Anne Avenue North, under which two sewer mains exist. The high coliform count suggests that the sewer mains may be leaking, or it may indicate the presence of a septic tank and associated drainfield which was hypothesized in the sewer line search task presented in Section 3.3.5.

The most important parameters identified from the inorganic water quality indicators are those having to deal with the ability of the waters to develop scale deposits in large evaporators or stripper systems such as those found in groundwater and vapor extraction cleanups. Because of the high concentration of calcium, magnesium, manganese, and iron ions in the groundwater, common scale precipitates of carbonates and oxides could be expected to affect any future treatment options. Iron occurs primarily as dissolved ferrous ions (Fe^{+2}). Concentrations may reach 50 mg/L in waters having little or no oxygen (reduced environment) and a pH of 7. The ferrous ions become very unstable when placed in contact with oxygen, resulting in precipitates.

4.2 SPILL CHARACTERISTICS

As petroleum accumulates at the groundwater interface, the product spreads laterally, initially under the influence of gravity, then by groundwater flow, and later in response to capillary forces. Capillary spreading becomes very slow and eventually a relatively stable condition of residual oil saturation within the soil column is attained. Over the range of groundwater/product movement that can occur, the petroleum is held in a relatively immobile state within the pore spaces, and the ponded petroleum is essentially stable (Freeze and Cherry 1979). If the amount of petroleum released to the subsurface were small enough, residual saturation would, in time, prevent the petroleum from reaching the water table, but in the case of the Express facility, petroleum has intercepted the groundwater in relatively large volumes, as evidenced by the floating product thicknesses observed in and around MW-6.

Precipitation events have been observed to influence water table elevations in the site area. Such fluctuations appear to have a significant effect upon contaminant migration, especially residual volumes suspended in the vadose zone within the groundwater fluctuation interval. Because the residual is not readily degraded, the zone subject to water level fluctuations can effectively supply petroleum product as a long-term source. Vapor problems then develop when petroleum contaminants, present as free or residual product, partition into the soil-gas through volatilization or into groundwater through dissolution (Domenico and Schwartz 1990). Long distance transport can result from dissolution into groundwater.

Commercial gasoline has an approximate solubility range of 20 to 80 mg/l in water and can be detected by taste and odor at concentrations of less than 5 ug/L in water (Ineson and Packham 1967). Because gasoline and its volatile components can be detected at low levels, even a small volume of gasoline that comes into contact with groundwater has the capability of contaminating a large area. The solubilities of selected, regulated gasoline components are shown in Table 4-2.

Table 4-2

GASOLINE COMPONENT SOLUBILITIES

Component	Solubility[1] (mg/L @ 20°C)
Benzene	1,780
Toluene	515
Ethylbenzene	152
Xylene-M	175
Xylene-O	162
Xylene-P	198

(1) EPA 1988

4.2.1 Soil-Gas and Groundwater Chromatogram Evaluation

E & E chemists evaluated selected soil-gas and groundwater PID and flame ionization detection (FID) chromatograms to qualitatively evaluate

contaminant characteristics. Sample organic peak patterns were compared to each other and to gasoline standard peak patterns to assess the characteristics, similarities, and differences of the detected constituents at various locations. For example, groundwater sampled from MW-10, located between the Express and Unocal properties, did not contain detectable BTEX levels or light petroleum fractions associated with gasoline or diesel.

Within the study area, certain soil-gas samples exhibited peak patterns which differed significantly from the peak patterns expected of a gasoline pattern: In particular, the sample chromatograms from soil-gas Station 2 did not clearly indicate peak patterns characteristic of petroleum hydrocarbon components, suggesting the presence of nonpetroleum-derived organic vapors. Other samples also contained unidentified, nongasoline (?) organic artifacts which contributed to the reported VTPH values, namely samples from soil-gas station numbers 1, 3, 4, 6, 11, and 15 (Figure 3-4).

Degradation characteristics also were evaluated. Soil-gas samples collected from Stations 3 and 4 near Unocal contained compounds composed primarily of heavier VTPH petroleum fractions, while samples from Stations 7 and 17, west of the Express property, contained relatively high concentrations of lighter VTPH petroleum fractions. These data support floating product "finger print" data which indicate that the petroleum associated with the Express facility is markedly less degraded than that found at Unocal.

4.2.2 Nonpetroleum Organic Compounds

From the groundwater sampling analyses, several other organic compounds were detected which are not usually associated with gasoline/diesel hydrocarbons (Table 3-8).

Chlorinated volatile organics were detected in samples from wells situated in the parking lot between the Monterey Apartments and the Alvena Vista Apartments. Tetrachloroethene (PCE) and trichloroethene (TCE) were detected in wells MW-7 and MW-3, while 1,2-dichloroethene total (DCE) was detected in MW-3. TCE and DCE are intermediate transformation products of PCE and are not common lab solvents (LeSarge et al. 1990, Olsen and Davis 1990, Wolf et al. 1987, Vogel et al., 1987).

These compounds and their associated degradation products are common industrial solvents. Due to interferences caused by the presence of petroleum components in several of the samples, dilutions were required prior to volatile analysis, which effectively elevated detection limits in certain samples (Table 3-8). Chlorinated compounds may be present in groundwater at levels below the attainable quantitation levels established for several of the monitoring well samples. The MTCA groundwater cleanup standard is 5 µg/L for both PCE and TCE. There is no state groundwater quality standard for DCE. The Federal Maximum Contaminant Level (MCL) for DCE is separated into two components; 70 µg/L for the cis-isomer and 100 µg/L for the trans-isomer (56 FR 3528).

Based on data validation review, carbon disulfide detected in the samples was labeled as a suspected laboratory-derived contaminant. Acetone and hexane were detected, but are not typical of gasoline or diesel fuels and are thought to have been associated, in part, with procedures used to decontaminate the sampling equipment due to their detection in the rinsate blank sample (RB-1).

4.2.3 Express Spill

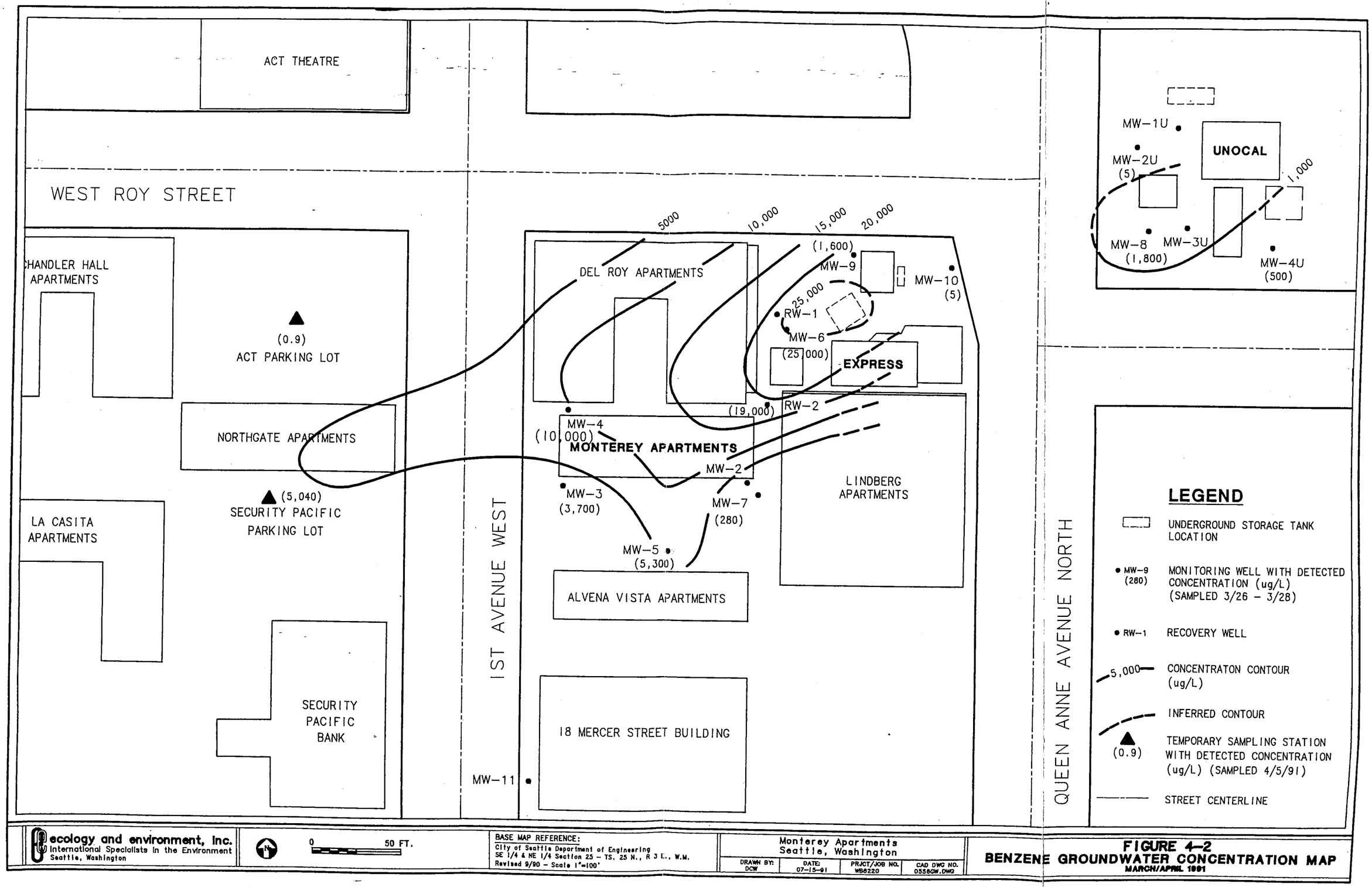
From the RI investigation and previous events in the study area, it is known that petroleum vapors have been a problem for residents of the Monterey Apartments and the Del Roy Apartments, and groundwater sampling has produced evidence that groundwater contamination via dissolution of the petroleum is widespread. The vertical distribution is thought to be limited to the shallow perched groundwater system with the basal clay unit being laterally continuous and having a thickness in excess of 23 feet.

The groundwater and soil-gas data show the Express and Unocal facilities as independent sources of petroleum releases. The data also suggested that low-level background concentrations of various contaminants, including nonpetroleum components, exist in the vadose zone and shallow groundwater in the lower Queen Anne District. The results did not indicate the existence of additional primary point sources or plumes that could have created the observed conditions at the Express. The petroleum components that have reached beneath the Monterey Apartments

building, and further westward, originated from the floating product pool existing beneath the Express facility.

The approximate aerial distribution of the petroleum spill can be seen in a contour map of benzene concentrations in the groundwater (Figure 4-2). The MTCA Method A groundwater cleanup standard for benzene is 5 µg/L for reference. The Geoprobe temporary station groundwater sample collected from the Security Pacific parking lot, the furthest groundwater sampling location from the Express, exhibited high levels of benzene (4,445 µg/L), toluene (13.65 µg/L), ethylbenzene (46.95 µg/L), and total xylenes (46.05 µg/L) (duplicate average values). The MTCA groundwater cleanup standards for toluene, ethylbenzene, and total xylenes are 40 µg/L, 30 ug/L, and 20 µg/L, respectively.

Groundwater BTEX data collected from temporary stations during the soil-gas survey are generally comparable with BTEX data obtained during the monitoring well groundwater sampling event. The temporary groundwater monitoring station data collected at the ACT Theatre parking lot exemplify the influence of major precipitation events, on the mobilization and transport of dissolved petroleum compounds away from the source area. A groundwater sample collected on April 5, immediately following a storm event contained 158.9 µg/L total BTEX. A second sample collected on April 19, during more stable hydrologic conditions contained 1.4 µg/L detectable BTEX. The data indicate that during periods of increased precipitation, petroleum constituents are flushed from the point source and from the zone of groundwater fluctuation. The sources of the mobilized contaminants are interpreted to occur through a complex combination of direct releases from the floating product pool, and from vadose zone interstitial spaces. Releases from these sources apparently subside following both individual storm events as well as on a seasonal scale, with groundwater contaminant concentrations downgradient of the spill area decreasing accordingly. Releases will continue to occur until the sources, namely petroleum-contaminated soils and free petroleum product existing beneath the Express and Monterey Apartment properties, are removed.



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Seattle, Washington

0 50 FT.

BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 - TS. 25 N., R 3 E., W.M.
Revised 9/90 - Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PRJCT/JOB NO.	CAD DWG NO.
DCW	07-15-91	W88220	0558GW.DWG

FIGURE 4-2
BENZENE GROUNDWATER CONCENTRATION MAP
MARCH/APRIL 1991

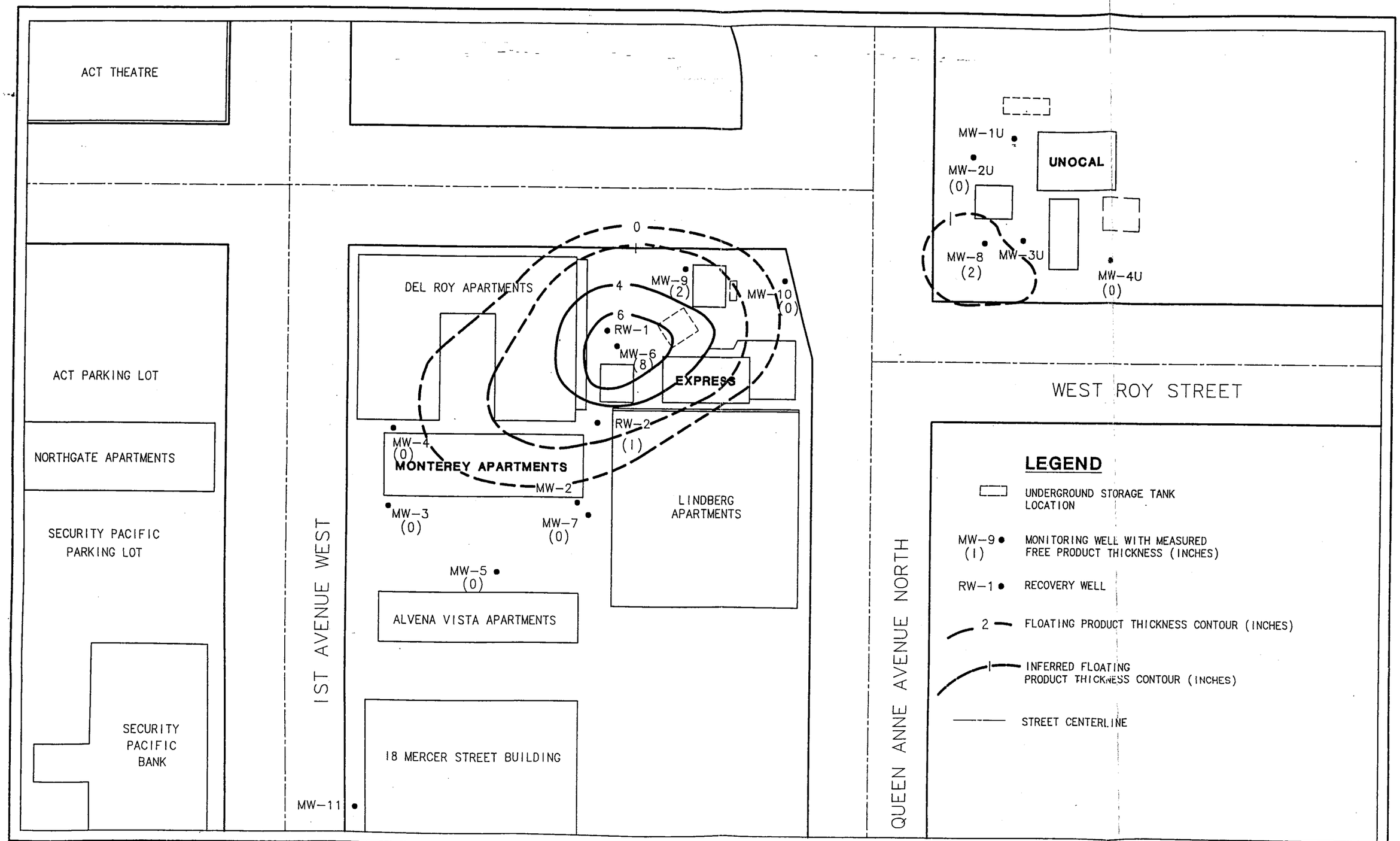
Waste Origin and Quantity Estimation. The contamination beneath the Express property originated from at least two tanks, evidenced by the mixed presence of gasoline and diesel in the floating layer. Diesel fuel is currently stored in a tank located near the northeast corner of the property. Although the tank tested tight, a predecessor diesel tank from approximately the same location reportedly was removed in 1982. This is the inferred source point for the diesel component of the spill. Since 1967, the gasoline tanks are thought to have been clustered in the west-center portion of the property, as are the current, active regular, unleaded, and premium tanks. The gasoline component of the spill is inferred to have originated from at least one of these three tanks, or from predecessor tanks which were replaced in approximately 1971.

Based on the current interpreted aerial extent of the product plume, an assumed effective soil porosity of 20 percent, release points, and well measurements, the existing volume of product persisting at the Express is estimated at 4,800 gallons (Figure 4-3). Original estimates placed the spill volume at between 5,000 to 8,000 gallons (Ecology 1989). Soil directly contaminated by spilled petroleum is estimated at 1,700 yd^3. The soil estimate assumes that soil was contaminated directly beneath the gasoline and diesel tanks, and that the product spread laterally upon contact with the water table, which fluctuates up to an estimated 2 feet seasonally.

The time of the release events at the Express is unclear, but based on previous records, a problem existed as early as 1978 when the Seattle Fire Department first received residential complaints.

4.2.4 Unocal Spill

Petroleum contamination of the Unocal facility subsurface soils and groundwater previously has been documented (GeoEngineers 1989). Evaluation of available investigative data indicates that historic release(s) of petroleum from the Unocal facility have accounted for no measurable direct contribution to the product pool residing beneath the Express property. Conditions that support this interpretation include the following observations:



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Seattle, Washington

0 50 FT.

BASE MAP REFERENCE:
City of Seattle Department of Engineering
SE 1/4 & NE 1/4 Section 25 – TS. 25 N., R 3 E., W.M.
Revised 9/90 – Scale 1"=100'

Monterey Apartments
Seattle, Washington

DRAWN BY:	DATE:	PRJCT/JOB NO.	CAD DWG NO.
DCW	07-15-91	WB6220	0549SM.DWG

FIGURE 4-3
FREE PRODUCT PETROLEUM DISTRIBUTION MAP-3/91

Transaction #: 11079902 Seq #: 03 (55) Air Toxics Volatiles

Sample No.: 90 298023 (continued from previous page)

5G03 CONT.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	18U
52	95636	1,2,4-Trimethylbenzene	ug/m3	3J
53	98066	Tert-Butylbenzene	ug/m3	18U
54	108678	[illegible]	ug/m3	30U
55	135988	Sec-Butylbenzene	ug/m3	18U
56	99876	p-Isopropyltoluene	ug/m3	18U
57	104518	Butylbenzene	ug/m3	18U
58	96128	DBCP	ug/m3	18U
59	87616	1,2,3-Trichlorobenzene	ug/m3	18U
60	98828	Isopropylbenzene (Cumene)	ug/m3	5U
61	103651	BENZENE, PROPYL-	ug/m3	18U
63	541731	1,3-Dichlorobenzene	ug/m3	18U
64	106467	1,4-Dichlorobenzene	ug/m3	18U
65	95501	1,2-Dichlorobenzene	ug/m3	18U
66	120821	1,2,4-Trichlorobenzene	ug/m3	18U
67	91203	Naphthalene	ug/m3	18U
68	87683	Hexachlorobutadiene	ug/m3	18U

11/16/90

Transaction #: 11079902 Seq #: 03 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298023 SG03 Alternate Keys:

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
Lab Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 900726 # Days to Ext/Anal: 07 8

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	18U
5	74839	Bromomethane	ug/m3	18U
6	75014	Vinyl Chloride	ug/m3	18U
7	75003	Chloroethane	ug/m3	18U
8	75694	Trichlorofluoromethane	ug/m3	18U
9	75092	Methylene Chloride	ug/m3	18U
10	67641	Acetone	ug/m3	32U
11	75150	Carbon Disulfide	ug/m3	18UJ
12	75354	1,1-Dichloroethene	ug/m3	18U
13	75343	1,1-Dichloroethane	ug/m3	18U
14	156605	trans-1,2-Dichloroethene	ug/m3	18U
15	156592	Cis-1,2-Dichloroethene	ug/m3	18U
16	590207	2,2-Dichloropropane	ug/m3	18U
17	74975	Bromochloromethane	ug/m3	18U
18	67663	Chloroform	ug/m3	18U
19	107062	1.2-Dichloroethane	ug/m3	18U
21	78933	2-Butanone	ug/m3	18U
22	71556	1,1,1-Trichloroethane	ug/m3	18U
23	56235	Carbon Tetrachloride	ug/m3	18U
24	563586	1.1-Dichloropropene	ug/m3	18U
26	75274	Bromodichloromethane	ug/m3	18U
27	78875	1,2-Dichloropropane	ug/m3	18U
28	74953	Dibromomethane	ug/m3	18U
29	10061026	trans-1,3-Dichloropropene	ug/m3	18U
30	79016	Trichloroethene	ug/m3	18U
31	124481	Dibromochloromethane	ug/m3	18U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	18U
33	79005	1,1,2-Trichloroethane	ug/m3	18U
34	142289	1,3-Dichloropropane	ug/m3	18U
35	71432	[redacted]	ug/m3	25 J
36	10061015	cis-1,3-Dichloropropene	ug/m3	18U
37	75252	Bromoform	ug/m3	18U
38	591786	2-Hexanone	ug/m3	18U
39	108101	4-Methyl-2-Pentanone	ug/m3	18U
40	127184	Tetrachloroethene	ug/m3	18U
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	18U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	18U
43	108883	Toluene	ug/m3	18U
44	108907	Chlorobenzene	ug/m3	18U
45	100414	BENZENE, ETHYL-	ug/m3	18U
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	18U
47	108861	Bromobenzene	ug/m3	18U
48	96184	1,2,3-Trichloropropane	ug/m3	18U
49	95498	2-Chlorotoluene	ug/m3	18U
50	106434	4-Chlorotoluene	ug/m3	18U

11/16/90

(continued on next page)

*** Lab Analysis Report ***

Transaction #: 11079901 Seq #: 02 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298022 Alternate Keys:
SG02 TICs
Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 07112

Line	Par #	Parameter Description	Units	Value	
1	5618622	HYDROXYLAMINE, O-(2-METHYLPR	ug/m3	82NJ	
2	629209	1,3,5,7-CYCLOOCTATETRAENE	ug/m3	30NJ	
3	5911046	NONANE,3-METHYL	ug/m3	76NJ	
4	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	57NJ	
5	526738	BENZENE, 1,2,3-TRIMETHYL-	ug/m3	100NJ	
6	1758889	BENZENE, 2-ETHYL-1,4-DIMETHY	ug/m3	59NJ	
7	933982	BENZENE, 1-ETHYL-2,3-DIMETHY	ug/m3	40NJ	
8	99876	p-Isopropyltoluene	ug/m3	27NJ	
9	17312559	DECANE, 3,8-DIMETHYL-	ug/m3	14NJ	
10	62016379	OCTANE, 2,4,6-TRIMETHYL-	ug/m3	9.5NJ	
11	62238146	DECANE, 2,3,8-TRIMETHYL-	ug/m3	23NJ	
12	1072055	HEPTANE, 2,6-DIMETHYL-	ug/m3	33NJ	
13	62108241	Decane, 2,6,6-Trimethyl-	ug/m3	180NJ	(3)
14	620144	BENZENE, 1-ETHYL-3-METHYL-	ug/m3	37NJ	
15	13475815	HEXANE, 2,2,3,3-TETRAMETHYL-	ug/m3	110NJ	16
16	62108252	DECANE, 2,6,7-TRIMETHYL-	ug/m3	120NJ	5
17	1074437	BENZENE, 1-METHYL-3-PROPYL-	ug/m3	57NJ	
18	62108230	DECANE, 2,5,6-TRIMETHYL-	ug/m3	810NJ	(1)
19	62108229	DECANE, 2,5,9 TRIMETHYL	ug/m3	170NJ	(4)
20	540841	2,2,4-TRIMETHYLPENTANE	ug/m3	510NJ	(2)

11/16/90

Transaction #: 11079902 Seq #: 02 (55) Air Toxics Volatiles

Sample No.: 90 298022 (continued from previous page)

SG02 CONT.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	58
52	95636	1,2,4-Trimethylbenzene	ug/m3	55
53	98066	Tert-Butylbenzene	ug/m3	17U
54	108678	1,3,5-Trimethylbenzene	ug/m3	130 J
55	135988	Sec-Butylbenzene	ug/m3	17U
56	99876	p-Isopropyltoluene	ug/m3	17U
57	104518	Butylbenzene	ug/m3	17U
58	96128	DBCP	ug/m3	17U
59	87616	1,2,3-Trichlorobenzene	ug/m3	17U
60	98828	Isopropylbenzene (Cumene)	ug/m3	17U
61	103651	BENZENE, PROPYL-	ug/m3	19
63	541731	1,3-Dichlorobenzene	ug/m3	17U
64	106467	1,4-Dichlorobenzene	ug/m3	17U
65	95501	1,2-Dichlorobenzene	ug/m3	17U
66	120821	1,2,4-Trichlorobenzene	ug/m3	17U
67	91203	Naphthalene	ug/m3	17U
68	87683	Hexachlorobutadiene	ug/m3	17U

11/16/90

*** Lab Analysis Report ***

Transaction #: 11079902 Seq #: 02 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298022 5602 Alternate Keys:

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 900726 # Days to Ext/Anal: 07 8

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	17U
2				59J
3				
4				
5	74839	Bromomethane	ug/m3	17U
6	75014	Vinyl Chloride	ug/m3	17U
7	75003	Chloroethane	ug/m3	17U
8	75694	Trichlorofluoromethane	ug/m3	17U
9	75092	Methylene Chloride	ug/m3	17U
10	67641	Acetone	ug/m3	49U
11	75150	Carbon Disulfide	ug/m3	17UJ
12	75354	1,1-Dichloroethene	ug/m3	17U
13	75343	1,1-Dichloroethane	ug/m3	17U
14	156605	trans-1,2-Dichloroethene	ug/m3	17U
15	156592	Cis-1,2-Dichloroethene	ug/m3	17U
16	590207	2,2-Dichloropropane	ug/m3	17U
17	74975	Bromochloromethane	ug/m3	17U
18	67663	Chloroform	ug/m3	17U
19	107062	1,2-Dichloroethane	ug/m3	17U
21	78933	2-Butanone	ug/m3	26U
22	71556	1,1,1-Trichloroethane	ug/m3	17U
23	56235	Carbon Tetrachloride	ug/m3	17U
24	563586	1,1-Dichloropropene	ug/m3	17U
26	75274	Bromodichloromethane	ug/m3	17U
27	78875	1,2-Dichloropropane	ug/m3	17U
28	74953	Dibromomethane	ug/m3	17U
29	10061026	trans-1,3-Dichloropropene	ug/m3	17U
30	79016	Trichloroethene	ug/m3	17U
31	124481	Dibromochloromethane	ug/m3	17U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	17U
33	79005	1,1,2-Trichloroethane	ug/m3	17U
34	142289	1,3-Dichloropropane	ug/m3	17U
35	71432	[redacted]	ug/m3	[redacted]
36	10061015	cis-1,3-Dichloropropene	ug/m3	17U
37	75252	Bromoform	ug/m3	17U
38	591786	2-Hexanone	ug/m3	17U
39	108101	4-Methyl-2-Pentanone	ug/m3	17U
40	127184	[redacted]	ug/m3	[redacted]
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	17U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	17U
43	108883	Toluene	ug/m3	17U
44	108907	Chlorobenzene	ug/m3	17U
45	100414	[redacted]	ug/m3	[redacted]
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	15J
47	108861	Bromobenzene	ug/m3	17U
48	96184	1,2,3-Trichloropropane	ug/m3	17U
49	95498	2-Chlorotoluene	ug/m3	17U
50	106434	4-Chlorotoluene	ug/m3	17U

(continued on next page)

11/16/90

Transaction #: 11079901 Seq #: 01 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298021 Alternate Keys: TIC S
SG01
Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/112

Line	Par #	Parameter Description	Units	Value	
1	526738	BENZENE, 1,2,3-TRIMETHYL-	ug/m3	3,900NJ	
2	1074175	BENZENE, 1-METHYL-2-PROPYL-	ug/m3	4,200NJ	
3	934805	BENZENE, 4-ETHYL-1,2-DIMETHY	ug/m3	8,000NJ	
4	99876	p-Isopropyltoluene	ug/m3	6,700NJ	
5	-300005	UNKNOW HYDROCARBONS	ug/m3	6.1E6NJ	(1)
6	624839	Isocyanic Acid, Methyl Ester	ug/m3	550,000NJ	(5)
7	75285	Propane, 2-Methyl	ug/m3	2.2E6NJ	(2)
8	1630940	CYCLOPROPANE, 1,1-DIMETHYL-	ug/m3	430,000NJ	(6)
9	109682	2-PENTENE	ug/m3	220,000NJ	
10	1630940	CYCLOPROPANE, 1,1-DIMETHYL-	ug/m3	600,000NJ	(4)
11	16747254	HEXANE, 2,2,3-TRIMETHYL-	ug/m3	1.3E6NJ	(3A)
12	763291	1-PENTENE, 2-METHYL-	ug/m3	170,000NJ	
13	96140	PENTANE, 3-METHYL-	ug/m3	1.3E6NJ	(3B)
14	13269528	3-HEXENE, (E)-	ug/m3	140,000NJ	
15	592438	2-HEXENE	ug/m3	270,000NJ	
16	691383	2-PENTENE, 4-METHYL-, (Z)-	ug/m3	230,000NJ	
17	616126	2-PENTENE, 3-METHYL-, (E)-	ug/m3	150,000NJ	
18	7642093	3-HEXENE, (Z)-	ug/m3	100,000NJ	
19	563791	2-BUTENE, 2,3-DIMETHYL-	ug/m3	68,000NJ	
20	1759815	CYCLOPENTENE, 4-METHYL-	ug/m3	140,000NJ	
21	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	54,000NJ	
22	620144	BENZENE, 1-ETHYL-3-METHYL-	ug/m3	15,000NJ	
23	1074551	BENZENE, 1-METHYL-4-PROPYL-	ug/m3	18,000NJ	

11/16/90

Transaction #: 11079902 Seq #: 01 (55) Air Toxics Volatiles

Sample No.: 90 298021 (continued from previous page)

SG Ø1 cont.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	41000
52	95636	1,2,4-Trimethylbenzene	ug/m3	18000
53	98066	Tert-Butylbenzene	ug/m3	8200U
54	108678	1,3,5-Trimethylbenzene	ug/m3	24000
55	135988	Sec-Butylbenzene	ug/m3	17000
56	99876	p-Isopropyltoluene	ug/m3	25000
57	104518	Butylbenzene	ug/m3	8200U
58	96128	DBCP	ug/m3	8200U
59	87616	1,2,3-Trichlorobenzene	ug/m3	8200U
60	98828	Isopropylbenzene (Cumene)	ug/m3	4600J
61	103651	BENZENE, PROPYL-	ug/m3	10000
63	541731	1,3-Dichlorobenzene	ug/m3	8200U
64	106467	1,4-Dichlorobenzene	ug/m3	8200U
65	95501	1,2-Dichlorobenzene	ug/m3	8200U
66	120821	1,2,4-Trichlorobenzene	ug/m3	8200U
67	91203	Naphthalene	ug/m3	8200U
68	87683	Hexachlorobutadiene	ug/m3	8200U

11/14/90

Transaction #: 11079902 Seq #: 01 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298021 S601 Alternate Keys:

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 900727 # Days to Ext/Anal: 0/ 9

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	8200U
5	74839	Bromomethane	ug/m3	8200U
6	75014	Vinyl Chloride	ug/m3	8200U
7	75003	Chloroethane	ug/m3	8200U
8	75694	Trichlorofluoromethane	ug/m3	8200U
9	75092	Methylene Chloride	ug/m3	8200U
10	67641	Acetone	ug/m3	8200U
11	75150	Carbon Disulfide	ug/m3	8200UJ
12	75354	1,1-Dichloroethene	ug/m3	8200U
13	75343	1,1-Dichloroethane	ug/m3	8200U
14	156605	trans-1,2-Dichloroethene	ug/m3	8200U
15	156592	Cis-1,2-Dichloroethene	ug/m3	8200U
16	590207	2,2-Dichloropropane	ug/m3	8200U
17	74975	Bromochloromethane	ug/m3	8200U
18	67663	Chloroform	ug/m3	8200U
19	107062	1,2-Dichloroethane	ug/m3	8200U
21	78933	2-Butanone	ug/m3	8200U
22	71556	1,1,1-Trichloroethane	ug/m3	8200U
23	56235	Carbon Tetrachloride	ug/m3	8200U
24	563586	1,1-Dichloropropene	ug/m3	8200U
25				REJ
26	75274	Bromodichloromethane	ug/m3	8200U
27	78875	1,2-Dichloropropane	ug/m3	8200U
28	74953	Dibromomethane	ug/m3	8200U
29	10061026	trans-1,3-Dichloropropene	ug/m3	8200U
30	79016	Trichloroethene	ug/m3	8200U
31	124481	Dibromochloromethane	ug/m3	8200U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	8200U
33	79005	1,1,2-Trichloroethane	ug/m3	8200U
34	142289	1,3-Dichloropropane	ug/m3	8200U
35	71432	[redacted]	ug/m3	[redacted]
36	10061015	cis-1,3-Dichloropropene	ug/m3	8200U
37	75252	Bromoform	ug/m3	8200U
38	591786	2-Hexanone	ug/m3	8200U
39	108101	4-Methyl-2-Pentanone	ug/m3	8200U
40	127184	Tetrachloroethene	ug/m3	8200U
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	8200U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	8200U
43	108883	[redacted]	ug/m3	[redacted]
44	108907	Chlorobenzene	ug/m3	8200U
45	100414	[redacted]	ug/m3	[redacted]
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	8200U
47	108861	Bromobenzene	ug/m3	8200U
48	96184	1,2,3-Trichloropropane	ug/m3	8200U
49	95498	2-Chlorotoluene	ug/m3	8200U
50	106434	4-Chlorotoluene	ug/m3	8200U

11/15/90

In Reference to Case No(s):
DOE-633

Telephone Record Log

Date of Call: 28 NOVEMBER 1990

Laboratory Name: MANCHESTER

Lab Contact: STEVE POPE

Region: X

Regional Contact: DAVID AKIO ICEDA

Call Initiated By: ____ Laboratory ____X____ Region

In reference to data for the following sample number(s):
90298021 - 27

Summary of Questions/Issues Discussed:
1. THE SYSTEM WAS CALIBRATED WITH STD OF 5 TO 20 Ng. BUT SEVERAL SAMPLES WE ABOVE THIS RANGE. HOW DID YOU ~~CALIBR~~ CALCULATE THE CONCENTRATION
3. WHAT IS THE SYSTEM NORMALLY CALIBRATION AT (IE, WHAT IS YOUR MAXIMUM CONCENTRATION ON COLUMN) ?

Summary of Resolution:
1. SAMPLES CALCULATIONS WERE EXTRAPOLATED 400 Ng ON COLUMN (AREA + TRAP).

David A Ikeda
Signature

28 NOVEMBER 1990
Date

Distribution: (1)Lab Copy, (2)Region Copy, (3)SMO Copy

Upon consideration of the data qualifications noted above, the data are ACCEPTABLE for use except where flagged with data qualifiers which modify the usefulness of the individual values.

This QA memorandum completes the series of QA reviews of CLP and/or EPA laboratory data for samples collected during the Sampling Effort identified on the cover page under the heading SUBJ: Pilot Soil/Gas Study.

Data Qualifiers

U - The material was analyzed for, but was not detected. The associated numerical value is a contractual quantitation limit, adjusted for sample weight/sample volume, extraction volume, percent solids and sample dilution.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

R - Quality Control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

N - Presumptive evidence of presence of material (tentative identification). Confirmation of the analyte requires further analysis.

NJ - The analysis indicates that the analyte is tentatively identified and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

M - Mass spectral criteria for positive identification were not met. However, in the opinion of the laboratory, the identification is correct based on the analyst's professional judgement.

X - The reported result may be a combination of indistinguishable isomers.

9) Sample Analysis

All reported results above IDLs but below MQLs were flagged as estimated quantities (J) on the Data Sheets.

No matrix spike or (MS) matrix spike duplicate (MSD) was analyzed for this case. The laboratory's QC for this method did not include an analysis for MS/MSD. No action was taken.

The laboratory chose a sample without detectable levels of target analytes for duplicate analysis, so method precision could not be evaluated. No action was taken.

Laboratory blanks and samples are diluted by over-pressurizing the cannister. This dilution is the fraction of absolute pressure before dilution to absolute pressure after dilution. This initial dilution factor causes the laboratory blanks and samples to have varying MQLs.

The initial calibration standards were analyzed at levels of 5.0 ng, 10 ng, and 20 ng. For samples 90298021, 90298022, 90298024, and 90298025 the calibration range was exceeded for at least one compound. The laboratory stated that the system is normally calibrated at levels up to 400 ng of each standard and that the reported results for these compounds were calculated by extrapolation. All sample results that exceeded the calibration range for this sample set were flagged as estimated (J).

The laboratory did not calibrate the system for 1,2-dichlorotetrafluorethane, 1,1,2-trichlorotrifluoroethane, 2,2,4-trimethylpentane, vinyl acetate, and benzyl chloride. All results for these compounds were removed from the Form I by the reviewer, since their identification was not verified by a standard analysis.

10) Laboratory Contact

The laboratory was contacted on November 28, 1990. See the attached Telephone Record Log.

Data Use

The usefulness of the data is based on the criteria outlined in the "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses" (February 1, 1988); the Data Qualifier Definitions supplied by the Office of Solid Waste and Emergency Response (September 1989); and the Regional Protocol for Holding Times, Blanks, and VOA Preservation (April 13, 1989).

Reported levels of the above compounds in the samples were flagged "UJ" (estimated quantitation limit) if the concentrations were below five times the concentrations found in the appropriate blank (10 times for common solvents).

The following Tentatively Identified Compounds (TICs) were identified in the laboratory blanks:

Blank ID	Fraction	Compound	Est. Conc.	Associated Samples
LBLK 1	VOC	Cyclotrisiloxane, hexamethyl	16	*
		Cyclotetrasiloxane, oxtamethyl	7.5	*
LBLK 2	VOC	Cyclopentane, methyl	22	**

Est. Conc. - Estimated Concentration
* 90298022, 90298023, and 90298024
** 90298021, 90298025, 90298026, and 90298027

Reported levels of these compounds found in the samples were flagged "UJ" (estimated quantitation limit) if the reported concentration was less than 10 times the concentration found in the appropriate blank.

6) Surrogate Recovery

Surrogate percent recoveries (%Rs) for volatile analysis (1-bromo-2-fluoroethane, toluene-d8, bromofluorobenzene, 1,2-dichloroethane-d4) were between 89 and 188 percent. According to the case narrative, no EPA surrogate recovery QC criteria has been established for this method. All samples exhibited a high hydrocarbon background, which resulted in high surrogate recoveries for several samples. No action was taken based on the elevated surrogate recoveries.

7) Duplicate Analysis

The relative percent difference (RPD) criteria were not applicable to the sample chosen for duplicate analysis since no VOCs were detected in either the sample or the sample duplicate analysis.

8) Internal Standard Recovery

All internal standard areas were within established QC limits.

Date	Compound	%D	Associated Samples
07/26/90	Benzene	40.2	*
07/27/90	Benzene	41.7	**
	Carbon Disulfide	38.9	**

* 90298022, 90298023, and 90298024
** 90298021, 90298025, 90298026, and 90298027

For samples associated with the corresponding calibration and compounds listed above, positive results were flagged as estimated quantities (J).

5) Blanks

Frequency criteria were met for laboratory blank analysis.

The following compounds were detected in laboratory blanks at levels above Instrument Detection Limits (IDL), but below Method Quantitation Limits (MQL):

Blank ID	Fraction	Compound	Conc. $\mu g/m^3$	MQL $\mu g/m^3$	Associated Samples
LBLK 2	VOC	Chloromethane	4	13	*
		Bromomethane	4	13	*
		Methylene Chloride	3	13	*
		Acetone	7	13	*
		Carbon Disulfide	1	13	*
		1,1-Dichloroethene	2	13	*
		2,2,4-Trimethylpentane	2	13	*
		2-Butanone	5	13	*
		Toluene	0.8	13	*
		Ethylbenzene	0.8	13	*
		Total Xylenes	2	13	*
		1,2,4-Trimethylbenzene	1	13	*
		1,3,5-Trimethylbenzene	2	13	*
		Naphthalene	1	13	*

Conc. - Concentration
LBLK - Laboratory Blank
* 90298021, 90298025, 90298026, and 90298027

All non-CCCs had percent RSDs less than or equal to 30 percent for the initial volatile calibration, except:

Date	Compound	%RSD	Associated Samples
07/17/90	Carbon Disulfide	32.2	All

For samples associated with the corresponding calibration and compounds listed above, positive results and sample quantitation limits were flagged as estimated quantities (J or UJ), as a high RSD is indicative of poor system linearity.

4) Continuing Calibrations

All SPCCs were at or above the required Relative Response Factor (RRF(10)) criteria of 0.05 for volatiles. All CCCs were at or below the required Percent Difference (%D) limits of 25 percent for the volatile continuing calibrations.

All non-SPCCs had RRF(10)s of greater than or equal to 0.05 for continuing volatile calibrations, except:

Date	Compound	RRF(10)	Associated Samples
07/26/90	Dichlorodifluoromethane	0.039	*
07/27/89	Dichlorodifluoromethane	0.031	**

* 90298022, 90298023, and 90298024
** 90298021, 90298025, 90298026, and 90298027

For samples associated with the corresponding calibration and compounds listed above, each compound was flagged as an estimated quantity (J) for positive results. Quantitation limits were rejected for all compounds with RRF(10)s below 0.05.

All non-CCCs that were detected in the sample had percent difference (%D) values for the continuing calibration of less than or equal to 25 percent, except:

1) Timeliness

Sample Number	E & E Field Station I.D.	Sample Date	VOC Anal.
90298021	SG01	07/18/90	07/27/90
90298022	SG02	07/18/90	07/26/90
90298023	SG03	07/18/90	07/26/90
90298024	SG04	07/18/90	07/26/90
90298025	SG05	07/19/90	07/27/90
90298026	SG06	07/19/90	07/27/90
90298027	SG07	07/18/90	07/27/90

VOC - Volatile Organic Compounds
Anal. - Analysis Date

All samples met EPA Region 10 holding time criteria for volatiles analysis.

2) Instrument Tuning

All tuning check compound mass abundances and ratios were within contract-required limits for volatile analysis.

3) Initial Calibration

All System Performance Check Compounds (SPCCs) were within the required limits for the initial calibration with average Relative Response Factors (RRFs) above 0.05 for volatiles. All Calibration Check Compounds (CCCs) were within the required limits for the initial calibration with Percent Relative Standard Deviations (%RSDs) below 30 percent.

All non-SPCCs had average RRFs of greater than or equal to 0.05 in the initial volatile calibration, except:

Date	Compound	RRF	Associated Samples
07/17/90	Dichlorodifluoromethane	0.047	All

For samples associated with the corresponding calibration and TCL compounds listed above, each compound was flagged as an estimated quantity (J) for positive results. Quantitation limits were rejected for all compounds with RRFs below 0.05.

MEMORANDUM

DATE: January 18, 1991

FOR: David South, Washington State Department of Ecology, Redmond

THRU: Peter Jowise, Program Manager, E & E, Seattle

FROM: David A. Ikeda, Chemist, E & E, Seattle
for Tracy Yerian, Senior Chemist, E & E, Seattle

SUBJ: QA of Case DOE-633 (Organics)
Pilot Soil Gas Study
Monterey Apartments, Seattle Washington

REF: Contract Number WB6040

CC: John L. Roland, Project Manager, E & E, Seattle

The Quality Assurance (QA) review of seven samples, Case DOE-633, collected from Monterey Apartments, has been completed. Seven soil gas samples were analyzed at low level for the Volatile Organics listed in "Standard Operating Procedure for the Analysis of Ambient Air Volatile Organic Compounds (VOCs) in Canister by GC/MS Analysis" Revision 3.0 (Manchester Labortory Modified Method TO-14), by the Manchester Environmental Laboratory of Port Orchard, Washington. The samples were numbered:

90298021	90298024	90298026
90298022	90298025	90298027
90298023		

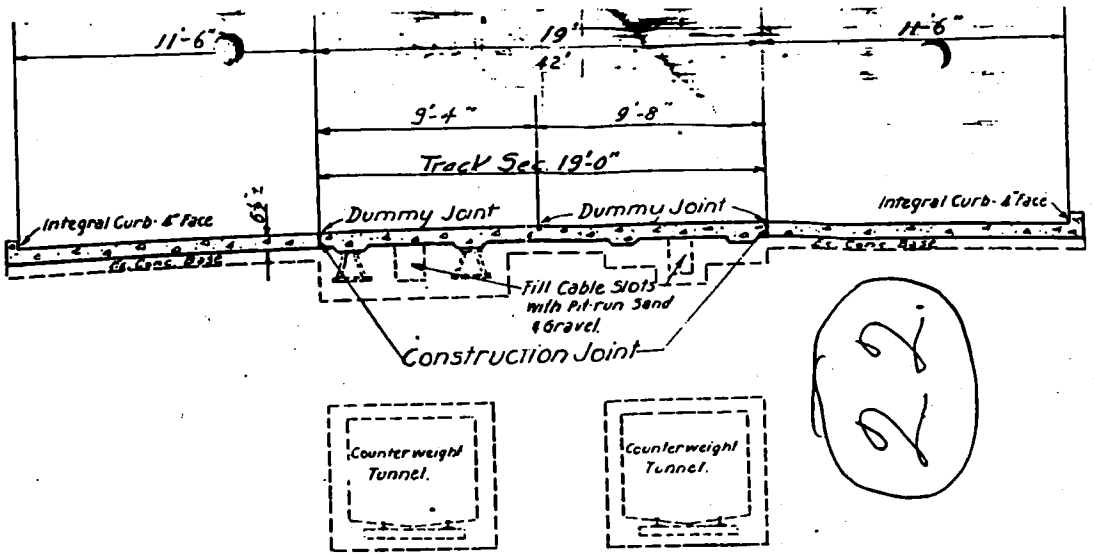
Sample 90298027 underwent duplicate analysis.

Data Qualifications

The following comments refer to the laboratory performance in meeting the Quality Control (QC) specifications outlined in Manchester Laboratory Modified Method TO-14 following Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis (February 1, 1988).

Appendix C

PILOT STUDY DATA VALIDATION REPORTING



TYPICAL SECTION- ROY ST. TO PROSPECT ST. - SECT. C

Scale 1"=5'

THE CITY OF SEATTLE
DEPARTMENT OF ENGINEERING
C. L. WARTELLE, CITY ENGINEER

IMPROVEMENT OF

QUEEN ANNE AVENUE

RESURFACING

ORDINANCE NO. 72852 APPROVED SEPT. 28, 1943

CITY STREET FUND

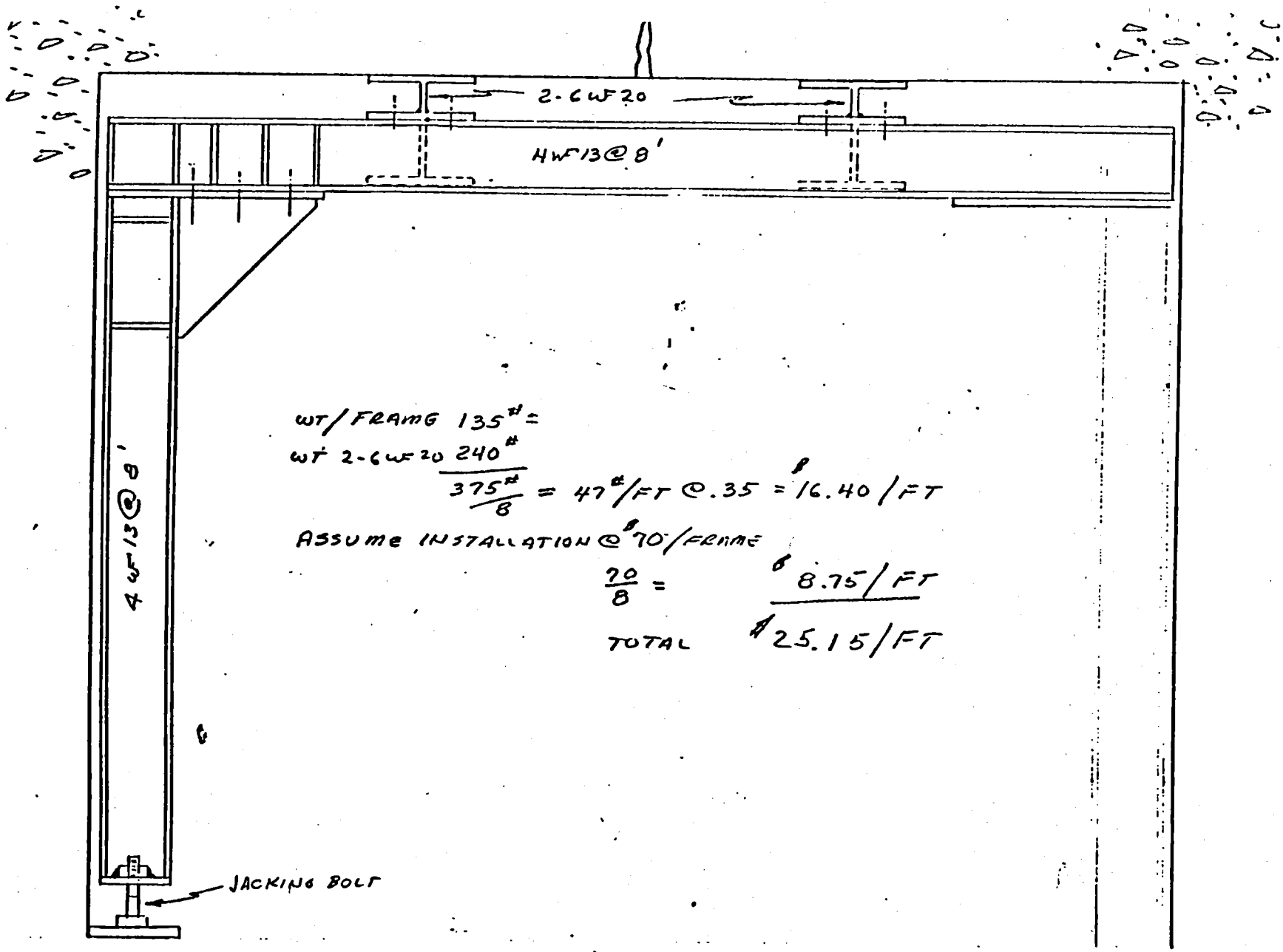
Scale, 1 Inch 50 Feet October, 1943

Drawn by COLFELT DEC. 20, 1943.	Approved by [illegible] 12-25-43
Traced by	Approved by [illegible] 12-20-43
Checked by	Approved by [illegible] Assistant City Engineer
Final Const. Chkd. by AJS 6-44	Contractor Ordered to Begin Work
Work Done under Standard Specifications Sub-Division, Supplemented by Special Specifications File No. 733-B	Work Reported Complete

APPROVED BY THE BOARD OF PUBLIC WORKS
SEATTLE, WASHINGTON Dec. 20 1943
ATTEST: [illegible] CHAIRMAN
SECRETARY

QUEEN ANNE AVE
ROY → GARFIELD
1944 REPAVING

ODD 1825
SEQUENCE
QUEEN ANNE AVE



WT/FRAME 135# =
WT 2-6WF20 240#

$\frac{375\#}{8}$ = 47#/FT @ .35 = $16.40/FT

ASSUME INSTALLATION @ $70/FRAME

$\frac{70}{8}$ = $8.75/FT

TOTAL $25.15/FT

QUEEN ANNIE COUNTERBALANCE

TYPICAL TUNNEL SHORING

CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTERBALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

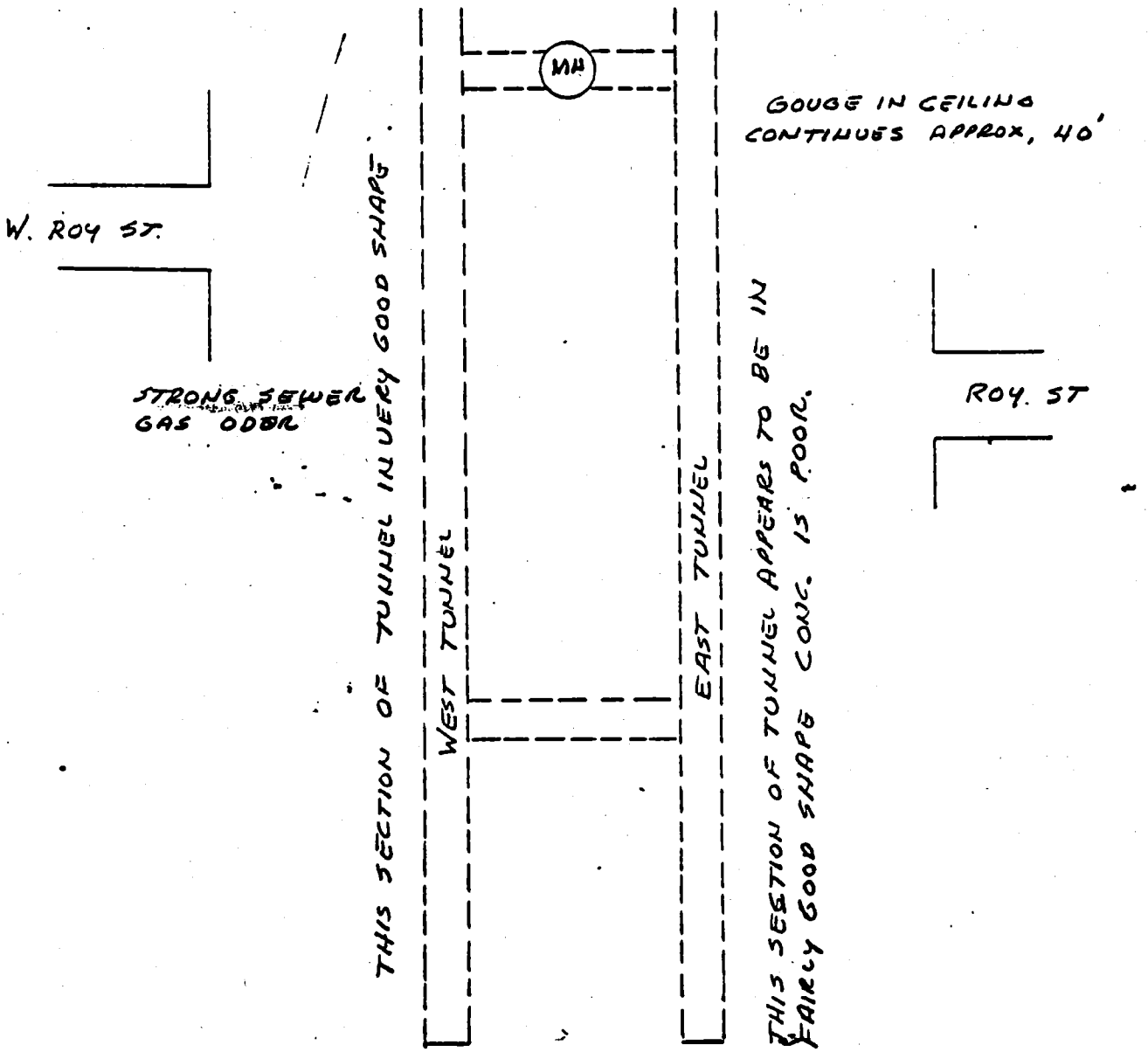
DETAIL W. ROY ST TO END

MADE WF DATE 11-19-69

CHK'D ____ DATE ____

BACK CHK'D ____ DATE ____

SHEET NO 7 OF ____ SHEETS



FM. 17L CS 11.124

CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTERBALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

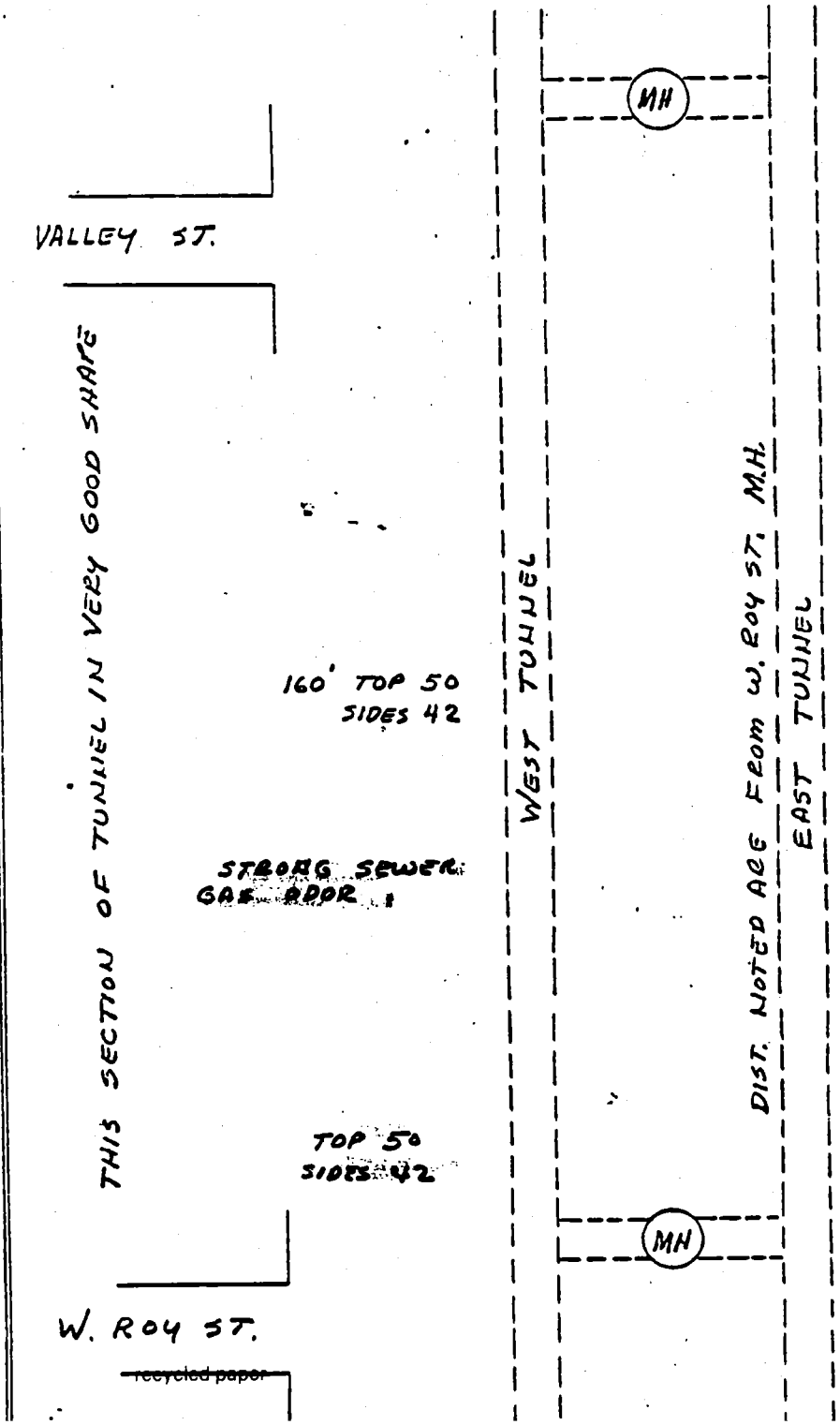
DETAIL VALLEY ST TO W. ROY ST

MADE WF DATE 11-19-69

CHK'D ____ DATE ____

BACK CHK'D ____ DATE ____

SHEET NO. 6 OF ____ SHEETS



250' SPALL ACROSS ENTIRE CEILING, 5 BARS EXPOSED

240' SPALL ACROSS ENTIRE CEILING 3 BARS EXPOSED

230' SPALL ACROSS ENTIRE CEILING, 5 BARS EXPOSED

160' TOP 50 LOOKS BETTER
SIDES 34

50-150' MANY SPALLS - CONC. LOOK BAD, BARS EXPOSED IN MANY PLACES

30' GOUGE ENDS

1" DEEP GOUGE IN CEILING FROM CABLE, BARS EXPOSED TUNNEL LEVELS OUT HERE
TOP 30
SIDES 28

CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTERBALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

DETAIL ALOHA ST TO VALLEY ST

MADE WF DATE 11-19-

CHK'D DATE

BACK CHK'D DATE

SHEET NO 5 OF SHEETS

IMPACT HAMMER READINGS ARE WITH A DIFFERENT HAMMER FROM ALOHA ST. TO END.

TOP 45
SIDES 40

ALOHA ST.

50' TUNNEL SLIGHTLY WET

THIS SECTION OF TUNNEL IN VERY GOOD SHAPE

150' TOP 54
SIDES 38

200' DRY LOCAL SPALL, REBEEL RUSTED.

TOP 48
SIDES 44

VALLEY ST

DIST. NOTED ARE FROM ALOHA ST. MH

WEST TUNNEL

MH

MH

DIST. NOTED ARE FROM VALLEY ST MH.

EAST TUNNEL

300' LARGE SPALL - 3 BARS EXPOSED, CEILING WET
TOP (37)? TAR
SIDES 32

280' LARGE SPALL - 6 BARS EXPOSED, CEILING WET

220' LARGE SPALL - 5 BAR EXPOSED

180' SPALL - 2 BARS EXPOSED

160' TOP (45)? TAR
SIDES 43

120' LARGE SPALL - 8 BARS EXPOSED AND RUSTED THRU

40' 2 SPALLS IN CEILING

20' LARGE OPEN ROCK POCKE

TOP (NO READING, TAR ON CEI
SIDES 37
TUNNEL GENERALLY GOOD

CITY OF SEATTLE

PARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN C[illegible]ULATIONS

JOB QUEEN ANNE [illegible]NTERBALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

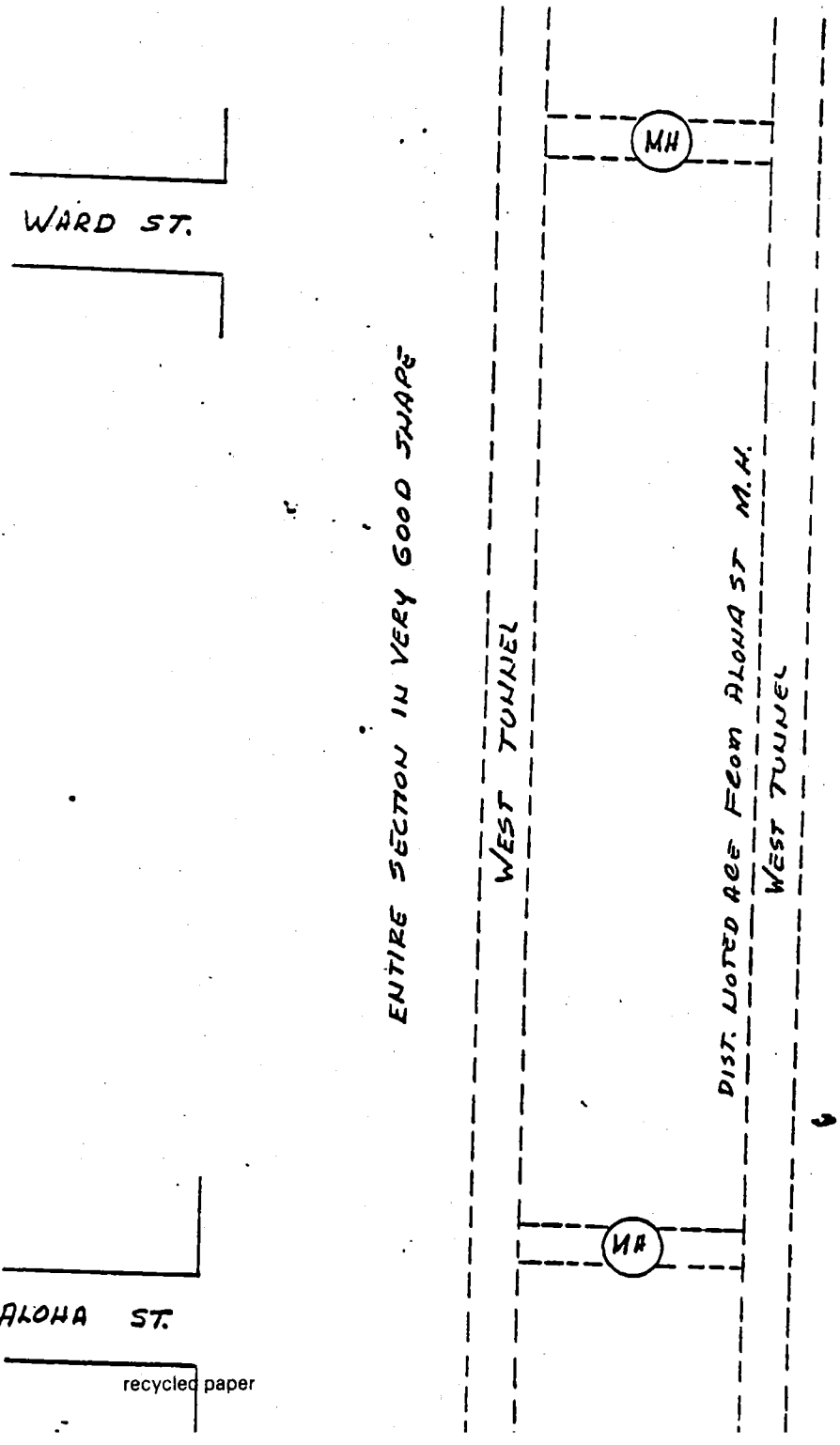
DETAIL WARD ST TO ALOHA ST

MADE WF DATE 11-19-69

CHK'D DATE

BACK CHK'D DATE

SHEET NO 4 OF SHEETS



320' VERY BAD SPALLING

180' TO 300' MAJOR LONGITUDINAL CRACK IN CENTER OF CEILING. CEILING IS SAGGING 1"±

150' VERY BADLY SPALLED; FAULTY CONCRETE, NOT STRUCTURAL FAILURE. HOLE CLEAR THRU IN ONE SPOT.

CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTER BALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

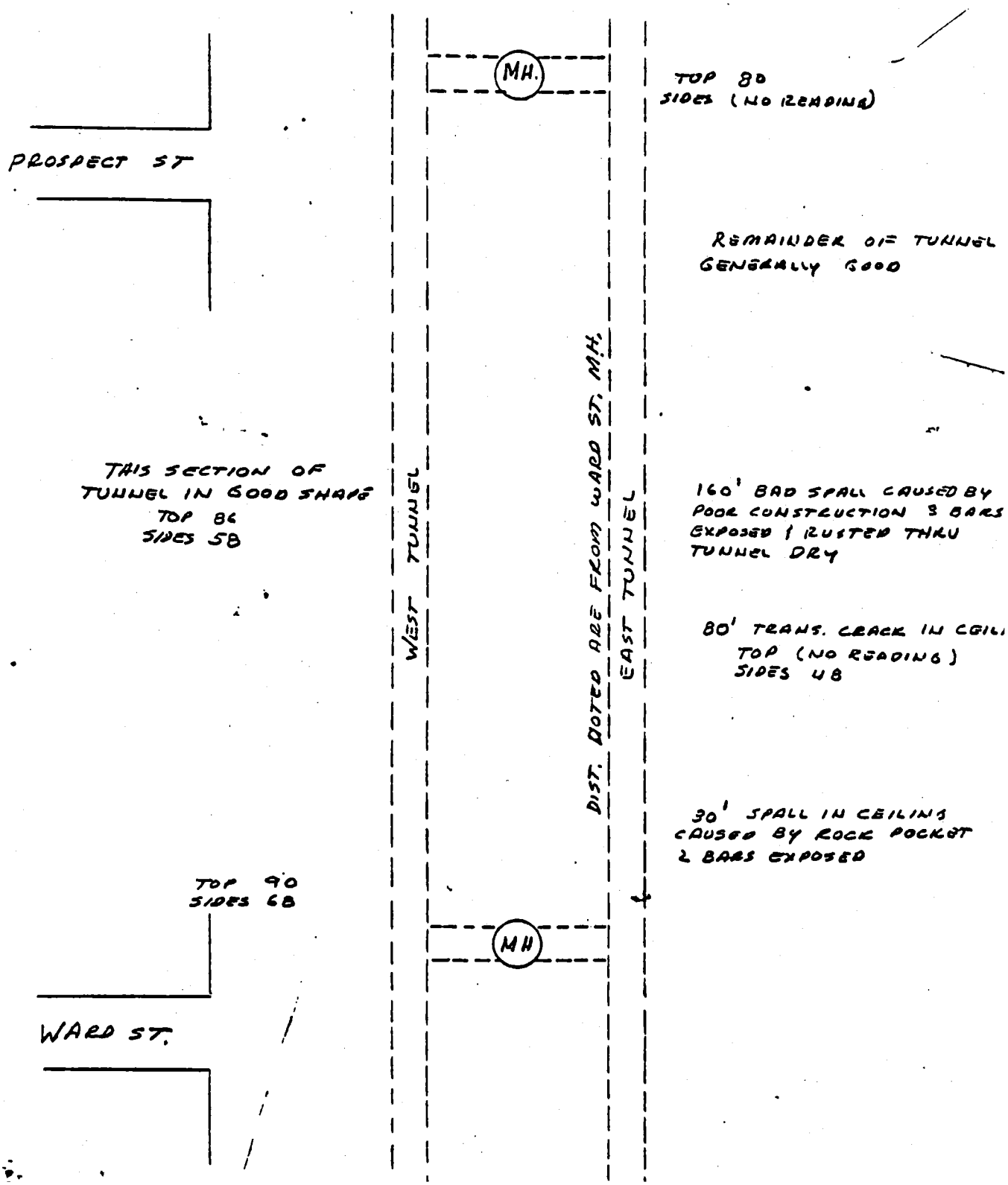
DETAIL PROSPECT ST. TO WARD ST

MADE WT DATE 11-18-6

CHK'D ____ DATE ____

BACK CHK'D ____ DATE ____

SHEET NO 3 OF ____ SHEETS



CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTERBALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

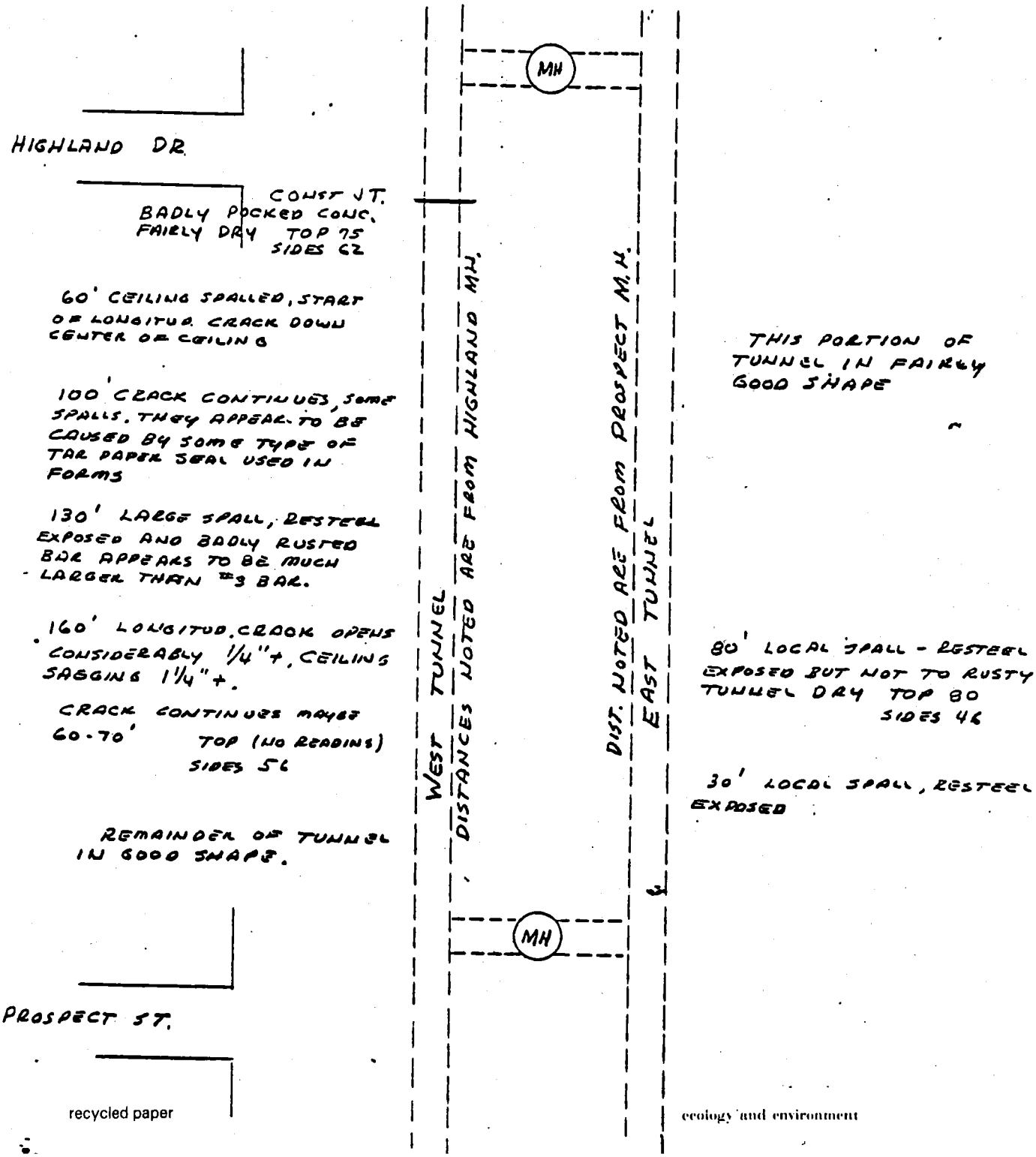
DETAIL HIGHLAND DR TO PROSPECT ST

MADE WF DATE 11-18-

CHK'D DATE

BACK CHK'D DATE

SHEET NO 2 OF SHEETS



FM. 171 CS 11.124

CITY OF SEATTLE

DEPARTMENT OF LIGHTING — ENGINEERING DIVISION

DESIGN CALCULATIONS

JOB QUEEN ANNE COUNTER BALANCE

PORTION OF STRUCTURE TUNNEL INSPECTION

DETAIL COMSTOCK ST TO HIGHLAND DR.

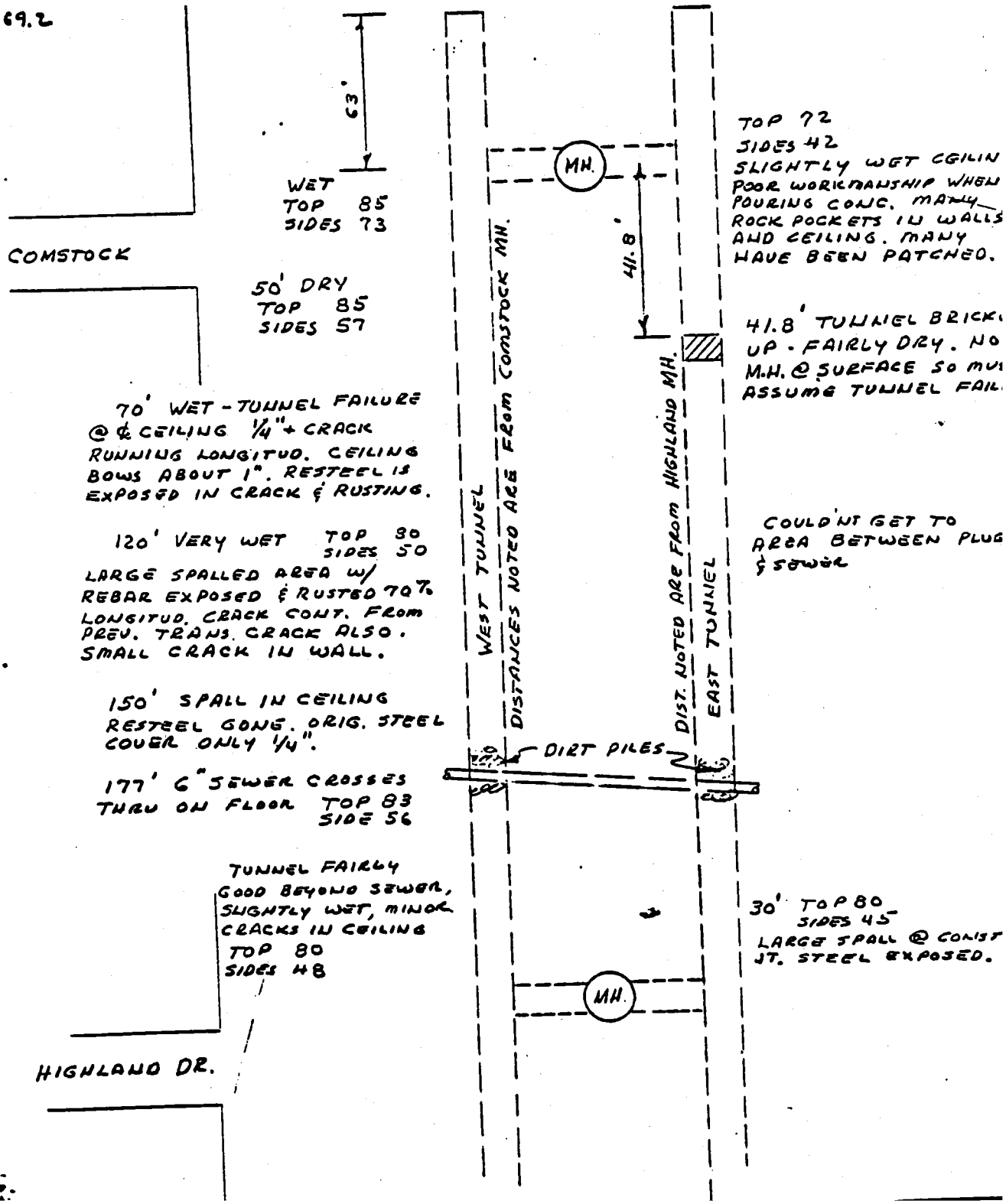
MADE WF DATE 11-18-69

CHK'D ____ DATE ____

BACK CHK'D ____ DATE ____

SHEET NO. 1 OF ____ SHEETS

W.O. 969.2



TO: Civil Engineering File
FROM: W. Freitas
SUBJ: Queen Anne Avenue Counterbalance Tunnels

November 21, 1969
Page 2

A decision as to whether or not City Light would accept the responsibility for these tunnels is dependent somewhat on the manner in which they will be used. If a duct system is installed and the tunnels are than backfilled, only temporary shoring would be required at the danger spots.

If other systems requiring tunnel access are employed, the entire east tunnel and approximately 450 feet of the west tunnel must be supported with some type of steel shoring. A very preliminary estimate indicates the cost of this shoring would be $25 per foot of tunnel.

WF:en
Att: Copy of inspection notes

Civil Engineering File

November 21, 1969

W. Freitas

Queen Anne Avenue Counterbalance Tunnels

On November 18 and 19, 1969, in response to a request by the Underground Division, Bill Freitas from Civil Engineering, Al Critz from Construction Engineering, and John Hickman from Underground Engineering inspected the existing counterbalance tunnels under Queen Anne Avenue. The purpose of the inspection was to determine whether the tunnels are structurally adequate to be considered for use as utility tunnels to serve underground power to the Queen Anne area. The telephone company and City Light's Communications Division would also like to use the tunnels.

The Seattle Transit System, current owners of the tunnels, are willing to permit us to use the tunnels if we agree to assume responsibility for maintenance and all damages caused by construction or failure of the tunnels and their appurtenances.

Two parallel concrete tunnels, each 5 feet wide and 4 feet high, extend from Comstock Street to Roy Street, a distance of approximately 2,200 feet. Along most of the length, the tunnels straddle the centerline of Queen Anne Avenue and are approximately 11 feet on centers. The depth of cover varies slightly but in most cases appears to be approximately 4 feet. Access is available from common manholes located at each street intersection.

Except for approximately 135 feet of the east tunnel, each tunnel was inspected along the entire length and the concrete was tested at intervals with a Schmitt hammer. A copy of the inspection notes is included at the end of this report.

The multitude of paving layers on Queen Anne Avenue and the bridging effect afforded by this paving make it difficult to predict the amount of vehicular load that is transmitted to the tunnel roof. It appears that the tunnels, as designed and constructed, are capable of withstanding only the superimposed pavement and earth loads. Many sections of the east tunnel where the concrete is poor and the resteel is exposed and rusted through are in danger of collapse. Portions of the west tunnel roof between Comstock Street and Prospect Street have failed structurally. This section of Queen Anne Avenue was graded and resurfaced sometime after tunnel construction, and failure undoubtedly occurred during this period and was caused by loads imposed by construction equipment operating over the tunnel without benefit of paving to distribute the load. The remainder of the west tunnel is in very good condition. The construction workmanship and the quality of concrete is substantially better than that of the east tunnel.

cc: Freitas

W. L. Freitas

TO :FILE

DATE: November 21, 1969

FROM :V. E. Critz

SUBJECT: QUEEN ANNE COUNTER BALANCE TUNNELS

During the mornings of November 18 and 19, Bill Freitas, John Hickman and myself made a conplete inspection of the two Queen Anne Counter Balance Tunnels.

The tunnels are located under the west side of Queen Anne Avenue and extend from Roy Street up Queen Anne Hill to Comstock Street. They are approximately 4' high, 5' wide, 6' apart and 2000' long.

A visual observation was made and the concrete was tested with a rebound hammer. These tunnels are approximately 60 years old. The test hammer will not indicate compressive strength of concrete this old, but will indicate the soundness of the concrete.

The west tunnel was in the best condition and of much better construction. The upper 600' from Comstock Street was cracked longitudinally along the center line of the top and sagging in one spot. The concrete is spalled in several places exposing the rebars. The rebar was badly rusted where exposed. The lower end (approximately 1500') was in good condition.

The east tunnel was of very poor construction with almost continuous rock pockets in the walls and many spalled out places in the top with the rebar rusted out to nothing. The top slab was cracked along the center line almost the entire length and sagging 1' or more in several places.

The test hammer indicated that the concrete is sound and in good condition where it isn't cracked or spalled.

VEC:ljh

cc: Jeffries
Freitas, W.

City Street Funds were used to return Queen Anne Avenue to a street use as it existed prior to the installation of the Counter Balance. On the basis of the foregoing data, we conclude the Counter Balance as an asset/liability of the City and the responsibility of the Engineering Department. Repair or removal could be accomplished with General Funds, City Street Funds, and possibly, Arterial City Street Funds, if the provision, " . . . to be used exclusively for construction, improvement, and repair of arterial highways and city streets . . ." (RCW 46.68.115), is met.

HTL:ft
12/31/81

THE QUEEN ANNE AVENUE COUNTER BALANCE

The Counter Balance was constructed by Sunset Electric Company in 1900-1901 (Stone and Webster Co.) within Queen Anne Avenue North, between West Roy Street and West Galer Street. The Counter Balance was constructed under Street Railway Franchise No. 5874 and No. 7015.

Sunset Electric Company was purchased by the Puget Sound Traction, Light and Power Company. The City of Seattle purchased P.S.T.L & P. Co. for $15,000,000.00 under Ordinance No. 29025 dated December 31, 1918. The City completed the purchase in 1939. This purchase was an addition, betterment and extension of the existing municipal street railway system owned and operated by the City of Seattle.

Puget Sound Traction, Light and Power Company ceased street railway operations in the City and surrendered its franchises and those of its predecessors in interest to the City when the City acquired the Company's street railway system in 1918. Ordinance No. 68592 repealed certain ordinances relating to the former street railway system of the Puget Sound Traction, Light and Power, and provided that the repeal by this ordinance of any existing ordinance shall not revive any former ordinance repealed nor affect any right existing or accrued in favor of the City. Ordinances No. 5374 and No. 7015, which authorized the construction and operation of the Counter Balance, are included in Ordinance No. 68592.

Ordinance No. 69274 adopted a plan for the existing Street Railway and Surface Transportation System and establishing a Transportation Commission. This Ordinance is dated June 19, 1939. The Counter Balance was now operated by the Transportation Commission.

The City ceased operation of the Counter Balance on Queen Anne Avenue August 10, 1940. Surface rails on Queen Anne Avenue were removed by contract between the City of Seattle and the Steel Recovery Corporation in 1944. Ordinance No. 72852 appropriated City Street Funds for this action which included the resurfacing of Queen Anne Avenue with concrete paving and the filling of the cable slots with pit-run sand and gravel.

Paragraph 7 of the Transit Transfer Agreement, City of Seattle - Municipality of Metropolitan Seattle - Transfer and Use of Properties - states:

> "On January 1, 1973, Metro shall have the right to use all operating properties of the City Transit System as provided in this Agreement."

The Counter Balance had ceased operation August 10, 1940 and was not an operating property in 1973.

CSS 7.11

60-7-1 RJA MDA JER JGR File

MEMORANDUM

To R. R. Parker, Attention: R. J. Anderson

By J. G. Ralph Date May 22, 1981

Subject Queen Anne Counterbalance Cable Ways

Recently a question was raised regarding ownership/responsibility for the Queen Anne counterbalance streetcar tunnels.

As I understand the background, Seattle Electric Co., built the trolley counterbalance around 1900. Later Seattle Electric became Puget Sound Power and Light Co. The counterbalance was sold by Puget Power to Seattle City Light in 1919. As an [illegible]
City Light claims the counterbalance was placed under the direction of Seattle Transit (not sure how this was accomplished), and of course, Seattle Transit is now a sub-set of METRO.

City Light, by letter (attached), believes they have no jurisdiction and suggests that either METRO or Engineering have jurisdiction.

I would have to believe this scenario would apply to other cableway, i.e., James Street and Madison Street, to name two.

I suggest a search be made of Engineering Department files and then, if nothing concrete turns up, to ask the City Attorney for his opinion.

Attached is a copy of our complete file on this subject.

JGR:bl
Att.
cc: E. V. Avery
J. J. Coover

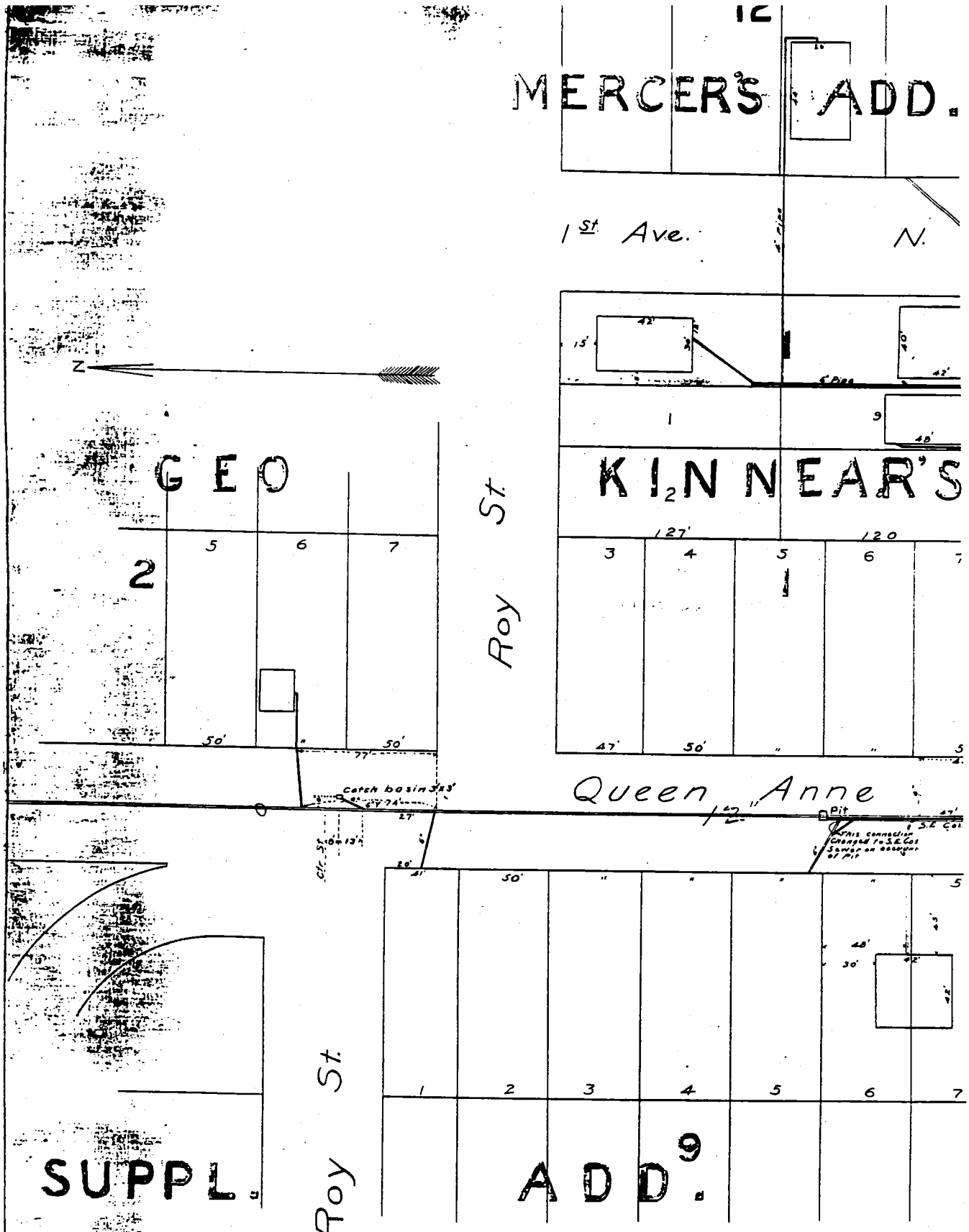
RECEIVED
MAY 27 1981
COURT & R/W DIVISION

recycled paper

ecology and environment

Appendix B

CITY ENGINEERING COUNTERBALANCE TUNNEL INSPECTION REPORT


MERCER'S ADD.
1st Ave. N.
GEO
KINNEAR'S
Roy St.
Queen Anne
Catch basin
Pit
SUPPL. ADD.
Roy St.
Made by
Checked by
N°3937

Seattle Sewerage.

FILE I.D. 33-43

Plan of Sewer and Side Connections on

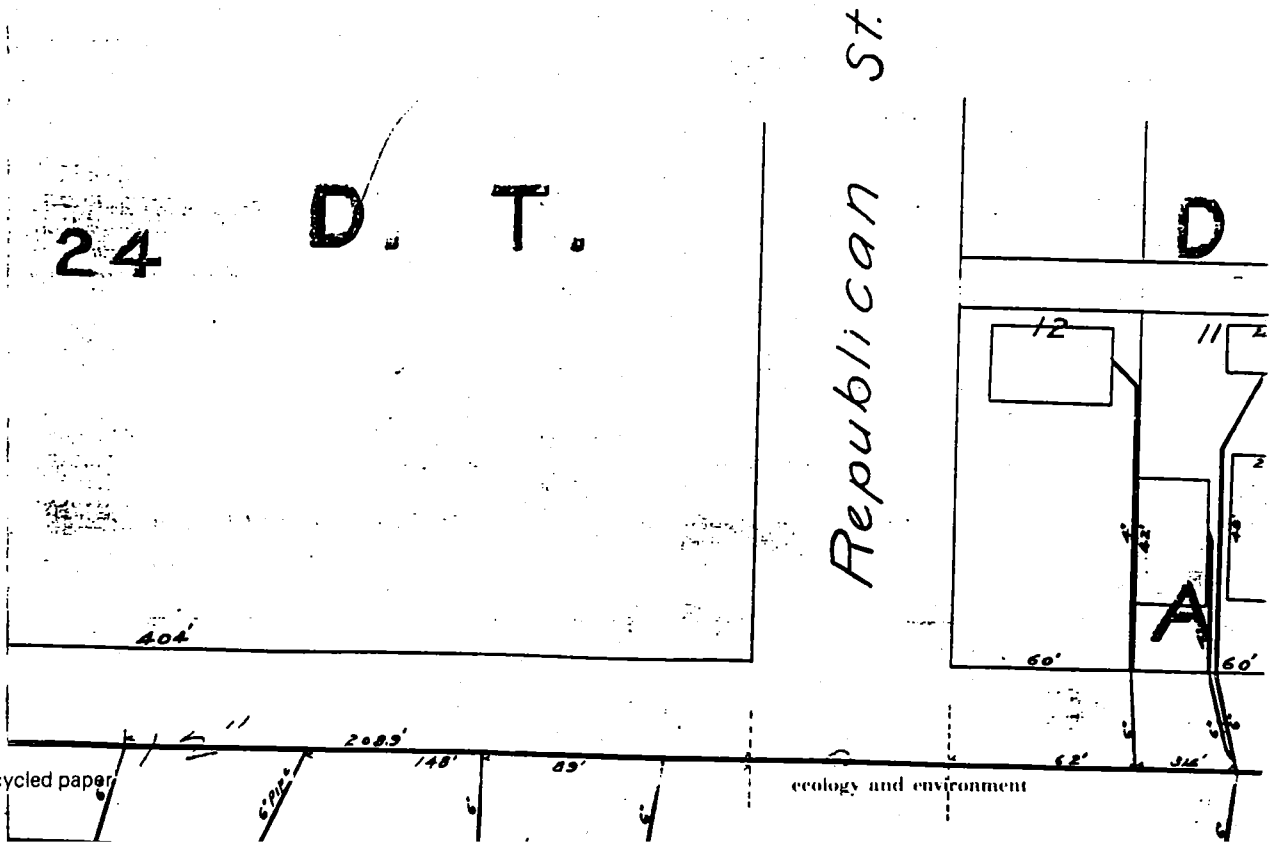
QUEEN ANNE AVENUE

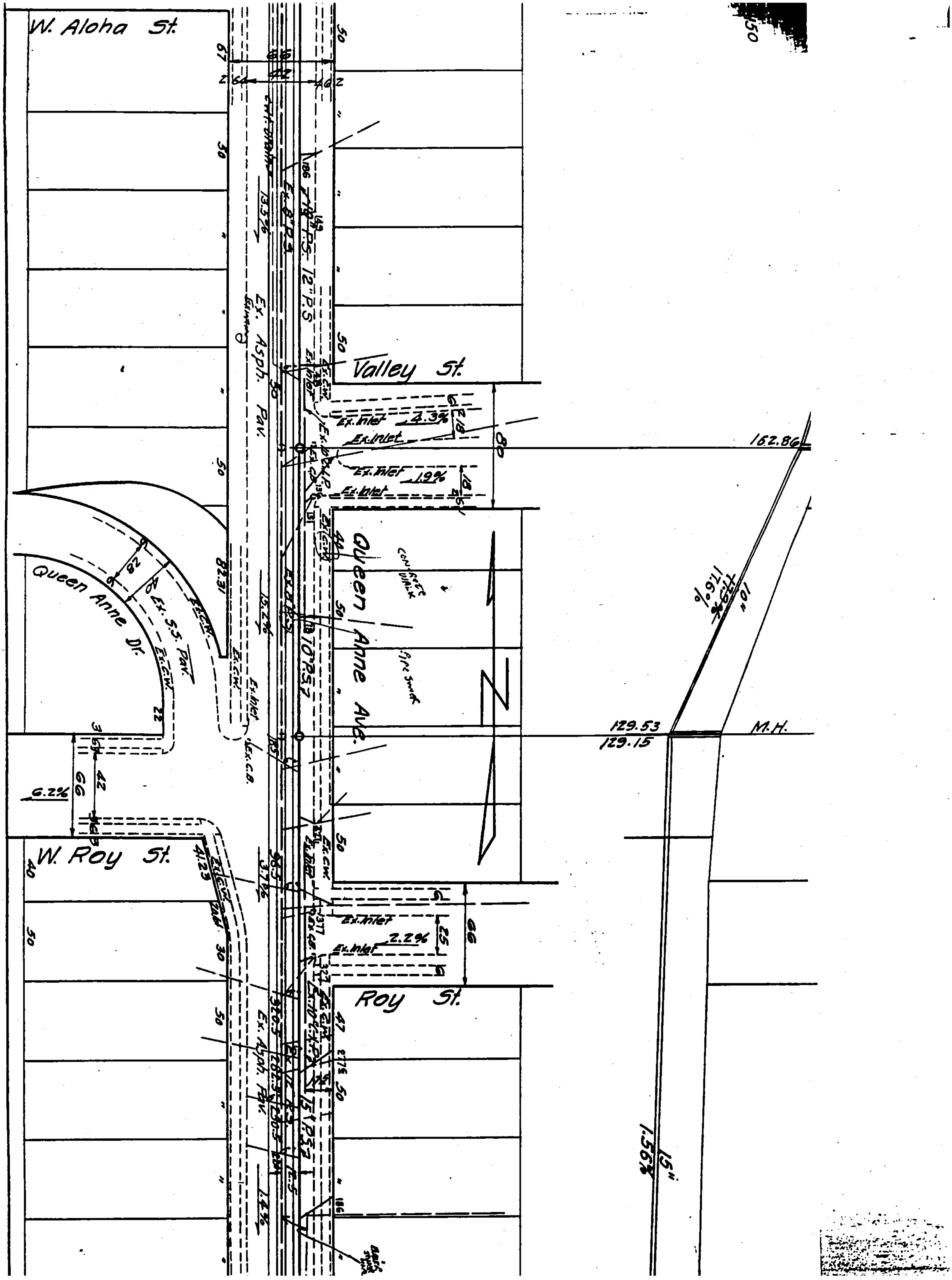
from Harrison Street to Roy Street.

September - 1903.

le: 1 inch = 50 feet.

R. H. Thomson,
City Engineer.




W. Aloha St.
Valley St.
Queen Anne Ave.
Queen Anne Dr.
W. Roy St.
Roy St.
Ex. Asph. Pav.
Ex. S.S. Pav.
Ex. Inlet
Ex. C.B.
Ex. C.W.
4.3%
1.9%
2.2%
6.2%
13.3%
15.2%
3.7%
1.4%
17.6%
1.56%
162.86
129.53
129.15
M.H.
15"
10"
12" P.S.
10" P.S.
15" P.S.
80
66
42
82.31
41.23

FILE I.D. 832-86

THE CITY OF SEATTLE

OFFICE OF THE CITY ENGINEER

QUEEN ANNE AVENUE
RELIEF SEWERS

King County Civil Works Administration

2 Sheets — Sheet 2

DECEMBER 1933

SCALE: 1 INCH 50 FEET

M. O. SYLLIAASEN
CITY ENGINEER

Drawn by A.L.H. 12-19-33	Approved by
Traced by " "	Approved by
Checked by	Approved by
Final Const. Chkd. by F.J.G. 12-6-34 From Info. Book	Assistant City Engineer
Work Done under Standard Specifications 5th Edition, Supplemented by Special Specifications. File No. 733-8	Contractor Ordered to Begin Work
	Work Reported Complete

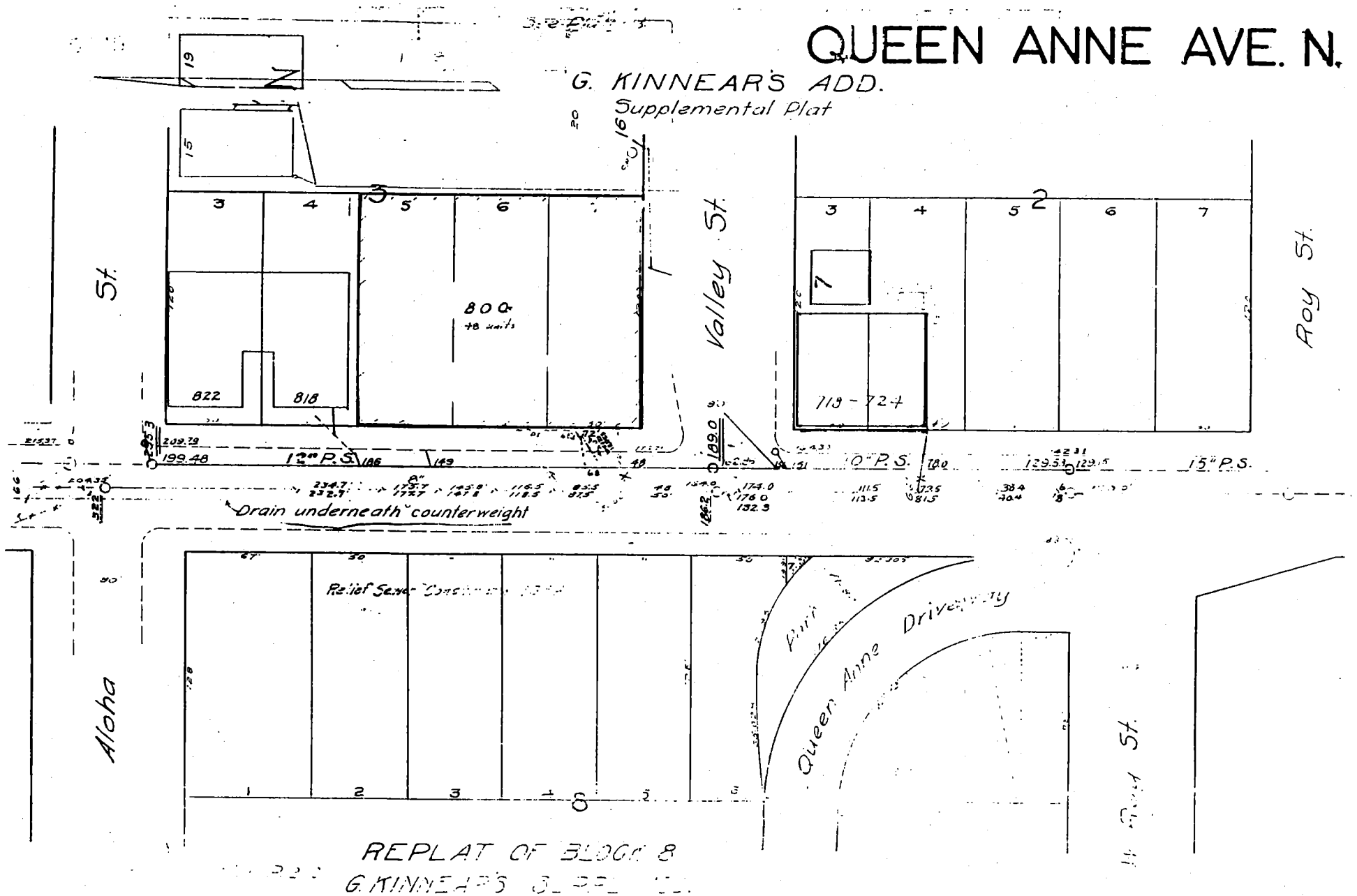
APPROVED BY THE BOARD OF PUBLIC WORKS

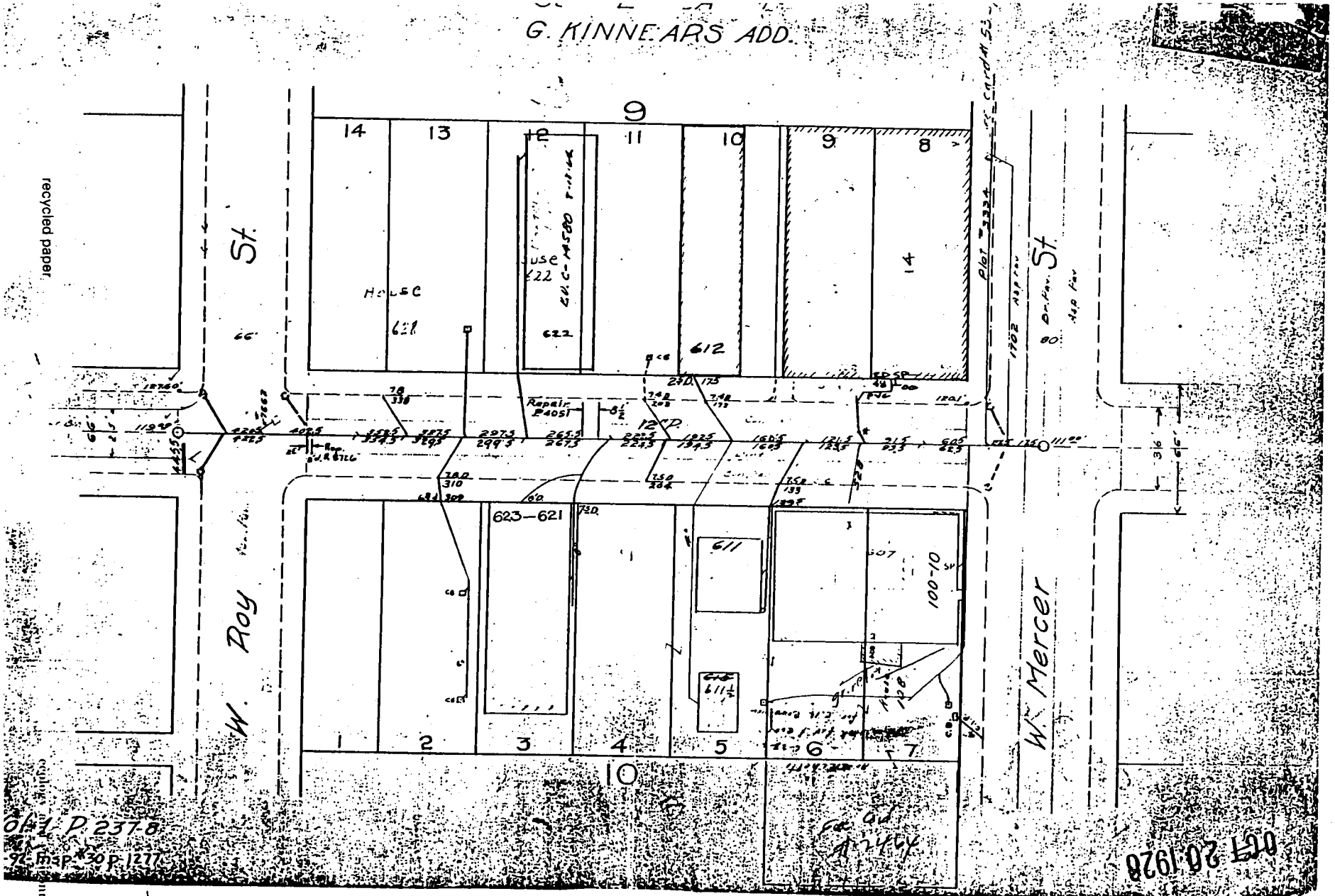
SEATTLE, WASHINGTON Dec 14 1933

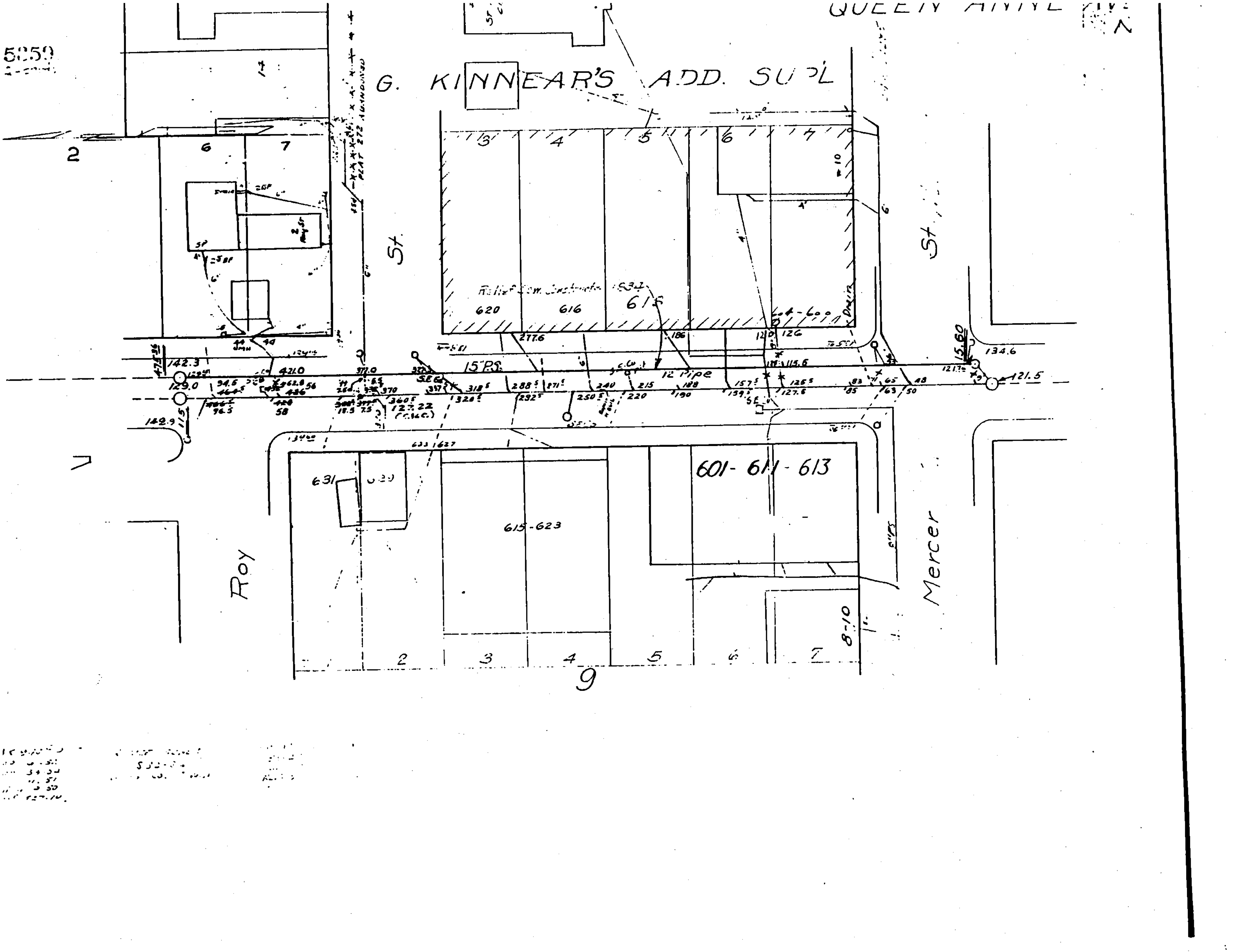
ATTEST: _____ _____

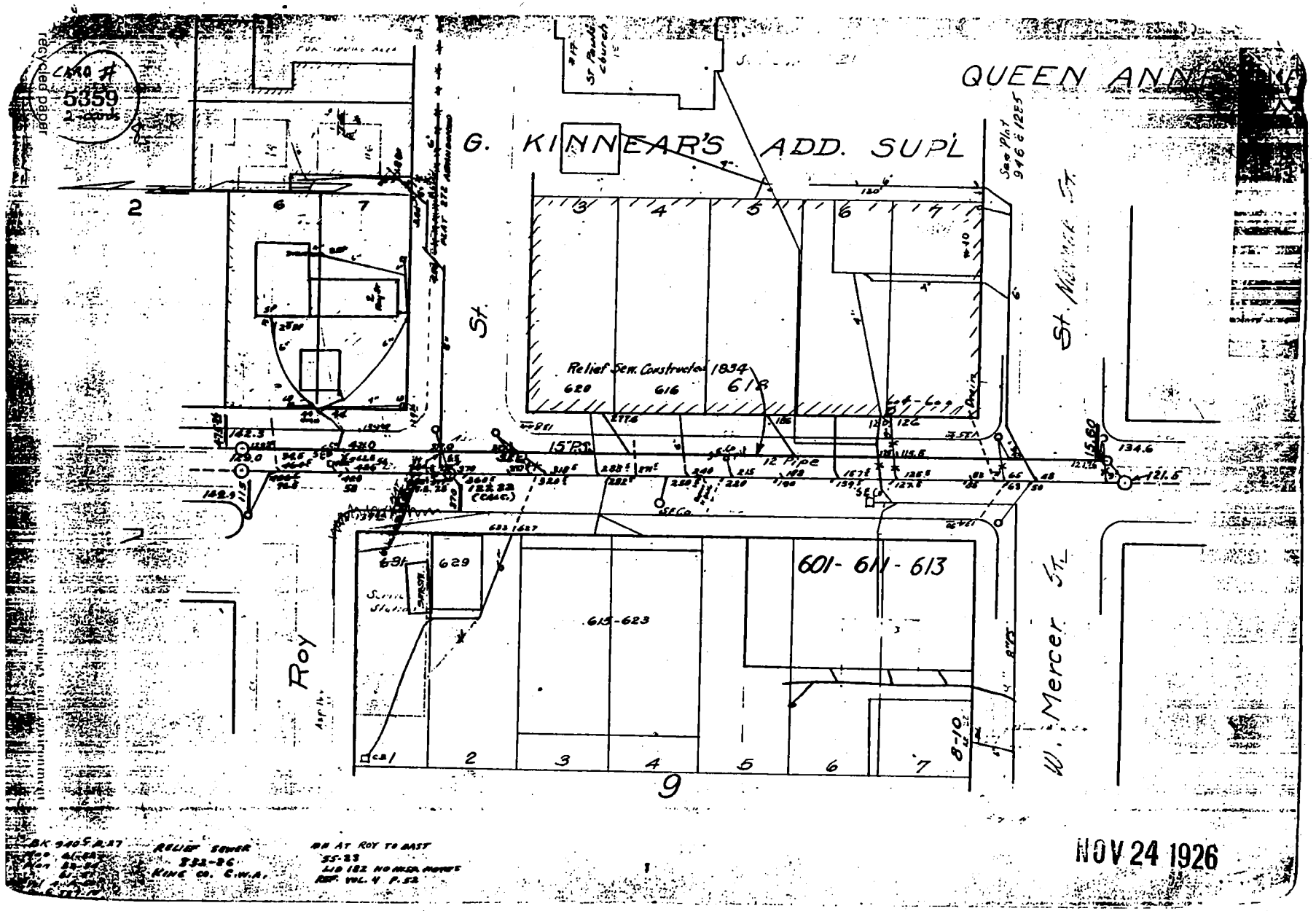
SECRETARY CHAIRMAN

19 X 37


QUEEN ANNE AVE. N.
G. KINNEAR'S ADD.
Supplemental Plat
Valley St.
Roy St.
Aloha St.
800
48 units
822
818
719 - 724
Drain underneath counterweight
Relief Sewer
Queen Anne Drive
REPLAT OF BLOCK 8
G. KINNEAR'S




5259
G. KINNEAR'S ADD. SUPL
St
St
Roy
Mercer
Relief Sew. Contract 1934
620
616
618
15 P.S.
12 Pipe
Drain
601- 611- 613
615-623
631
8-10
9



CARD H
5359
2 cards

recycled paper

SEATTLE
SEWER CARD
622 1st Ave

Appendix A

SEATTLE SEWERAGE AND STREET PLANS

Ineson, J. and R.F. Packham, 1967, Contamination of Water by Petroleum Products, The Joint Problems of the Oil and Water Industry, pp. 97-116.

Krullman, G.P., and N.A. de Ridder, 1990 - Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement - Publication 47.

LeSarge, Suzanne, Richard E. Jackson, Mark W. Priddle, Peter G. Riemann, 1990, Occurrence and Fate of Organic Solvent Residues in Anoxic Groundwater at the Glouester Landfill, Canada, Environ. Sci. Technol. Vol 24, No. 4, 1990.

Mullineaux, D.R., H.H. Waldron, and M. Rubin, 1965, U.S. Geological Survey Bulletin 1194-0.

Olsen, Roger L. and Andy Davis, 1990 - Predicting the Fate and Transport of Organic Compounds in Groundwater: Parts 1 and 2, May/June and July/August, HMC, pp. 39-64 and 18-37.

Puget Sound Council of Governments, December 1989, Population and Housing Estimates - April 1, 1989, Grand Central on the Park, 216 First Avenue South, Seattle, WA.

Richardson, Bingham, and Madison, 1968, Water Resources of King County, U.S. Geological Survey - Water Supply Paper 1852.

Seattle Post Intelligencer, August 8, 1940, City Ponders Very Weighty Tram Problem, p.13.

United States Environmental Protection Agency, April 1988, Cleanup of Releases from Petroleum USTs: Selected Technologies, EPA/530/-UST-88/001.

U.S. Geological Survey/National Ocean Survey, 1983, 1:25000-scale Metric Topographic-Bathymetric Map of Seattle North and Seattle South, Washington.

Vegei, T.M., C.S. Criddle, P.L. McCarty, 1987, Environ. Sci. Technol. Vol 21, pp. 722-736.

Washington State Department of Ecology, March 1989, Monterey Apartments, Internal repor' by David South, 23p.

Wolf K., R. Holland, A. Rajuratham, 1987, Journal of Hazardous Materials, vol. 15, pp. 163-184.

6. REFERENCES

Bouwer, H. and Rice, R.C., 1976, A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells, Water Resources Razz., Volume 12, pp. 423-428.

Converse Consultants NW, October 26, 1990, Level II Environmental Site Assessment 18 West Mercer Building Seattle, Washington, prepared for: Martin Selig Real Estate, Converse Project No. 90-35173-02.

Cooper, H.H., J.D. Bredehoeft, and I.S. Papadopulos, 1967, Response of a Finite-Diameter Well to an Instantaneous Charge of Water, Water Resources Res., Vol 3. pp. 263-269.

Domenico, Patrick A. and Franklin W. Schwartz, 1990, Physical and Chemical Hydrogeology, published by John Weley and Sons, Inc.

Driscoll, F.G., 1986, Groundwater and Wells, Published by Johnson Division, St. Paul, Minnesota.

Ecology and Environment, Inc., May 15, 1991, Phase 1 Remedial Investigation Project Work Plan, Monterey Apartments, Seattle, Washington.

____, September 11, 1990a, Trip Report, Monterey Apartments Site - Soil-Gas Pilot Study Summary.

____, August 1990b, Monterey Apartments, State of Washington, Remedial Investigation/Feasibility Study, Pilot Soil-Gas Study, Sampling Analytical Plan - FINAL.

Environmental Research Center, University of Nevada, Las Vegas, 1987, Soil-Gas Sensing for Detection and Mapping of Volatile Organics, published thru the National Water Well Association.

Freeze, R.A., and J.A. Cherry, 1979, Groundwater, published by Prentice-Hall, Inc., Englewood Cliffs, N.J.

GeoEngineers, Inc., 1989, Report of Geotechnical Services Subsurface Contamination Study Unocal Service Station 0255, Seattle, Washington for Unocal.

____, 1986, Report of Hydrogeologic Services Subsurface Fuel Contamination Problem Queen Anne District, Seattle, Washington for the Washington State Department of Ecology.

Senn, R., and M. Johnson, Winter 1987, Interpretation of Gas Chromatographic Data in Subsurface Hydrocarbon Investigations, Ground Water Monitoring Review, Vol. 7, No. 1.

Ineson, J. and R.F. Packham, 1967, Contamination of Water by Petroleum Products, The Joint Problems of the Oil and Water Industry, pp. 97-116.

Krullman, G.P., and N.A. de Ridder, 1990 - Analysis and Evaluation of Pumping Test Data, International Institute for Land Reclamation and Improvement - Publication 47.

LeSarge, Suzanne, Richard E. Jackson, Mark W. Priddle, Peter G. Riemann, 1990, Occurrence and Fate of Organic Solvent Residues in Anoxic Groundwater at the Gloucster Landfill, Canada, Environ. Sci. Technol. Vol 24, No. 4, 1990.

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Olsen, Roger L. and Andy Davis, 1990 - Predicting the Fate and Transport of Organic Compounds in Groundwater: Parts 1 and 2, May/June and July/August, HMC, pp. 39-64 and 18-37.

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United States Environmental Protection Agency, April 1988, Cleanup of Releases from Petroleum USTs: Selected Technologies, EPA/530/-UST-88/001.

U.S. Geological Survey/National Ocean Survey, 1983, 1:25000-scale Metric Topographic-Bathymetric Map of Seattle North and Seattle South, Washington.

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Washington State Department of Ecology, March 1989, Monterey Apartments, Internal report by David South, 23p.

Wolf K., R. Holland, A. Rajuratham, 1987, Journal of Hazardous Materials, vol. 15, pp. 163-184.

5. CONCLUSION

Site characterization accomplished during the Phase 1 RI identified contaminants and defined the concentrations of those contaminants existing on and in the groundwater beneath the site. With the application of soil-gas sensing techniques, the distribution and pathways of the petroleum contamination also was evaluated. The origins of the released petroleum compounds were interpreted from the data and identified.

Regulated petroleum compounds caused by gasoline/diesel spillage have contaminated the soils, vadose zone, and groundwater at the Monterey Apartments site. Floating petroleum persisting beneath the Express facility is responsible for the organic vapor human health risk conditions occurring at the Monterey and Del Roy apartment buildings. Migration of contaminants away from the product plume has been observed to be influenced by precipitation events which mobilize the residing free product as well as petroleum residuals in the zone of groundwater fluctuation. Continued health risk from organic vapor problems can be expected to reoccur indefinitely as long as the product pool and associated residual soil contamination within the impact zone remain in place and available for transport, especially during high water table periods and/or specific meteorological events.

- The fuel composition gas chromatogram patterns of floating product samples collected from wells at the Express and Unocal facilities were dissimilar (MW-6 and MW-8).

- Known utility corridors existing between the Express and Unocal properties are not orientated in such a way as to create potential hydraulic migration pathways toward the Express property. Utilities installed beneath Queen Anne Avenue are oriented north-south, and utility trenches positioned at water table depths (e.g., sewer) would favor a southward flow direction beneath the street.

- The soil-gas survey results did not indicate the existence of relatively nondegraded fuel, like that found beneath the Express property, at locations along potential migration routes from the Unocal property.

- Based on groundwater elevation data collected since 1986, MW-10 is positioned at a location which would be expected to intercept groundwater flow from Unocal prior to moving beneath the Express property. This well has consistently been free of floating petroleum and the groundwater contained no BTEX or TPH analytes during the RI which would indicate a measurable contribution from Unocal to the Express problem.

A more detailed evaluation of contaminant distribution, release history, spill volumes, and contaminated soil volumes at Unocal was not performed as part of the Phase 1 RI. Future study of this property will require these topics be addressed prior to cleanup planning. The times of the Unocal release(s) are not defined, but may have occurred prior to 1966, when the facility was reconstructed (see Section 3.3.5).

4.3 CONTAMINANTS OF CONCERN

The results of the Phase 1 RI documented the persistence of gasoline/diesel petroleum contamination at the site in three principle environmental media: soil, groundwater, and soil-gas. The UST releases beneath both the Express and Unocal facilities impacted soils and reached the underlying shallow water table, resulting in groundwater contamination. The less degraded character of the free product found beneath the Express facility has resulted in an organic vapor human health hazard not observed at Unocal.

Transaction #: 11079901 Seq #: 03 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298023 Alternate Keys:

SGDJ TICs

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/112

Line	Par #	Parameter Description	Units	Value	
1	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	6.3NJ	
2	933982	BENZENE, 1-ETHYL-2,3-DIMETHY	ug/m3	10NJ	
3	535773	BENZENE, 1-METHYL-3-(1-METHY	ug/m3	17NJ	
4	624839	Isocyanic Acid, Methyl Ester	ug/m3	110NJ	4A
5	79298	BUTANE, 2,3-DIMETHYL-	ug/m3	440NJ	(1)
6	16747254	HEXANE, 2,2,3-TRIMETHYL-	ug/m3	180NJ	(2)
7	96140	PENTANE, 3-METHYL-	ug/m3	100NJ	(5)
8	5618622	HYDROXYLAMINE, O-(2-METHYLPR	ug/m3	67NJ	(6)
9	51677419	BUTANE, 2-AZIDO-2,3,3-TRIMET	ug/m3	150NJ	(3)
10	108872	CYCLOHEXANE, METHYL-	ug/m3	23NJ	
11	584941	Hexane, 2,3-Dimethyl-	ug/m3	28NJ	
12	620144	BENZENE, 1-ETHYL-3-METHYL-	ug/m3	20NJ	
13	62108230	DECANE, 2,5,6-TRIMETHYL-	ug/m3	110NJ	(4B)
14	526738	BENZENE, 1,2,3-TRIMETHYL-	ug/m3	28NJ	
15	62108263	DECANE, 2,6,8-TRIMETHYL-	ug/m3	51NJ	
16	31081182	Nonane, 3-Methyl-5 Propyl	ug/m3	18NJ	

11/16/90

Transaction #: 11079902 Seq #: 04 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298024 Alternate Keys:

SC84

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 900726 # Days to Ext/Anal: 0/ 6

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	18U
5	74839	Bromomethane	ug/m3	18U
6	75014	Vinyl Chloride	ug/m3	18U
7	75003	Chloroethane	ug/m3	18U
8	75694	Trichlorofluoromethane	ug/m3	130 J
9	75092	Methylene Chloride	ug/m3	18U
10	67641	Acetone	ug/m3	46U
11	75150	Carbon Disulfide	ug/m3	18UJ
12	75354	1,1-Dichloroethene	ug/m3	8J
13	75343	1,1-Dichloroethane	ug/m3	18U
14	156605	trans-1,2-Dichloroethene	ug/m3	18U
15	156592	Cis-1,2-Dichloroethene	ug/m3	18U
16	590207	2,2-Dichloropropane	ug/m3	18U
17	74975	Bromochloromethane	ug/m3	18U
18	67663	Chloroform	ug/m3	18U
19	107062	1,2-Dichloroethane	ug/m3	18U
21	78933	2-Butanone	ug/m3	29U
22	71556	1,1,1-Trichloroethane	ug/m3	18U
23	56235	Carbon Tetrachloride	ug/m3	18U
24	563586	1,1-Dichloropropene	ug/m3	18U
26	75274	Bromodichloromethane	ug/m3	18U
27	78875	1,2-Dichloropropane	ug/m3	18U
28	74953	Dibromomethane	ug/m3	18U
29	10061026	trans-1,3-Dichloropropene	ug/m3	18U
30	79016	Trichloroethene	ug/m3	18U
31	124481	Dibromochloromethane	ug/m3	18U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	18U
33	79005	1,1,2-Trichloroethane	ug/m3	18U
34	142289	1,3-Dichloropropane	ug/m3	18U
35	71432	Benzene	ug/m3	18U
36	10061015	cis-1,3-Dichloropropene	ug/m3	18U
37	75252	Bromoform	ug/m3	18U
38	591786	2-Hexanone	ug/m3	18U
39	108101	4-Methyl-2-Pentanone	ug/m3	18U
40	127184	Tetrachloroethene	ug/m3	8J
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	18U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	18U
43	108883	Toluene	ug/m3	18U
44	108907	Chlorobenzene	ug/m3	18U
45	100414	BENZENE, ETHYL-	ug/m3	18U
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	18U
47	108861	Bromobenzene	ug/m3	18U
48	96184	1,2,3-Trichloropropane	ug/m3	18U
49	95498	2-Chlorotoluene	ug/m3	18U
50	106434	4-Chlorotoluene	ug/m3	18U

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(continued on next page)

Transaction #: 11079902 Seq #: 04 (55) Air Toxics Volatiles

Sample No.: 90 298024 (continued from previous page)

5634 cont.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	18U
52	95636	1,2,4-Trimethylbenzene	ug/m3	19
53	98066	Tert-Butylbenzene	ug/m3	18U
54	108678	1,3,5-Trimethylbenzene	ug/m3	52
55	135988	Sec-Butylbenzene	ug/m3	41
56	99876	p-Isopropyltoluene	ug/m3	18U
57	104518	Butylbenzene	ug/m3	18U
58	96128	DBCP	ug/m3	18U
59	87616	1,2,3-Trichlorobenzene	ug/m3	18U
60	98828	Isopropylbenzene (Cumene)	ug/m3	18U
				18U
62	98873	Benzal Chloride	ug/m3	
63	541731	1,3-Dichlorobenzene	ug/m3	18U
64	106467	1,4-Dichlorobenzene	ug/m3	18U
65	95501	1,2-Dichlorobenzene	ug/m3	18U
66	120821	1,2,4-Trichlorobenzene	ug/m3	18U
67	91203	Naphthalene	ug/m3	18U
68	87683	Hexachlorobutadiene	ug/m3	18U

11/14/90

*** Lab Analysis Report ***

Transaction #: 11079901 Seq #: 04 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298024 Alternate Keys:

Samp Matrix: (60) Air SG04 TICs Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/112

Line	Par #	Parameter Description	Units	Value
1	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	26NJ
2	1074175	BENZENE, 1-METHYL-2-PROPYL-	ug/m3	24NJ
3	934805	BENZENE, 4-ETHYL-1,2-DIMETHY	ug/m3	40NJ
4	488233	Benzene, 1,2,3,4-Tetramethyl	ug/m3	27NJ
5	1196583	BENZENE, (1-ETHYLPROPYL)-	ug/m3	18NJ
6	62108229	DECANE, 2,5,9 TRIMETHYL	ug/m3	140NJ (3)
7	62108252	DECANE, 2,6,7-TRIMETHYL-	ug/m3	270NJ (1)
8	25340174	BENZENE, DIETHYL-	ug/m3	66NJ
9	624839	Isocyanic Acid, Methyl Ester	ug/m3	92NJ (5)
10	109682	2-PENTENE	ug/m3	30NJ
11	1647254	HEXANE, 2,2,3-TRIMETHYL-	ug/m3	150NJ (2)
12	96140	PENTANE, 3-METHYL-	ug/m3	68NJ
13	5618622	HYDROXYLAMINE, O-(2-METHYLPR	ug/m3	51NJ
14	589344	HEXANE, 3-METHYL-	ug/m3	32NJ
15	108872	CYCLOHEXANE, METHYL-	ug/m3	18NJ
16	20278879	HEPTANE, 3,3,4-TRIMETHYL-	ug/m3	25NJ
17	921471	HEXANE, 2,3,4-TRIMETHYL-	ug/m3	12NJ
18	66221	HEXANAL	ug/m3	19NJ
19	62108230	DECANE, 2,5,6-TRIMETHYL-	ug/m3	110NJ (4)
20	25155151	BENZENE, METHYL(1-METHYLETHY	ug/m3	80NJ (6)
21	622968	BENZENE, 1-ETHYL-4-METHYL-	ug/m3	26NJ
22	620144	BENZENE, 1-ETHYL-3-METHYL-	ug/m3	9.2NJ
23	1758889	BENZENE, 2-ETHYL-1,4-DIMETHY	ug/m3	40NJ

11/14/90

ansaction #: 11079902 Seq #: 05 (55) Air Toxics Volatiles
roj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

mple No.: 90 298025 Alternate Keys:

amp Matrix: (60) Air S-05 Units: (93) ug/m3 %Slds: ____
Code: ( ) Unspecifed Peaks Total: ____
te Extracted: Date Analyzed: 900727 # Days to Ext/Anal: 0/ 8

ne	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	9200U
5	74839	Bromomethane	ug/m3	9200U
6	75014	Vinyl Chloride	ug/m3	9200U
7	75003	Chloroethane	ug/m3	9200U
8	75694	Trichlorofluoromethane	ug/m3	9200U
9	75092	Methylene Chloride	ug/m3	9200U
0	67641	Acetone	ug/m3	9200U
1	75150	Carbon Disulfide	ug/m3	9200UJ
12	75354	1,1-Dichloroethene	ug/m3	9200U
13	75343	1,1-Dichloroethane	ug/m3	9200U
4	156605	trans-1,2-Dichloroethene	ug/m3	9200U
15	156592	Cis-1,2-Dichloroethene	ug/m3	9200U
16	590207	2,2-Dichloropropane	ug/m3	9200U
7	74975	Bromochloromethane	ug/m3	9200U
8	67663	Chloroform	ug/m3	9200U
19	107062	1,2-Dichloroethane	ug/m3	9200U
1	78933	2-Butanone	ug/m3	9200U
22	71556	1,1,1-Trichloroethane	ug/m3	9200U
23	56235	Carbon Tetrachloride	ug/m3	9200U
4	563586	1,1-Dichloropropene	ug/m3	9200U
26	75274	Bromodichloromethane	ug/m3	9200U
27	78875	1,2-Dichloropropane	ug/m3	9200U
8	74953	Dibromomethane	ug/m3	9200U
29	10061026	trans-1,3-Dichloropropene	ug/m3	9200U
30	79016	Trichloroethene	ug/m3	9200U
1	124481	Dibromochloromethane	ug/m3	9200U
2	106934	1,2-Dibromoethane (EDB)	ug/m3	9200U
33	79005	1,1,2-Trichloroethane	ug/m3	9200U
34	142289	1,3-Dichloropropane	ug/m3	9200U
5	71432	[redacted]	ug/m3	[redacted]
36	10061015	cis-1,3-Dichloropropene	ug/m3	9200U
37	75252	Bromoform	ug/m3	9200U
8	591786	2-Hexanone	ug/m3	9200U
9	108101	4-Methyl-2-Pentanone	ug/m3	9200U
40	127184	Tetrachloroethene	ug/m3	9200U
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	9200U
2	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	9200U
43	108883	[redacted]	ug/m3	[redacted]
44	108907	Chlorobenzene	ug/m3	9200U
5	100414	[redacted]	ug/m3	[redacted]
6	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	9200U
47	108861	Bromobenzene	ug/m3	9200U
48	96184	1,2,3-Trichloropropane	ug/m3	9200U
9	95498	2-Chlorotoluene	ug/m3	9200U
50	106434	4-Chlorotoluene	ug/m3	9200U

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Transaction #: 11079902 Seq #: 05 (55) Air Toxics Volatiles

Sample No.: 90 298025 (continued from previous page)

5605 cont.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	27000U
52	95636	1,2,4-Trimethylbenzene	ug/m3	9200U
53	98066	Tert-Butylbenzene	ug/m3	9200U
54	108678	1,3,5-Trimethylbenzene	ug/m3	9200U
55	135988	Sec-Butylbenzene	ug/m3	9200U
56	99876	p-Isopropyltoluene	ug/m3	9200U
57	104518	Butylbenzene	ug/m3	9200U
58	96128	DBCP	ug/m3	9200U
59	87616	1,2,3-Trichlorobenzene	ug/m3	9200U
60	98828	Isopropylbenzene (Cumene)	ug/m3	9200U
61	103651	BENZENE, PROPYL-	ug/m3	9200U
63	541731	1,3-Dichlorobenzene	ug/m3	9200U
64	106467	1,4-Dichlorobenzene	ug/m3	9200U
65	95501	1,2-Dichlorobenzene	ug/m3	9200U
66	120821	1,2,4-Trichlorobenzene	ug/m3	9200U
67	91203	Naphthalene	ug/m3	9200U
68	87683	Hexachlorobutadiene	ug/m3	9200U

11/16/90

Transaction #: 11079901 Seq #: 05 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298025 Alternate Keys:

Samp Matrix: (60) Air 5605 TICs Units: (93) ug/m3 %Slds: ____
Qa Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/111

Line	Par #	Parameter Description	Units	Value
1	-300013	UNKNOWN HYDROCARBON (TOTAL)	ug/m3	1.5E7NJ (1)
2	624839	Isocyanic Acid, Methyl Ester	ug/m3	2.E6NJ
3	1630940	CYCLOPROPANE, 1,1-DIMETHYL-	ug/m3	2.4E6NJ (5)
4	109682	2-PENTENE	ug/m3	4.4E6NJ (3)
5	5618622	HYDROXYLAMINE, O-(2-METHYLPR	ug/m3	650,000NJ
6	79298	BUTANE, 2,3-DIMETHYL-	ug/m3	5.3E6NJ (2)
7	16747254	HEXANE, 2,2,3-TRIMETHYL-	ug/m3	3.6E6NJ (4)
8	763291	1-PENTENE, 2-METHYL-	ug/m3	760,000NJ
9	96140	PENTANE, 3-METHYL-	ug/m3	3.2E6NJ
10	616126	2-PENTENE, 3-METHYL-, (E)-	ug/m3	530,000NJ
11	592438	2-HEXENE	ug/m3	800,000NJ
12	691383	2-PENTENE, 4-METHYL-, (Z)-	ug/m3	760,000NJ
13	616126	2-PENTENE, 3-METHYL-, (E)-	ug/m3	400,000NJ
14	7642093	3-HEXENE, (Z)-	ug/m3	310,000NJ
15	1115088	1,4-PENTADIENE, 3-METHYL-	ug/m3	500,000NJ
16	594821	BUTANE, 2,2,3,3-TETRAMETHYL-	ug/m3	2.2E6NJ (6)
17	108872	CYCLOHEXANE, METHYL-	ug/m3	610,000NJ
18	584941	Hexane, 2,3-Dimethyl-	ug/m3	370,000NJ
19	921471	HEXANE, 2,3,4-TRIMETHYL-	ug/m3	380,000NJ
20	108087	PENTANE, 2,4-DIMETHYL-	ug/m3	270,000NJ
21	921471	HEXANE, 2,3,4-TRIMETHYL-	ug/m3	190,000NJ
22	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	46,000NJ
23	526738	BENZENE, 1,2,3-TRIMETHYL-	ug/m3	7,400NJ

4/16/90

Transaction #: 11079902 Seq #: 06 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298026 Alternate Keys:

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 900727 # Days to Ext/Anal: 07 8

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	200U
5	74839	Bromomethane	ug/m3	200U
6	75014	Vinyl Chloride	ug/m3	200U
7	75003	Chloroethane	ug/m3	200U
8	75694	Trichlorofluoromethane	ug/m3	200U
9	75092	Methylene Chloride	ug/m3	200U
10	67641	Acetone	ug/m3	200U
11	75150	Carbon Disulfide	ug/m3	200UJ
12	75354	1,1-Dichloroethene	ug/m3	200U
13	75343	1,1-Dichloroethane	ug/m3	200U
14	156605	trans-1,2-Dichloroethene	ug/m3	200U
15	156592	Cis-1,2-Dichloroethene	ug/m3	200U
16	590207	2,2-Dichloropropane	ug/m3	200U
17	74975	Bromochloromethane	ug/m3	200U
18	67663	Chloroform	ug/m3	200U
19	107062	1.2-Dichloroethane	ug/m3	200U
21	78933	2-Butanone	ug/m3	200U
22	71556	1,1,1-Trichloroethane	ug/m3	200U
23	56235	Carbon Tetrachloride	ug/m3	200U
24	563586	1,1-Dichloropropene	ug/m3	200U
26	75274	Bromodichloromethane	ug/m3	200U
27	78875	1,2-Dichloropropane	ug/m3	200U
28	74953	Dibromomethane	ug/m3	200U
29	10061026	trans-1,3-Dichloropropene	ug/m3	200U
30	79016	Trichloroethene	ug/m3	200U
31	124481	Dibromochloromethane	ug/m3	200U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	200U
33	79005	1,1,2-Trichloroethane	ug/m3	200U
34	142289	1,3-Dichloropropane	ug/m3	200U
35	71432	[redacted]		
36	10061015	cis-1,3-Dichloropropene	ug/m3	200U
37	75252	Bromoform	ug/m3	200U
38	591786	2-Hexanone	ug/m3	200U
39	108101	4-Methyl-2-Pentanone	ug/m3	200U
40	127184	Tetrachloroethene	ug/m3	200U
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	200U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	200U
43	108883	Toluene	ug/m3	200U
44	108907	Chlorobenzene	ug/m3	200U
45	100414	BENZENE, ETHYL-	ug/m3	200U
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	200U
47	108861	Bromobenzene	ug/m3	200U
48	96184	1,2,3-Trichloropropane	ug/m3	200U
49	95498	2-Chlorotoluene	ug/m3	200U
50	106434	4-Chlorotoluene	ug/m3	200U

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ransaction #: 11079902 Seq #: 06 (55) Air Toxics Volatiles

Sample No.: 90 298026 (continued from previous page)

5606 cont.

Line	Par #	Parameter Description	Units	Value
51	95476	Total Xylenes	ug/m3	59J
52	95636	1,2,4-Trimethylbenzene	ug/m3	200U
53	98066	Tert-Butylbenzene	ug/m3	200U
54	108678	1,3,5-Trimethylbenzene	ug/m3	550
55	135988	Sec-Butylbenzene	ug/m3	200U
56	99876	p-Isopropyltoluene	ug/m3	200U
57	104518	Butylbenzene	ug/m3	200U
58	96128	DBCP	ug/m3	200U
59	87616	1,2,3-Trichlorobenzene	ug/m3	200U
60	98828	Isopropylbenzene (Cumene)	ug/m3	39J
51	103651	BENZENE, PROPYL-	ug/m3	88J
63	541731	1,3-Dichlorobenzene	ug/m3	200U
64	106467	1,4-Dichlorobenzene	ug/m3	200U
65	95501	1,2-Dichlorobenzene	ug/m3	200U
66	120821	1,2,4-Trichlorobenzene	ug/m3	200U
67	91203	Naphthalene	ug/m3	200U
68	87683	Hexachlorobutadiene	ug/m3	200U

11/16/90

*** Lab Analysis Report ***

Transaction #: 11079901 Seq #: 06 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298026 Alternate Keys:

Samp Matrix: (60) Air SG06 T.C.s Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/111

Line	Par #	Parameter Description	Units	Value
1	-300013	UNKNOWN HYDROCARBON (TOTAL)	ug/m3	5400J
2	1630940	CYCLOPROPANE, 1,1-DIMETHYL-	ug/m3	2,100NJ (3)
3	109682	2-PENTENE	ug/m3	1,200NJ (5)
4	589344	HEXANE, 3-METHYL-	ug/m3	8,700NJ (1)
5	16747254	HEXANE, 2,2,3-TRIMETHYL-	ug/m3	3,400NJ (2A)
6	96140	PENTANE, 3-METHYL-	ug/m3	3,400NJ (2B)
7	-300012	NUMEROUS UNKNOWN HYDROCARBON	ug/m3	1,100NJ (6)
8	108872	CYCLOHEXANE, METHYL-	ug/m3	1,600NJ (4)
9	584941	Hexane, 2,3-Dimethyl-	ug/m3	1,000NJ
10	921471	HEXANE, 2,3,4-TRIMETHYL-	ug/m3	980NJ
11	611143	BENZENE, 1-ETHYL-2-METHYL-	ug/m3	470NJ

11/16/90

Transaction #: 11079902 Seq #: 07 (55) Air Toxics Volatiles
Proj Code : DOE-633C MONTEREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298027 Alternate Keys:

Samp Matrix: (60) Air 5607 Units: (93) ug/m3 %Slds: ____
Lab Code: ( ) Unspecifed AMBIENT SAMPLE Peaks Total: ____
Date Extracted: Date Analyzed: 900727 # Days to Ext/Anal: 07 9

Line	Par #	Parameter Description	Units	Value
1	74873	Chloromethane	ug/m3	13U
5	74839	Bromomethane	ug/m3	13U
6	75014	Vinyl Chloride	ug/m3	13U
7	75003	Chloroethane	ug/m3	13U
8	75694	Trichlorofluoromethane	ug/m3	13U
9	75092	Methylene Chloride	ug/m3	13U
10	67641	Acetone	ug/m3	13U
11	75150	Carbon Disulfide	ug/m3	13UJ
12	75354	1,1-Dichloroethene	ug/m3	13U
13	75343	1,1-Dichloroethane	ug/m3	13U
14	156605	trans-1,2-Dichloroethene	ug/m3	13U
15	156592	Cis-1,2-Dichloroethene	ug/m3	13U
16	590207	2,2-Dichloropropane	ug/m3	13U
17	74975	Bromochloromethane	ug/m3	13U
18	67663	Chloroform	ug/m3	13U
19	107062	1,2-Dichloroethane	ug/m3	13U
21	78933	2-Butanone	ug/m3	13U
22	71556	1,1,1-Trichloroethane	ug/m3	13U
23	56235	Carbon Tetrachloride	ug/m3	13U
24	563586	1,1-Dichloropropene	ug/m3	13U
26	75274	Bromodichloromethane	ug/m3	13U
27	78875	1,2-Dichloropropane	ug/m3	13U
28	74953	Dibromomethane	ug/m3	13U
29	10061026	trans-1,3-Dichloropropene	ug/m3	13U
30	79016	Trichloroethene	ug/m3	13U
31	124481	Dibromochloromethane	ug/m3	13U
32	106934	1,2-Dibromoethane (EDB)	ug/m3	13U
33	79005	1,1,2-Trichloroethane	ug/m3	13U
34	142289	1,3-Dichloropropane	ug/m3	13U
35	71432	Benzene	ug/m3	13U
36	10061015	cis-1,3-Dichloropropene	ug/m3	13U
37	75252	Bromoform	ug/m3	13U
38	591786	2-Hexanone	ug/m3	13U
39	108101	4-Methyl-2-Pentanone	ug/m3	13U
40	127184	Tetrachloroethene	ug/m3	13U
41	79345	ETHANE, 1,1,2,2-TETRACHLORO-	ug/m3	13U
42	630206	Ethane, 1,1,1,2-Tetrachloro-	ug/m3	13U
43	108883	Toluene	ug/m3	13U
44	108907	Chlorobenzene	ug/m3	13U
45	100414	BENZENE, ETHYL-	ug/m3	13U
46	100425	BENZENE, ETHENYL-(STYRENE)	ug/m3	13U
47	108861	Bromobenzene	ug/m3	13U
48	96184	1,2,3-Trichloropropane	ug/m3	13U
49	95498	2-Chlorotoluene	ug/m3	13U
50	106434	4-Chlorotoluene	ug/m3	13U

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Transaction #: 11079902 Seq #: 07 (55) Air Toxics Volatiles

Sample No.: 90 298027 (continued from previous page)

SG07 cont.
AMBIENT SAMPLE

Line	Par #	Parameter Description	Units	Value	
51	95476	Total Xylenes	ug/m3	13U	
52	95636	1,2,4-Trimethylbenzene	ug/m3	13U	
53	98066	Tert-Butylbenzene	ug/m3	13U	
54	108678	1,3,5-Trimethylbenzene	ug/m3	13U	
55	135988	Sec-Butylbenzene	ug/m3	13U	
56	99876	p-Isopropyltoluene	ug/m3	13U	
57	104518	Butylbenzene	ug/m3	13U	
58	96128	DBCP	ug/m3	13U	
59	87616	1,2,3-Trichlorobenzene	ug/m3	13U	
60	98828	Isopropylbenzene (Cumene)	ug/m3	13U	
61	103651	BENZENE, PROPYL-	ug/m3	13U	
63	541731	1,3-Dichlorobenzene	ug/m3	13U	
64	106467	1,4-Dichlorobenzene	ug/m3	13U	
65	95501	1,2-Dichlorobenzene	ug/m3	13U	
66	120821	1,2,4-Trichlorobenzene	ug/m3	13U	
67	91203	Naphthalene	ug/m3	13U	
68	87683	Hexachlorobutadiene	ug/m3	13U	
69	-762492	Surrog: 1-Bromo-2-Fluoroetha	% Recov	128	(Surr) PR
70	-200004	Surrog: D8-Toluene	% Recov	94	(Surr) PR
71	-200003	Surrog: 1,4-Bromofluorobenze	% Recov	96	(Surr) PR
72	-200002	Surrog: D4-1,2-Dichloroethan	% Recov	154	(Surr) PR

11/16/90

*** Lab Analysis Report ***

Transaction #: 11079901 Seq #: 07 (52) Tent Ident - VOA Scan (GCMS)
Proj Code : DOE-633C MONTERREY APARTMENTS SITE PE # : J5K15

Sample No.: 90 298027 Alternate Keys:

SG07 TIC's
AMBIENT SAMPLE

Samp Matrix: (60) Air Units: (93) ug/m3 %Slds: ____
QA Code: ( ) Unspecifed Peaks Total: ____
Date Extracted: Date Analyzed: 901107 # Days to Ext/Anal: 0/112

Line	Par #	Parameter Description	Units	Value
1	624839	Isocyanic Acid, Methyl Ester	ug/m3	57NJ
2	19411655	HYDROXYLAMINE, O-(3-METHYLBU	ug/m3	170NJ
3	42474442	DISULFIDE, METHYL (METHYLTHI	ug/m3	78NJ
4	-300013	UNKNOWN HYDROCARBON (TOTAL)	ug/m3	220NJ

10/16/90

Appendix D

HYDROCARBON IDENTIFICATION REPORT

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Post Office Box 307 • Manchester, Washington 98353-0346 • (206) 895-4740

August 13, 1990

TO: David South

FROM: Bob Carrell

SUBJECT: Monterey Apartments Project: Hydrocarbon Analysis on 90298020 and 90298028

Both these samples contained gasoline; however, 90298020's gasoline was only slightly weathered and this sample also contains #2 diesel oil. Sample 90298028 has extremely weathered gasoline with no other hydrocarbon mixtures. This indicates that given the same weathering conditions, sample 90298028 is an older spill than 90298020.

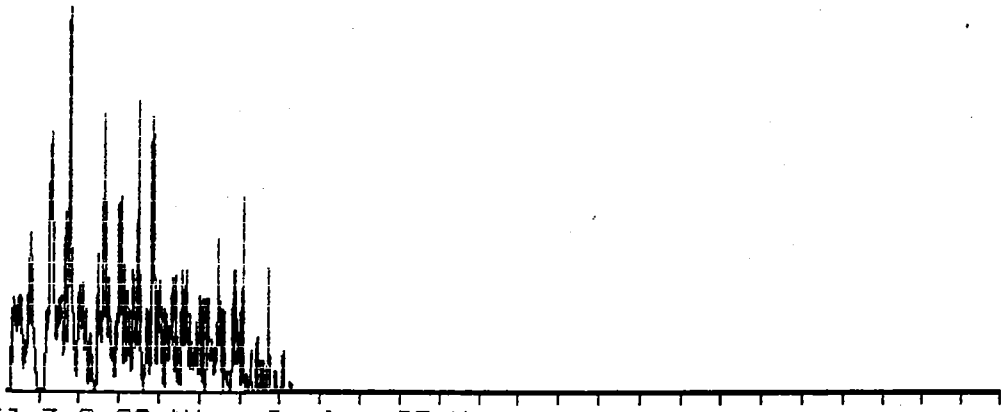
It should be possible to determine which source is responsible for the Monterey Apartments problem by acquiring a groundwater/product sample from that site. This, of course, assumes that one source is responsible for the problem.

In any event, there appears to be at least two, if not three, tanks leaking into the groundwater (i.e., gasoline and #2 diesel). Attached with this memo you will find the copies of the field sample data sheets and chromatograms.

BC:mb
Attachments

cc: Bill Kammin

MW-8



nterface 5] 3.2-28 Min Scale: 25 Mv
)298028 2ul/2000m Processed: 08-02-1990 10:25:21, segment 4, cycle 4
RAW DATA SAVED IN FILE X:A214X4.PTS

***** EXTERNAL STANDARD TABLE *****

********** 08-02-1990 10:25:30 Version 5.1 **********
* Sample Name: 90298028 2ul/2000m Data File: X:A214X4 *
* Date: 08-02-1990 10:25:22 Method: HCARB-ID 08-02-1990 08:27:55 # 121 *
* Interface: 5 Cycle#: 4 Operator B.C Channel#: 0 Vial#: N.A. *
* Starting Peak Width: 3 Threshold: 5 Area Threshold: 100 *
****
* Instrument Type: HP5890A Column Type: DB5 .25MM .25 FILM *
* Solvent Description: HELIUM *
* Conditions: 050C,HOLD 2 MIN; 15C/MIN TO 320C; HOLD 8 MIN *
* Detector 0: Detector 1: FID *
* Misc. Information: HYDROCARBONS *
****

Amount injected: 1.00 Dilution factor: 1.00
Sample Weight: 1.00

PEAK NUM	RET TIME	PEAK NAME	CONCENTRATION in AREA	NORMALIZED CONC	AREA	HEIGHT	AREA/ HEIGHT	BL	REF PEAK	% DELTA RET TIME	CONC/AREA
1	3.475		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				1.0000E+00
2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]
3	3.485		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]
4	3.525		17747.2969	2.6980%	17747	3546	5.0	2			1.0000E+00
5	3.630		5533.9922	0.8413%	5534	2060	2.7	2			1.0000E+00
6	3.690		6256.1792	0.9511%	6256	2027	3.1	2			1.0000E+00
7	3.720		6765.3438	1.0285%	6765	3618	1.9	2			1.0000E+00
8	3.775		395[illegible].[illegible]	[illegible].0149%	395[illegible]	5722	[illegible].7	2			1.0000E+00
9	4.175		13129.3604	1.9959%	13129	3424	3.8	2			1.0000E+00
10	4.215		6804.7900	1.0345%	6805	3556	1.9	2			1.0000E+00
11	4.265		19352.6953	2.9420%	19353	7536	2.6	2			1.0000E+00
12	4.310		47681.8520	7.2486%	47682	9222	5.2	2			1.0000E+00
13	4.470		14681.6465	2.2319%	14682	3621	4.1	2			1.0000E+00
14	4.520		8662.3984	1.3169%	8662	3663	2.4	2			1.0000E+00
15	4.560		13012.7236	1.9782%	13013	3739	3.5	2			1.0000E+00
16	4.660	ETHYL BENZENE	0.0000	0.0000%	26853	6386	4.2	2	0	.2150	0.0000E+00
17	4.770	M+P-XYLENE	0.0000	0.0000%	50265	10996	4.6	2	0	.2300	0.0000E+00
18	4.985		10798.1631	1.6415%	10798	3610	3.0	2			1.0000E+00
19	5.015		13292.7754	2.0208%	13293	3848	3.5	2			1.0000E+00
20	5.100	O-XYLENE	0.0000	0.0000%	12853	3870	3.3	2	0	0	0.0000E+00
21	5.165	nC9	0.0000	0.0000%	10975	3046	3.6	2	0	0	0.0000E+00
22	5.290		10087.9180	1.5336%	10088	2126	4.7	2			1.0000E+00
24	5.480		18795.6016	2.8573%	18796	4601	4.1	2			1.0000E+00
25	5.640		41233.8980	6.2684%	41234	8985	4.6	2			1.0000E+00
26	5.750		14309.3535	2.1753%	14309	3571	4.0	2			1.0000E+00
27	5.860		3669.9587	0.5579%	3670	1195	3.1	2			1.0000E+00
28	5.935		5218.6597	0.7933%	5219	2223	2.3	2			1.0000E+00
29	6.000		12346.4307	1.8769%	12346	5641	2.2	2			1.0000E+00
30	6.020		9845.2988	1.4967%	9845	5780	1.7	2			1.0000E+00
31	6.055	TRIMETHYLBENZENE	0.0000	0.0000%	16972	5888	2.9	2	0	.1654	0.0000E+00
32	6.145		7187.5879	1.0927%	7188	3641	2.0	2			1.0000E+00
33	6.210		10918.5146	1.6598%	10919	2658	4.1	2			1.0000E+00
35	6.350		10299.0664	1.5657%	10299	3071	3.4	3			1.0000E+00
37	6.485	METHYLETHYLBENZENE	0.0000	0.0000%	9995	6944	1.4	1	0	0	0.0000E+00
39	6.705		9750.3008	1.4822%	9750	2561	3.8	2			1.0000E+00
40	6.825		18048.9004	2.7438%	18049	8826	2.0	2			1.0000E+00
41	6.875		22770.7227	3.4616%	22771	8212	2.8	2			1.0000E+00
42	6.980		8095.2002	1.2306%	8095	3161	2.6	2			1.0000E+00
43	7.040		13592.6396	2.0664%	13593	3443	3.9	2			1.0000E+00
44	7.170		4263.9004	0.6482%	4264	2513	1.7	2			1.0000E+00
45	7.200		6005.7002	0.9130%	6006	1928	3.1	2			1.0000E+00
46	7.265		3480.3000	0.5291%	3480	1934	1.8	2			1.0000E+00
47	7.340		15016.2002	2.2828%	15016	3531	4.3	2			1.0000E+00
48	7.430		6099.6001	0.9273%	6100	3554	1.7	2			1.0000E+00
50	7.575		8392.9453	1.2759%	8393	3629	2.3	2			1.0000E+00
51	7.650		9682.0879	1.4719%	9682	3047	3.2	2			1.0000E+00
52	7.690		7684.3081	1.1682%	7684	3435	2.2	2			1.0000E+00
53	7.780	nC11	0.0000	0.0000%	3345	1882	1.8	2	0	0	0.0000E+00
56	7.920		1678.5376	0.2552%	1679	1462	1.1	2			1.0000E+00
57	8.015		8717.7002	1.3253%	8718	2747	3.2	2			1.0000E+00
58	8.105		6773.4004	1.0297%	6773	2965	2.3	2			1.0000E+00
59	8.220		13076.0908	1.9878%	13076	3150	4.2	2			1.0000E+00
60	8.325		5537.0156	0.8417%	5537	1865	3.0	2			1.0000E+00
61	8.380		2521.1204	0.3833%	2521	1431	1.8	2			1.0000E+00
62	8.415		3576.3083	0.5437%	3576	1896	1.9	2			1.0000E+00
63	8.475		13020.0166	1.9793%	13020	5133	2.5	2			1.0000E+00
64	8.520		6621.3169	1.0066%	6621	2600	2.5	2			1.0000E+00
65	8.605		6054.9121	0.9205%	6055	2953	2.1	2			1.0000E+00

68	8.825		7494.9004	1.1394%	7495	5130	2.4	2				1.0000E+00
69	8.880	nC12	0.0000	0.0000%	14252	4190	3.4	2			.0563	0.0000E+00
70	8.965		4401.0352	0.6690%	4401	2090	2.1	2				1.0000E+00
71	9.005		4894.2188	0.7440%	4894	2933	1.7	2				1.0000E+00
72	9.080		11411.9297	1.7348%	11412	6596	1.7	2				1.0000E+00
74	9.170		1839.5298	0.2796%	1840	897	2.1	2				1.0000E+00
76	9.290		5624.6533	0.8551%	5625	1672	3.4	2				1.0000E+00
77	[illegible]				[illegible]	[illegible]	[illegible]	2				[illegible]
78	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2				[illegible]
79	9.520		2645.2595	0.4021%	2645	1356	2.0	2				1.0000E+00
80	9.575		2549.0344	0.3875%	2549	1387	1.8	2				1.0000E+00
82	9.710	ISOPRENOID C12-13	0.0000	0.0000%	7806	4244	1.8	1	0		0	0.0000E+00
84	9.890		1885.7134	0.2867%	1886	1110	1.7	2				1.0000E+00
88	10.080	nC13	0.0000	0.0000%	2927	1772	1.7	2	0		.9009	0.0000E+00
92	10.265		1626.9000	0.2473%	1627	1096	1.5	2				1.0000E+00

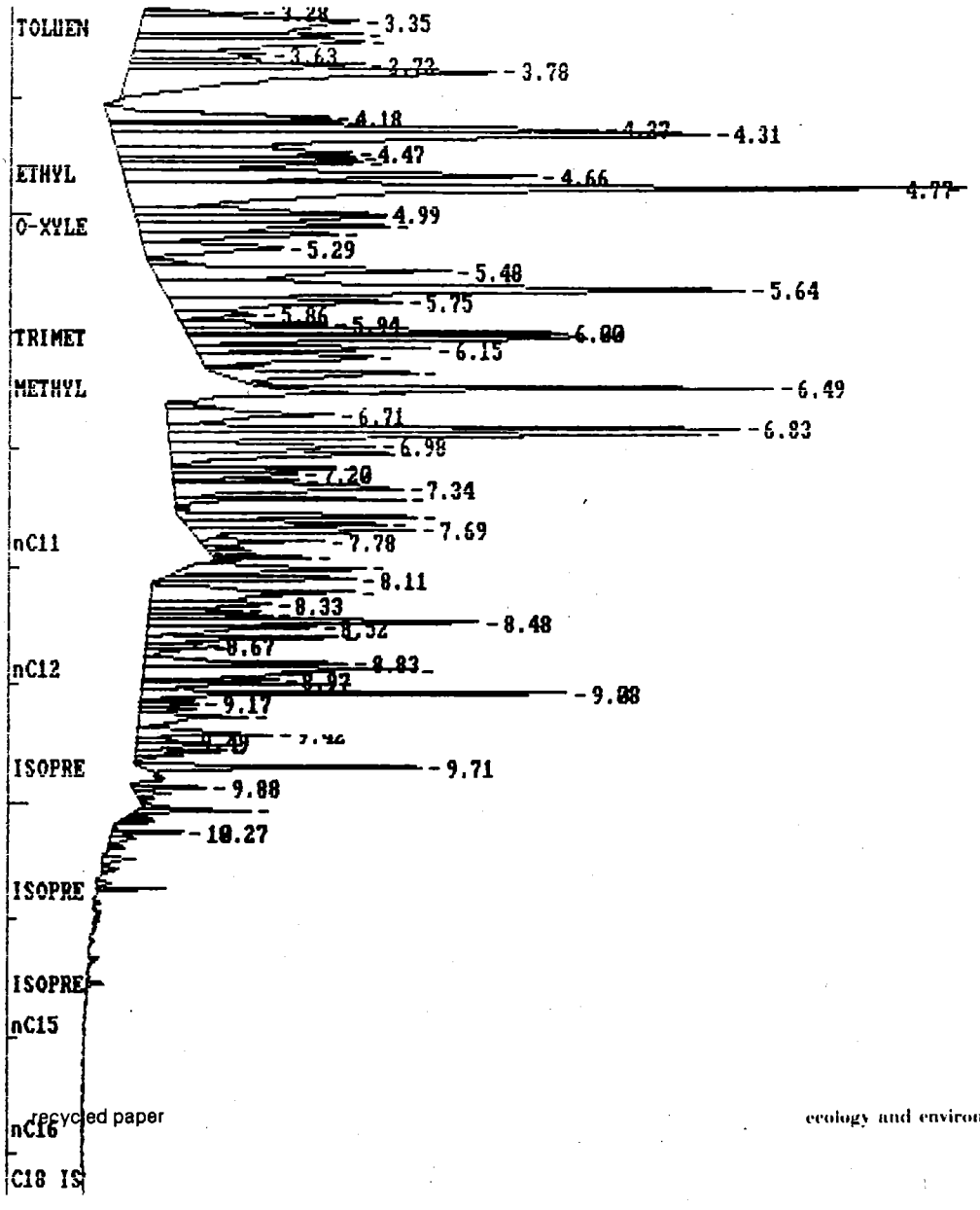
TOTAL AMOUNT = 657805.3800

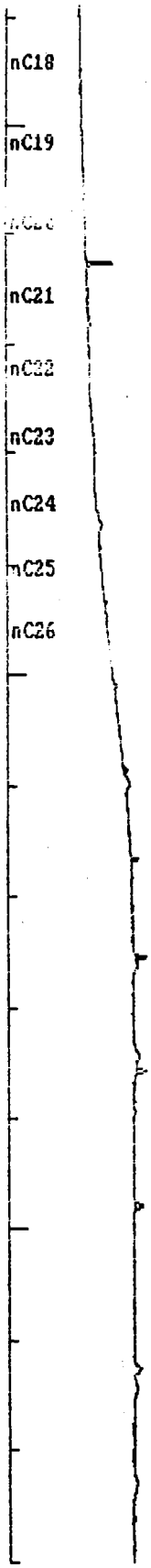
PEAKS NOT FOUND IN THIS RUN

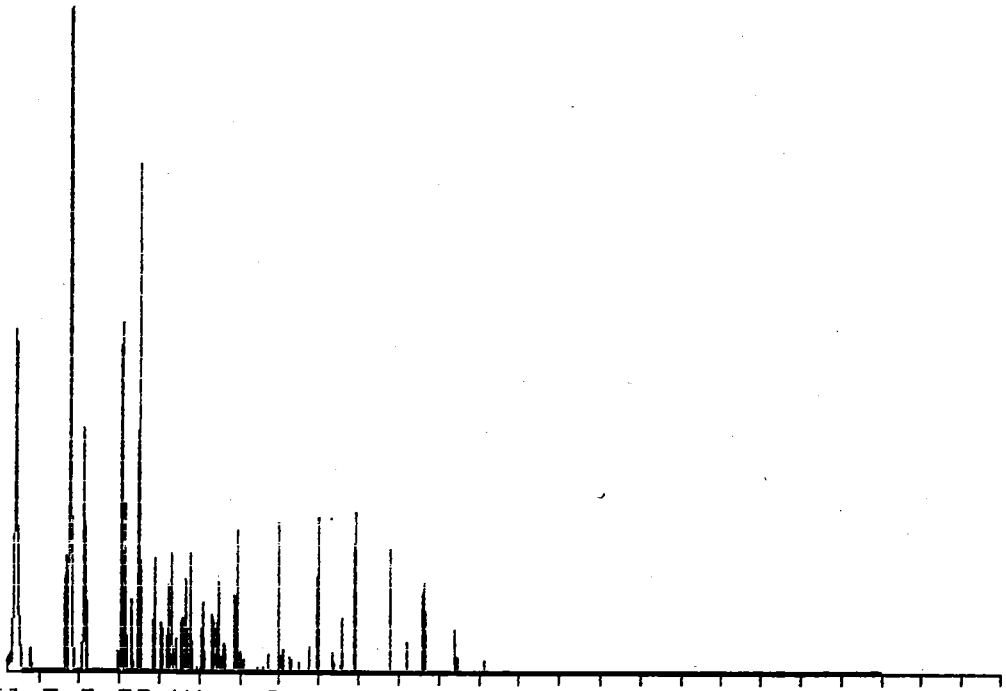
NAME	ADJUSTED RET.TIME.	REFERENCE PEAK
TOLUENE	3.40	M+P-XYLENE
nC10	6.53	nC16
ISOPRENOID C13-14	10.76	nC16
nC14	10.98	nC16
ISOPRENOID C14-15	11.57	nC16
nC15	11.91	nC16
nC16	12.77	nC16
C18 ISOPRENOID	13.21	nC16
nC17	13.62	nC16
PRISTANE	13.68	nC16
nC18	14.41	nC16
PHYTANE	14.50	nC16
nC19	15.16	nC16
nC20	15.88	nC16
nC21	16.56	nC16
nC22	17.21	nC16
nC23	17.84	nC16
nC24	18.44	nC16
nC25	19.02	nC16
nC26	19.58	nC16

GROUP NUMBER	GROUP AMOUNT	GROUP PERCENT

reas, times, and heights stored in: X:A214x4.ATB
ata File = X:A214X4.PTS Printed on 08-02-1990 at 10:27:06
tart time: 3.20 min. Stop time: 28.00 min. Offset: 0 mv.
ow Value: 6280 uv High Value: 19922 uv Scale factor: 1.0




nC18
nC19
nC21
nC23
nC24
nC25
nC26



nterface 5] 3.2-28 Min Scale: 25 Mv
298020 2ul/2000m Processed: 08-02-1990 09:44:32, segment 3, cycle 3
AW DATA SAVED IN FILE X:A214X3.PTS

******* EXTERNAL STANDARD TABLE ********

********** 08-02-1990 09:44:41 Version 5.1 **********

Sample Name: 90298020 2ul/2000m Data File: X:A214X3 *

Date: 08-02-1990 09:44:33 Method: HCARB-ID 08-02-1990 08:27:55 # 121 *

Interface: 5 Cycle#: 3 Operator B.C Channel#: 0 Vial#: N.A. *

Starting Peak Width: 3 Threshold: 5 Area Threshold: 100 *

****

Instrument Type: HP5890A Column Type: DB5 .25MM .25 FILM *

Solvent Description: HELIUM *

Conditions: 050C,HOLD 2 MIN; 15C/MIN TO 320C; HOLD 8 MIN *

Detector 0: Detector 1: FID *

Misc. Information: HYDROCARBONS *

****

Amount injected: 1.00 Dilution factor: 1.00
Sample Weight: 1.0 00

PEAK NUM	RET TIME	PEAK NAME	CONCENTRATION in AREA	NORMALIZED CONC	AREA	HEIGHT	AREA/HEIGHT	BL	REF PEAK	% DELTA RET TIME	CONC/AREA
	3.350		6772.2295	2.2921%	6772	3567	1.9	2			1.0000E+00
	3.780		6779.6677	2.2947%	6780	1754	3.9	2			1.0000E+00
19	4.265		7021.5005	2.3765%	7022	1456	4.8	2			1.0000E+00
	4.660	ETHYL BENZENE	0.0000	0.0000%	17427	5108	3.4	2	0	.2150	0.0000E+00
	4.770	M+P-XYLENE	0.0000	0.0000%	[illegible]	[illegible]	3.5	2	0	.2100	0.0000E+00
15	5.105	O-XYLENE	0.0000	0.0000%	15023	7369	2.0	1	0	.1962	0.0000E+00
	5.540		3197.2212	1.0821%	3197	603	5.3	2			1.0000E+00
	5.640		4354.6270	1.4739%	4355	1024	4.3	2			1.0000E+00
21	5.945		4885.6104	1.6536%	4886	2267	2.2	2			1.0000E+00
	6.050	TRIMETHYLBENZENE	0.0000	0.0000%	40120	12993	3.1	2	0	0	0.0000E+00
	6.140		18941.6582	6.4110%	18942	7119	2.7	2			1.0000E+00
24	6.300		10027.1113	3.3938%	10027	3960	2.5	2			1.0000E+00
25	6.485	METHYLETHYLBENZENE	0.0000	0.0000%	44528	18114	2.5	2	0	0	0.0000E+00
	6.710		2001.0516	0.6773%	2001	839	2.4	2			1.0000E+00
	6.870		14543.9023	4.9226%	14544	5259	2.8	2			1.0000E+00
29	6.980		2080.0195	0.7040%	2080	932	2.2	2			1.0000E+00
	7.050		8295.6562	2.8078%	8296	3194	2.6	2			1.0000E+00
	7.225		9704.9697	3.2848%	9705	4396	2.2	2			1.0000E+00
33	7.270		5090.4106	1.7229%	5090	2699	1.9	2			1.0000E+00
34	7.310		16642.9512	5.6330%	16643	5389	3.1	2			1.0000E+00
	7.430		5040.3096	1.7060%	5040	2658	1.9	2			1.0000E+00
	7.550		5529.0425	1.8714%	5529	3150	1.8	2			1.0000E+00
37	7.575		5425.2402	1.8362%	5425	3325	1.6	2			1.0000E+00
	7.655		9555.8906	3.2343%	9556	4548	2.1	2			1.0000E+00
	7.695		6096.6543	2.0635%	6097	2965	2.1	2			1.0000E+00
40	7.780	nC11	0.0000	0.0000%	9871	5366	1.8	2	0	0	0.0000E+00
41	7.840		1813.5024	0.6138%	1814	894	2.0	2			1.0000E+00
	7.875		1789.1204	0.6056%	1789	895	2.0	2			1.0000E+00
43	7.920		3576.0610	1.2104%	3576	1656	2.2	2			1.0000E+00
44	7.995		1830.7161	0.6196%	1831	839	2.2	2			1.0000E+00
	8.035		5889.6094	1.9934%	5890	2953	2.0	2			1.0000E+00
	8.090		7278.5884	2.4635%	7279	3763	1.9	2			1.0000E+00
49	8.265		3399.4502	1.1506%	3399	1338	2.5	2			1.0000E+00
	8.330		8769.2773	2.9681%	8769	3331	2.6	2			1.0000E+00
	8.465		12745.8945	4.3140%	12746	4483	2.8	2			1.0000E+00
52	8.520		6192.7407	2.0960%	6193	1737	3.6	2			1.0000E+00
53	8.605		5326.9219	1.8030%	5327	2404	2.2	2			1.0000E+00
	8.710		1788.8368	0.6055%	1789	1010	1.8	2			1.0000E+00
	8.825		3267.9143	1.1061%	3268	1568	2.1	2			1.0000E+00
56	8.875	nC12	0.0000	0.0000%	7357	3968	1.9	2	0	0	0.0000E+00
	8.925		9605.4756	3.2511%	9605	6079	1.6	2			1.0000E+00
	8.970		3500.8208	1.1849%	3501	1727	2.0	2			1.0000E+00
59	9.005		3158.8420	1.0691%	3159	2112	1.5	2			1.0000E+00
	9.085		4316.6675	1.4610%	4317	1823	2.4	2			1.0000E+00
	9.420		4222.3457	1.4291%	4222	1522	2.8	2			1.0000E+00
67	9.515		2836.6899	0.9601%	2837	1065	2.7	2			1.0000E+00
68	9.575		2865.4805	0.9699%	2865	1508	1.9	2			1.0000E+00
	9.610		2139.3704	0.7241%	2139	1115	1.9	2			1.0000E+00
	9.710	ISOPRENOID C12-13	0.0000	0.0000%	4122	1945	2.1	2	0	0	0.0000E+00
72	9.760		2594.6672	0.8782%	2595	1324	2.0	2			1.0000E+00
	9.885		1871.7047	0.6335%	1872	856	2.2	2			1.0000E+00
	9.935		1502.6884	0.5086%	1503	879	1.7	2			1.0000E+00
76	9.985	nC13	0.0000	0.0000%	8566	6128	1.4	2	0	0	0.0000E+00
77	10.080		6218.8364	2.1048%	6219	2036	3.1	2			1.0000E+00
	10.270		2424.2532	0.8205%	2424	1697	1.4	2			1.0000E+00
81	10.310		3156.2510	1.0683%	3156	1329	2.4	2			1.0000E+00
83	10.490		2924.6953	0.9899%	2925	1514	1.9	2			1.0000E+00

87	10.755	ISOPRENOID C13-14	0.0000	.000%	2495	1975	1.3	2	0	0	0.0000E+00
89	10.975	nC14	0.000	0.0000%	7983	6050	1.3	2		0	0.0000E+00
93	11.190		1710.7501	0.5790%	1711	765	2.2	1			1.0000E+00
95	11.340		3031.5845	1.0261%	3032	1746	1.7	2			1.0000E+00
96	11.375		2080.0830	0.7040%	2080	1391	1.5	2			1.0000E+00
97	11.425		2235.1501	0.7565%	2235	846	2.6	2			1.0000E+00
98	11.495		1844.9157	0.6244%	1845	988	1.9	2			1.0000E+00
100					5113	2221	2.3	2			1.0000E+00
105	11.790	nC15	0.0000	0.0000%	9807	6243	1.5	2	0	0	0.0000E+00
106	11.985		1709.0110	0.5784%	1709	615	2.8	2			1.0000E+00
111	12.320		3004.4062	1.0169%	3004	1151	2.6	2			1.0000E+00
112	12.370		2344.1064	0.7934%	2344	1187	2.0	2			1.0000E+00
113	12.460		2452.0312	0.8299%	2452	691	3.5	2			1.0000E+00
115	12.535		1777.4907	0.6016%	1777	828	2.1	2			1.0000E+00
118	12.775	nC16	0.0000	0.0000%	6105	4917	1.2	2	0	0	0.0000E+00
124	13.190	C18 ISOPRENOID	0.0000	0.0000%	3560	1999	1.8	2	0	-.1513	0.0000E+00
129	13.605	nC17	0.0000	0.0000%	5372	4020	1.3	2	0	-.1101	0.0000E+00
130	13.660	PRISTANE	0.0000	0.0000%	4450	3037	1.5	2	0	-.1462	0.0000E+00
139	14.390	nC18	0.0000	0.0000%	3721	2544	1.5	2	0	-.1387	0.0000E+00
140	14.475	PHYTANE	0.0000	0.0000%	2576	1616	1.6	2	0	-.1517	0.0000E+00
148	15.140	nC19	0.0000	0.0000%	2270	1623	1.4	2	0	-.1319	0.0000E+00

TOTAL AMOUNT = 295453.6900

PEAKS NOT FOUND IN THIS RUN

NAME	ADJUSTED RET.TIME.	REFERENCE PEAK
nC9	5.16	M+P-XYLENE
nC10	6.53	nC16
nC20	15.88	nC16
nC21	16.56	nC16
nC22	17.21	nC16
nC23	17.84	nC16
nC24	18.44	nC16
nC25	19.02	nC16
nC26	19.58	nC16

GROUP NUMBER	GROUP AMOUNT	GROUP PERCENT

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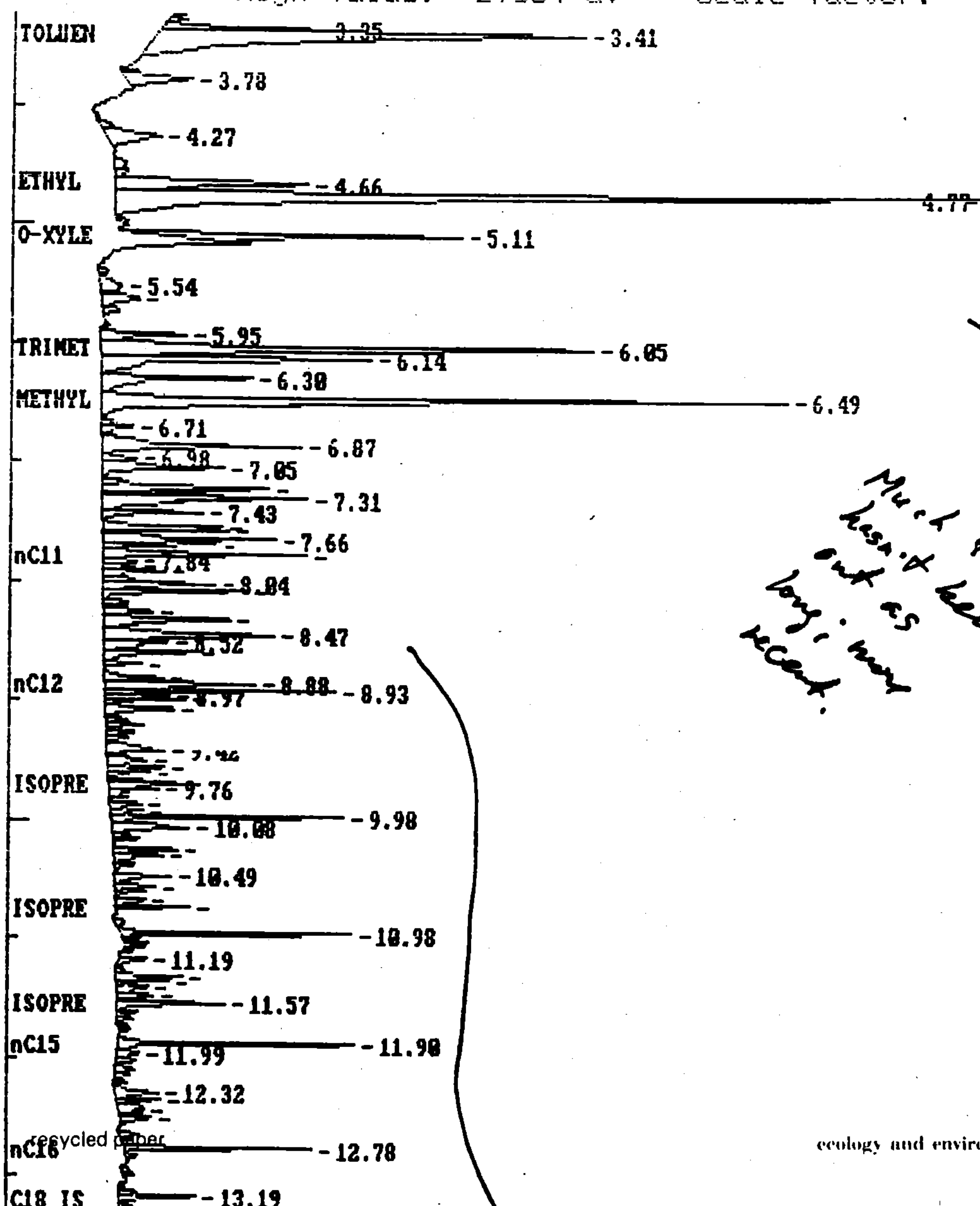
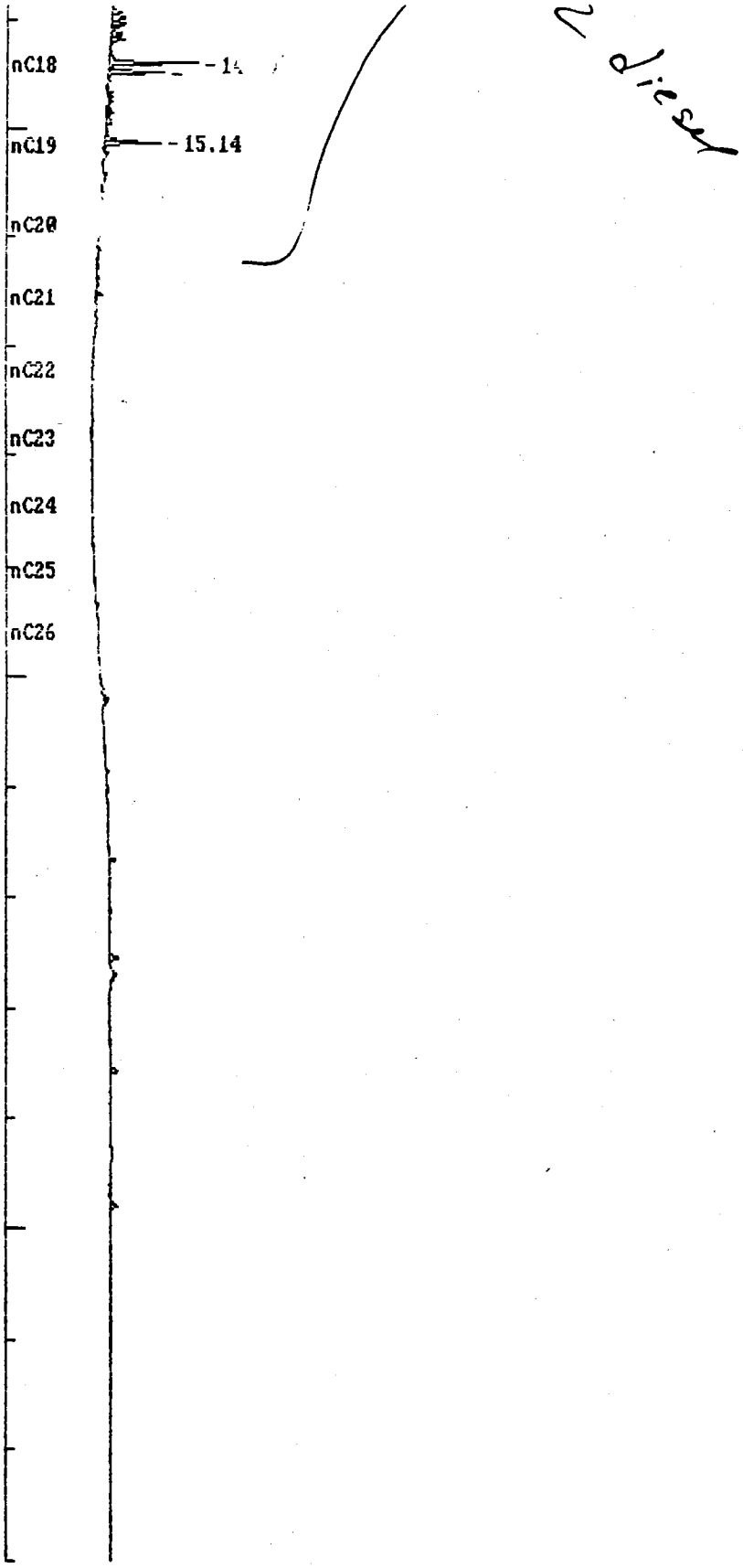
Start time: 3.20 min. Stop time: 28.00 min. Offset: 0 mv.
ow Value: 6258 uv High Value: 29854 uv Scale factor: 1.0

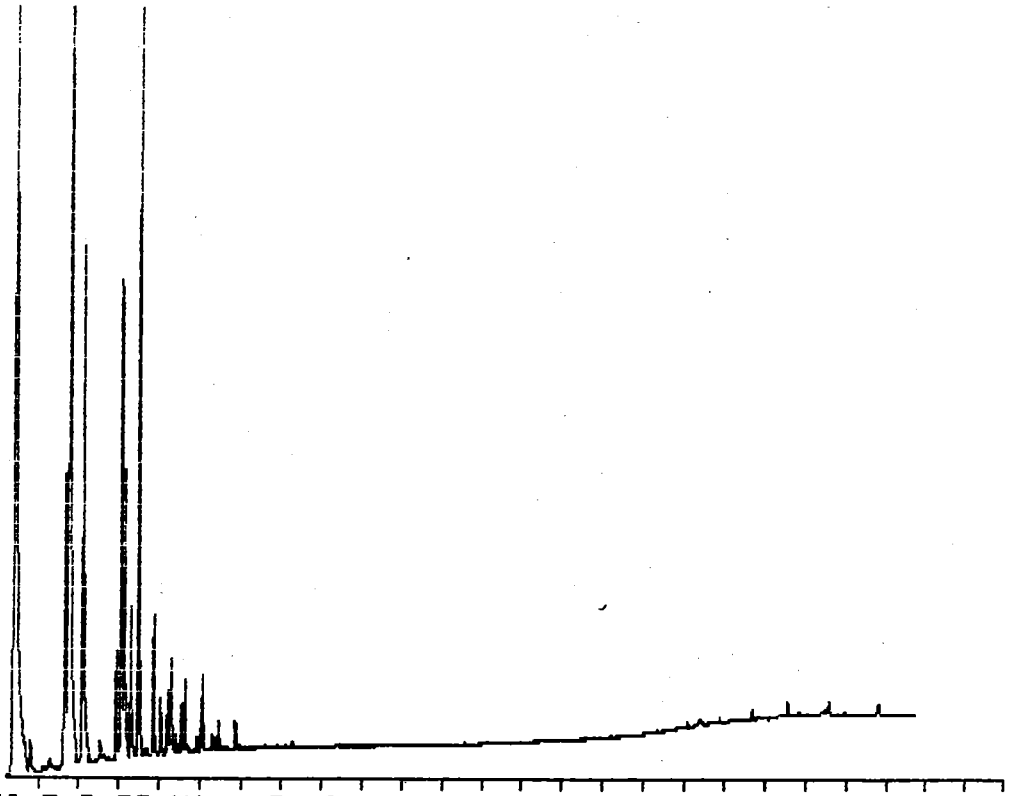


Somewhat mixed

Much fresher - hasn't been out as long; more recent.


nC18
nC19
nC20
nC21
nC22
nC23
nC24
nC25
nC26
- 15.14
Diesel

unweathered gasoline



Interface 5] 3.2-28 Min Scale: 25 Mv
asoline 250ng Processed: 08-02-1990 08:59:12, segment 2, cycle 2
RAW DATA SAVED IN FILE X:A214X2.PTS

***** EXTERNAL STANDARD TABLE ******

********** 08-02-1990 08:59:20 Version 5.1 **********
* Sample Name: gasoline 250ng Data File: X:A214X2 *
* Date: 08-02-1990 08:59:13 Method: HCARB-ID 08-02-1990 08:27:55 # 121 *
* Interface: 5 Cycle#: 2 Operator B.C Channel#: 0 Vial#: N.A. *
* Starting Peak Width: 3 Threshold: 5 Area Threshold: 100 *
****
* Instrument Type: HP5890A Column Type: DB5 .25MM .25 FILM *
* Solvent Description: HELIUM *
* Conditions: 050C,HOLD 2 MIN; 15C/MIN TO 320C; HOLD 8 MIN *
* Detector 0: Detector 1: FID *
* Misc. Information: HYDROCARBONS *
****

mount injected: 1.00 Dilution factor: 1.00
[illegible]le Weight: 1.0[illegible]000

[illegible]AK [illegible]UM	RET TIME	PEAK NAME	CONCENTRATION in AREA	NORMALIZED CONC	AREA	HEIGHT	AREA/ HEIGHT	BL	REF PEAK	% DELTA RET TIME	CONC/AREA
1	3.395	TOLUENE	0.0000	0.0000%	142667	31678	4.5	1	0	0	0.0000E+00
2	[illegible]										[illegible]
5	4.250	ETHYL [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]
6	4.760	M+P-XYLENE	0.0000	0.0000%	123476	40022	3.1	2	0	0	0.0000E+00
7	5.095	O-XYLENE	0.0000	0.0000%	47379	16718	2.8	1	0	0	0.0000E+00
9	5.940		7157.8315	8.9808%	7158	3541	2.0	2			1.0000E+00
10	6.045	TRIMETHYLBENZENE	0.0000	0.0000%	40113	15527	2.6	2	0	0	0.0000E+00
11	6.140		[illegible].5840	26.0769%	20784	[illegible]	2.2	2			1.0000E+00
2	6.295		9784.7490	12.2768%	9785	4823	2.0	2			1.0000E+00
13	6.480	METHYLETHYLBENZENE	0.0000	0.0000%	45515	24817	1.8	2	0	0	0.0000E+00
16	6.865	/Toluene = 6.1%	8672.4004	10.8811%	8672	4571	1.9	1			1.0000E+00
7	7.050		3319.2002	4.1646%	3319	1791	1.9	1			1.0000E+00
8	7.220		3855.3000	4.8372%	3855	2000	1.9	2			1.0000E+00
19	7.275		1617.9797	2.0301%	1618	962	1.7	2			1.0000E+00
[illegible]	7.310		5414.9395	6.7940%	5415	2988	1.8	2			1.0000E+00
2	7.550		2098.7063	2.6332%	2099	1553	1.4	2			1.0000E+00
23	7.575		2753.6650	3.4550%	2754	1608	1.7	2			1.0000E+00
24	[illegible]		[illegible].4072	4.7495%	3785	2385	1.6	2			1.0000E+00
7	8.035		2547.8508	3.1968%	2548	1758	1.4	2			1.0000E+00
28	8.085		3775.3525	4.7369%	3775	2511	1.5	2			1.0000E+00
30	8.470		1931.7001	2.4237%	1932	911	2.1	1			1.0000E+00

TOTAL AMOUNT = 79701.2730

PEAKS NOT FOUND IN THIS RUN

[illegible]AME	ADJUSTED RET.TIME.	REFERENCE PEAK
nC9	5.16	M+P-XYLENE
nC10	6.53	nC16
[illegible]C11	7.79	nC16
[illegible]C12	8.88	nC16
ISOPRENOID C12-13	9.72	nC16
[illegible]C13	9.99	nC16
[illegible]SOPRENOID C13-14	10.76	nC16
nC14	10.98	nC16
[illegible]SOPRENOID C14-15	11.57	nC16
[illegible]C15	11.91	nC16
nC16	12.77	nC16
[illegible]18 ISOPRENOID	13.21	nC16
[illegible]C17	13.62	nC16
[illegible]ISTANE	13.68	nC16
nC18	14.41	nC16
[illegible]YTANE	14.50	nC16
[illegible]C19	15.16	nC16
[illegible]C20	15.88	nC16
[illegible]C21	16.56	nC16
[illegible]C22	17.21	nC16
[illegible]C23	17.84	nC16
C24	18.44	nC16
[illegible]C25	19.02	nC16
[illegible]C26	19.58	nC16

[illegible]OUP NUMBER GROUP AMOUNT GROUP PERCENT

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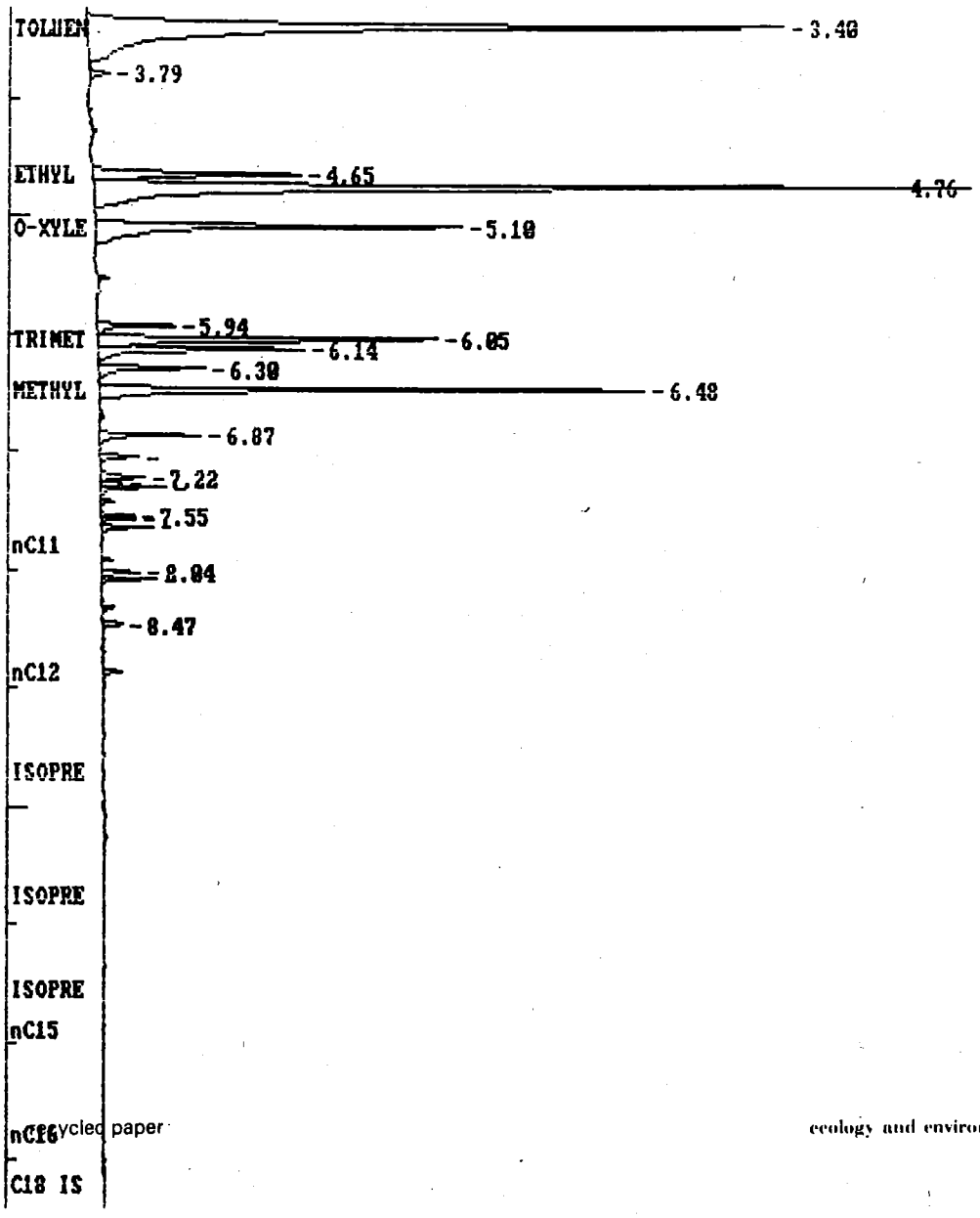
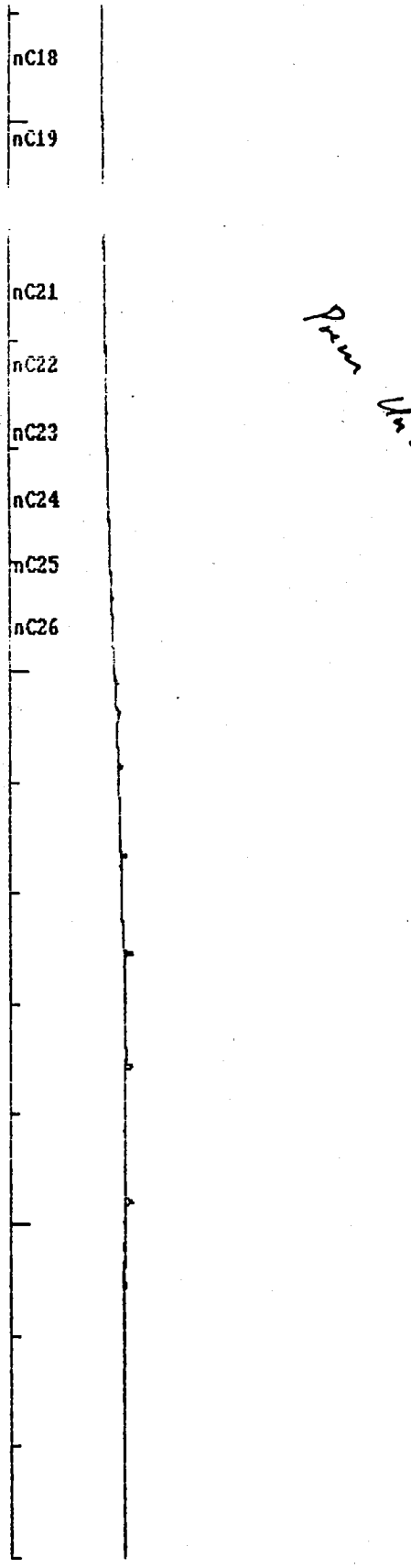
ow Value: 5196 uv High Value: 45589 uv Scale factor: 1.0




nC18
nC19
nC21
nC22
nC23
nC24
nC25
nC26

WASHINGTON STATE DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
P.O. Box 307, Manchester, WA 98353

DATA REVIEW

August 23, 1990

PROJECT: Monterey Apartments

SAMPLE NO: 298028 ICP Scan, Oil

LABORATORY: Sound Analytical
4630 Pacific Highway
Fife, WA 98424

By: Craig Smith, Chemist

Metals

Holding time: Analyses for all parameters were performed within the holding time limits.

Reagent Blank: The method blank showed no amounts of the analytes above the reporting detection limit.

Matrix Spike: The targeted accuracy of matrix spikes is +/- 25% of the true value. A matrix spike was not run.

Sample Duplicate: The target limits are +/- 20%, or +/- 1 detection limit for samples less than 5 times the detection limit. A duplicate was not run.

Laboratory Control Sample: The target is a +/- 20% recovery control limit. A LCS was not run.

Sample Data: The data is acceptable for use. This is an ICP Scan and the values are approximate. The values may be used as an indication of the presence of a metal.

The analyte ofinterest was Pb, and the result was a value of 700ppm.

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922- 5047

Report To: WA State Dept. of Ecology Date: August 17, 1990

Report On: Analysis of Soil Lab No.: 12590

IDENTIFICATION:
Sample Received on 08-03-90
Project: Monterey Apts. J5K15
Client ID: 298028 MW-8

ANALYSIS:

ICP METAL SCAN	< 10 ppm	10 - 50 ppm	50 - 100 ppm	Over 100 ppm
Aluminum	< 5			
Antimony	< 5			
Arsenic	< 5			
Beryllium	< 5			
Cadmium	< 5			
Chromium	< 5			
Copper	< 5			
Iron		17.6		
Lead				707

Continued . . . . .

SOUND ANALYTICAL SERVICES, INC.

WA State Dept. of Ecology

Lab No. 12590
August 17, 1990

Client ID: 298028

ICP METAL SCAN	< 10 ppm	10 - 50 ppm	50 - 100 ppm	Over 100 ppm
Magnesium	< 5			
Manganese	< 5			
Mercury	< 0.1			
Molybdenum	< 5			
Nickel	< 5			
Selenium	< 5			
Silica		15		
Silver	< 5			
Thallium	< 5			
Titanium	< 5			
Zinc	< 5			

The values in this analysis are approximate and are intended to be used only as an indication of the presence of a metal.

*Note - Weight used - 0.6780
*Note - Total Dilution - 35 mls.

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922- 5047

Discussion

August 17, 1990

WA State Dept. of Ecology

Lab No. 12590

The sample was digested using SW-846 method 3050.

Mercury was run by cold vapor SW-846 method 7470.

All other metals were analyzed using SW-846 6000 series methods.

WASHINGTON STATE DEPARTMENT OF ECOLOGY
MANCHESTER ENVIRONMENTAL LABORATORY
P.O. Box 307, Manchester, WA 98353

DATA REVIEW

October 8, 1990

PROJECT: Monterey Apartments

SAMPLE NO: 298020 MW- ICP Scan, solvent

LABORATORY: North Creek Analytical
18939 120th Avenue N.E., Suite 101
Bothell, WA 98011

By: Craig Smith, Chemist

Metals

Holding time: Analyses for all parameters were performed within the holding time limits.

Reagent Blank: The method blank showed no analyte values above the reporting detection limit.

Matrix Spike: The targeted accuracy of matrix spikes is +/- 25% of the true value. A Matrix spike was not run.

Spike Duplicate: The target limits are +/- 20%, or +/- 1 detection limit for samples less than 5 times the detection limit. A Spike duplicate was not run.

Laboratory Control Sample: The target is a +/- 20% recovery control limit. All values were within the targeted limits.

The data may be used without qualification.

Pb and Ca were found at low levels. No other parameters were detected above the reporting limit.

NORTH CREEK ANALYTICAL

18939 120th Avenue N.E., Suite 101 • Bothell, WA 98011
Phone (206) 481-9200 • FAX (206) 485-2992

WA State Dept. of Ecology	Client Project ID:	Monterey Apartments	Sampled:	Jul 18, 1990
P.O. Box 307	Sample Descript:	Solvent, #298020	Received:	Aug 30, 1990
Manchester, WA 98353	Analysis Method:	EPA 6010	Analyzed:	Sep 17, 1990
Attention: Craig Smith	Lab Number:	009-0182	Reported:	Sep 20, 1990

SEMI-QUANTITATIVE ICP METALS SCAN

Analyte	Detection Limit mg/L (ppm)	Sample Results mg/L (ppm)
Aluminum	0.50	N.D.
Antimony	0.50	N.D.
Arsenic	1.0	N.D.
Barium	0.50	N.D.
Beryllium	0.50	N.D.
Cadmium	0.50	N.D.
Calcium	0.50	1.0
Chromium	0.50	N.D.
Cobalt	0.50	N.D.
Copper	0.50	N.D.
Iron	0.50	N.D.
Lead	0.50	1.0
Magnesium	0.50	N.D.
Manganese	0.50	N.D.
Molybdenum	0.50	N.D.
Nickel	0.50	N.D.
Selenium	0.50	N.D.
Silver	0.50	N.D.
Thallium	0.50	N.D.
Tin	0.50	N.D.
Vanadium	0.50	N.D.
Zinc	0.50	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

NORTH CREEK ANALYTICAL

Janet Cocanour
Laboratory Director

Appendix E

AQUIFER TEST DATA

AQUIFER TEST DATA AT MW-6
MONTEREY APARTMENTS SITE

MARCH 1991

Initial Static Water Level (Pre-Test Measurement): 20.93 feet (ft.) below top of casing (BTOC)

Recovery Test No. 1

Time (minutes)	Reading (ft. BTOC)
0.00	21.45
0.00	21.44
0.00	21.43
0.01	21.43
0.02	21.42
0.03	21.42
0.05	21.40
0.06	21.40
0.08	21.39
0.10	21.37
0.11	21.44
0.13	21.42
0.15	21.37
0.16	21.36
0.18	21.35
0.20	21.35
0.21	21.34
0.23	21.33
0.25	21.32
0.26	21.32
0.28	21.31
0.30	21.31
0.31	21.30
0.33	21.29
0.41	21.27
0.50	21.25
0.58	21.22
0.66	21.21
0.75	21.19
0.83	21.18
0.91	21.17
1.00	21.20
1.08	21.24
1.16	21.18
1.25	21.16
1.33	21.15

Note: All data recorded by Hermit 1000B Data Logger/4 Pressure Transducer.

Recovery Test No. 1 (cont.)

Time (minutes)	Reading (ft. BTOC)
1.41	21.14
1.50	21.13
1.58	21.12
1.66	21.11
1.75	21.10
1.83	21.09
1.91	21.08
2.00	21.08
2.50	21.04
3.00	21.00

Recovery Test No. 2

Time (minutes)	Reading (ft. BTOC)
0.00	22.37
0.00	22.35
0.00	22.33
0.00	22.31
0.01	22.28
0.01	22.27
0.02	22.25
0.02	22.23
0.02	22.21
0.03	22.20
0.03	22.18
0.05	22.11
0.06	22.05
0.08	22.00
0.10	21.96
0.11	21.92
0.13	21.88
0.15	21.85
0.16	21.82
0.18	21.79
0.20	21.77
0.21	21.75
0.23	21.73
0.25	21.71
0.26	21.70
0.28	21.68
0.30	21.66
0.31	21.65
0.33	21.63
0.41	21.57
0.50	21.53
0.58	21.48
0.66	21.44
0.75	21.41
0.83	21.38

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North
Seattle, WA 98109-5187
(206) 621-6490
(206) 621-7523 (FAX)

Final Report
Laboratory Analysis of Selected Parameters

Matrix: WATER

Data Release Authorized: DMG

Report Prepared : April 12, 1991

Project No: 64220-C10
QC Report No: E&E-7965
Date Received: 3/26/91

Sample Data:

		DATE OF ANALYSIS					
		3/27/91	3/27/91	3/28/91	3/27/91	3/27/91	3/27/91
Lab ID	Sample Number	NITRITE (mg N/l)	NITRATE (mg N/l)	COLOR (Pt-Co units)	TURBIDITY (NTU)	BOD (mg/l)	TOTAL COLIF (# / 100 ml)
7965 A	MW-3	0.010 U	0.010 U	15	> 200	19.5	10 U
7965 B	MW-10	0.014	0.243	5	74.0	1.5	180
7965 C	RB-1	0.010 U	0.010 U	5 U	0.6 UJ	1.0 U	2 U
7965 D	DW-1	0.011	0.214	5	79.0	1.5	180

LaJ 5-29-91

Recovery Test No. 2 (cont.)

Time (minutes)	Reading (ft. BTOC)	
0.91	21.37	Log Recovery-Bailer
1.00	21.35	
1.08	21.34	
1.16	21.33	
1.25	21.32	
1.33	21.31	
1.41	21.30	
1.50	21.29	
1.58	21.28	
1.66	21.27	
1.75	21.27	
1.83	21.26	
1.91	21.25	
2.00	21.24	
2.50	21.20	
3.00	21.17	
3.50	21.15	
4.00	21.14	
4.50	21.11	

Appendix F

PHASE 1 REMEDIAL INVESTIGATION
GROUNDWATER DATA AND VALIDATION REPORTING

WB6000/12/001/91

ecology and environment, inc.

101 YESLER WAY, SEATTLE, WASHINGTON, 98104, TEL. 206/624-9537

International Specialists in the Environment

MEMORANDUM

DATE: May 31, 1991

TO: Brian Sato, Project Officer, Ecology, Olympia

THRU: Peter Jowise, Program Manager, E & E, Seattle PJ

FROM: Lila Transue, Chemist, E & E, Seattle LJT 5-31-91

SUBJ: Validation of Total Coliform, Biochemical Oxygen Demand, Nitrate, Color, and Turbidity Data Monterey Apartments, Seattle

REF: Contract Number: C0089007
Job Number: WB6210

CC: John L. Roland, Project Manager, E & E, Seattle
Laura Lowe, Dept. of Ecology, Olympia

The Quality Assurance (QA) review of four samples collected from Monterey Apartments, Seattle, Washington has been completed. Four water samples were analyzed for total coliform, biochemical oxygen demand (BOD), nitrate, nitrite, color, and turbidity by Analytical Resources, Incorporated of Seattle, Washington. The samples were numbered:

Station I.D.	Sample Number
MW-3	9113MA001GW
MW-10	9113MA002GW
RB-1	9113MA015GW
DW-1	9113MA016GW

Data Qualifications

The following comments refer to the laboratory performance in meeting the Quality Control (QC) specifications outlined in the methods listed below and the data quality objectives outlined in the Monterey Apartments Phase 1 Remedial Investigation Quality Assurance Project Plan.

Parameter	Analytical Method
Total Coliform	SM 909A(1)
Biochemical Oxygen Demand	EPA 405.1(2)
Nitrate	EPA 353.3(2)
Nitrite	EPA 354.1(2)
Color	EPA 110.3(2)
Turbidity	EPA 180.1(2)

(1) Methods are contained in "Standard Methods for the Examination of Water and Wastewater," 16th Edition (1986).

(2) Methods are contained in USEPA "Methods for Chemical Analysis of Water and Wastes", Revised March, 1983 (EPA-600/4-79/020).

1) Timeliness

Sample Number	Sample Date	Rec'd Date	Coliform Anal.	BOD Anal.	Nitrate Anal.	Nitrite Anal.	Color Anal.	Turbid. Anal.
9113MA001GW	3-26-91	3-26-91	3-27-91	3-27-9	13-27-91	3-27-91	3-28-91	3-28-91
9113MA002GW	3-26-91	3-26-91	3-27-91	3-27-9	13-27-91	3-27-91	3-28-91	3-28-91
9113MA015GW	3-26-91	3-26-91	3-27-91	3-27-9	13-27-91	3-27-91	3-28-91	3-28-91
9113MA016GW	3-26-91	3-26-91	3-27-91	3-27-9	13-27-91	3-27-91	3-28-91	3-28-91

Rec'd - Received
Anal - Analysis
Turbid. - Turbidity

All samples met holding time criteria specified in the analytical method.

2) Instrument Calibration

All instrument calibration data was within the required QC criteria.

3) Blanks

Frequency criteria were met for all laboratory blank analyses.

The following laboratory blank contained levels of the indicated parameters above the method detection limit (MDL).

Blank ID	Parameter	Result	MDL
Method Blank 1	Turbidity	0.3 NTU	0.1 NTU

Method detection limits were adjusted for all sample results below five times the blank result.

4) Check Standards

Check standards were analyzed for nitrite, nitrate and BOD analyses as specified in the individual methods. Recoveries were acceptable.

5) Duplicate Analyses.

Sample 9113MA001GW (MW-3) underwent duplicate analysis for turbidity and color. Sample 9113MA2GW (MW-10) underwent duplicate analysis for the coliform. Sample 9113MA016GW (DW-1) underwent duplicate analysis for nitrate and nitrite. All duplicate results were within required QC criteria.

6) Matrix Spike Analysis

A matrix spike analysis was performed on sample 9113MA016GW (DW-1) for nitrate and nitrite. Recoveries were within required QC criteria.

Data Use

The usefulness of the data is based on the criteria outlined in the analytical methodologies and the data quality objectives outlined in the Monterey Apartments Phase 1 Remedial Investigation Quality Assurance Project Plan.

Upon consideration of the data qualifications noted above, the data are acceptable for use except where QC criteria were not met, which may have modified the usefulness of individual values.

Data Qualifiers

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and sample dilution.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

R - Quality Control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

N - Presumptive evidence of presence of material (tentative identification). Confirmation of the analyte requires further analysis.

NJ - The analysis indicates that the analyte is tentatively identified and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

M - Mass spectral criteria for positive identification were not met. However, in the opinion of the laboratory, the identification is correct based on the analyst's professional judgement.

X - The reported result may be a combination of indistinguishable isomers.

LT:rmh

MEMORANDUM

DATE: June 21, 1991

TO: Brian Sato, Project Officer, Department of Ecology, Bellevue

THRU: Peter Jowise, Program Manager E & E, Seattle

FROM: David A. Ikeda, Chemist, E & E, Seattle
Lila Transue, Senior Chemist, E & E, Seattle

SUBJ: Validation of Groundwater Analytical Data
(Delivery Group 9100.696)
Phase 1 Remedial Investigation - Monterey Apartments Site

REF: Contract Number C0089007
Job Number: WB6210

CC: John L. Roland, Project Manager, E & E, Seattle
Laura Lowe, Department of Ecology, Olympia

The Quality Assurance (QA) review of four samples, collected from Monterey Apartments in March of 1991, has been completed. Four water samples were analyzed at low level for organic compounds, inorganic elements, and general chemistry parameters by Ecology and Environment Inc. Analytical Services Center of Buffalo, New York. The analyses performed by the laboratory included:

	Analysis	Method
I.	Organics	
	Volatile Organic Compounds (VOCs)	8240(1)
	Ethylene Dibromide (EDB)	Modified 8010(1)
II.	Inorganics	
	Metals (ICP)	6010(1)
	Lead	7421(1)
	Arsenic	7060(1)
	Mercury	7470(1)
	Selenium	7741(1)
III.	General Chemistry	
	Hardness	130.2(2)
	Total Dissolved Solids (TDS)	160.1(2)
	Chloride	325.3(2)
	Fluoride	340.2(2)
	Alkalinity	310.1(2)
	Ammonia	350.2(2)
	Total Phosphorus	365.2(2)
	Sulfate	375.4(2)
	Chemical Oxygen Demand (COD)	410.2(2)
	Total Organic Carbon (TOC)	415.2(2)
	Total Petroleum Hydrocarbons (TPH)	418.1(2)

(1) Methods are listed in United States Enviromental Protection Agency (USEPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition, 1986 (SW-846).

(2) Methods are listed in USEPA, "Methods for the Chemical Analysis of Water and Waste," EPA-600/4-79-020, March 1983 (EPA-600/4-79-020).

The samples were numbered:

Laboratory Number	Station Number
91-06304	MW-10
91-06305	RB-1
91-06306	DW-1
91-06307	MW-3

Sample 91-06307 (MW-3) underwent matrix spike (MS), matrix spike duplicate (MSD) and/or duplicate analyses for organic compounds, inorganic elements, and general chemistry parameters except alkalinity and total phosphorus. Sample 91-06306 (DW-1) underwent duplicate and MS analysis for alkalinity. No MS, MSD, or duplicate was analyzed for total phosphorus.

Data Qualifications

The following comments refer to the laboratory performance in meeting the Quality Control (QC) specifications outlined in the Monterey Apartments Phase I Remedial Investigation (RI) Quality Assurance Project Plan (QAPjP), and the appropriate analytical methods, following USEPA Hazardous Site Evaluation Division (HSED) "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis" (February 1, 1988); USEPA HSED "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" (July 1, 1988); and the USEPA "Regional Protocol for Organic Sample Holding Times" (December 7, 1990).

1) Timeliness

Sample Number	Sample Date	Rec'd Date	VOC Anal.	EDB Anal.	ICP Anal.	AA Anal.	Hg Anal.
91-06304	3/26/91	3/27/91	4/05/91	4/08/91	4/05/91	4/22/91	5/01/91
91-06305	3/26/91	3/27/91	4/05/91	4/08/91	4/05/91	4/22/91	5/01/91
91-06306	3/26/91	3/27/91	4/05/91	4/08/91	4/05/91	4/22/91	5/01/91
91-06306DL	3/26/91	3/27/91	4/05/91	NA	NA	NA	NA
91-06307	3/26/91	3/27/91	4/05/91	4/08/91	4/05/91	4/22/91	5/01/91

Rec'd - Received
VOC - Volatile Organic Compounds
EDB - Ethylene Dibromide
ICP - Inductively Coupled Plasma
AA - Atomic Absorption
Hg - Mercury
Anal. - Analysis Date
NA - Not Analyzed

All samples met holding time criteria for volatiles, ethylene dibromide, metals, mercury, and all other general chemistry parameters.

2) Instrument Tuning

All tuning check compound mass abundances and ratios were within method QC limits for volatile analysis.

3) Initial Calibration

a) Organics

All System Performance Check Compounds (SPCCs) were within method QC limits for the initial calibration with average Relative Response Factors (RRFs) above 0.05 for volatiles. All Calibration Check Compounds (CCCs) were within QC limits for the initial calibration with Percent Relative Standard Deviations (RSDs) below 30 percent.

All non-SPCCs had average RRFs of greater than or equal to 0.05 in the initial volatile calibration.

All non-CCCs had percent RSDs of less than or equal to 30 percent for the initial volatile calibration, except:

Date	Fraction	Compound	%RSD	Samples
1/30/91	VOC	Acetone	32.8	All

For samples associated with the corresponding calibration compound listed above, positive results and sample quantitation limits were flagged as estimated quantities (J or UJ), as a high RSD is indicative of poor system linearity.

Ethylene dibromide percent RSD was less than or equal to 30 percent for the initial calibration.

b) Inorganics

All ICP results fell within the control limits of 90 to 110 percent of the true values. Furnace AA results fell within the control limits of 90 to 110 percent of the true values for all analytes. Mercury results fell within the control limits of 80 to 120 percent of the true value.

c) General Chemistry

TPH, fluoride, and TOC correlation coefficients were within the method QC limits of greater than or equal to 0.995 for the initial calibration. No other general chemistry methods required an initial calibration.

4) Continuing Calibrations

a) Organics

All SPCCs were at or above the Relative Response Factor (RRF) criteria of 0.05 for volatiles. All CCCs were at or below Percent Difference (%D) limits of 25 percent for the volatile continuing calibrations.

All non-SPCCs had RRFs of greater than or equal to 0.05 for continuing volatile calibrations.

All non-CCCs that were detected in the samples had %D values for the continuing calibration of less than or equal to 25 percent.

No continuing calibration was required for ethylene dibromide analyses since all sample analyses were completed on the same date that the initial calibration was performed.

b) Inorganics

All ICP results fell within the control limits of 90 to 110 percent of the true values. Furnace AA results fell within the control limits of 90 to 110 percent of the true values for all analytes. Mercury results fell within the control limits of 80 to 120 percent of the true value.

c) General Chemistry

All general chemistry results for the daily standard fell within laboratory QC limits of 75 to 125 percent.

5) Blanks

Frequency criteria were met for all laboratory blank analyses.

a) Organics

The following organic compounds were detected in laboratory blanks at levels above laboratory reporting limits (LRL):

Blank ID	Fraction	Compound	Conc. µg/L	Associated Samples
VBLKW1	VOC	Methylene Chloride	5	*
VBLKW2	VOC	Methylene Chloride	3	91-06306 (DW-1)
		Acetone	6	91-06306 (DW-1)

Conc. - Concentration
* 91-06304 (MW-10), 91-06305 (RB-1), and 91-06307 (MW-3)

Reported levels of the above compounds in the samples were flagged "UJ" (estimated quantitation limit) if the concentrations were below five times the concentrations found in the appropriate blank (10 times for common solvents).

b) Inorganics

The following laboratory blanks contained elemental contamination:

Blank*	Element	Conc. µg/L
PB	Iron	49.6
	Manganese	1.3

PB - preparation blank
Conc. - concentration

All sample results below five times the highest analyte level reported in the blank were flagged "UJ" (not detected, estimated quantitation limit).

c) General Chemistry

No contaminants were detected in the laboratory blanks for alkalinity, fluoride, sulfate, TDS, TPH and total phosphorus. All sample results for other general chemistry parameters (hardness, chloride, ammonia, COD, and TOC) underwent blank correction.

6) Duplicate Sample Analysis

a) Inorganics

The Relative Percent Difference (RPD) values for the inorganic duplicate sample analysis were within QC criteria of less than 20 percent for sample values greater than five times the LRL.

b) General Chemistry

The RPD values for the duplicate sample analyses were within the required method QC criteria for all general chemistry parameters.

7) Matrix Spike and Matrix Spike Duplicate

a) Organics

All MS and MSD Percent Recoveries (%R) for organic analyses met the required QC criteria. All (RPD) values for the MS and MSD organic analyses were within QC criteria.

b) Inorganics

All MS %Rs for inorganic elements met the required QC criteria, except:

Sample Number	Fraction	Element	%R	QC Limits
91-06307MS	Metals	Lead	69.2	75-125
		Selenium	0.0	75-125

Positive results and quantitation limits for lead in all samples were flagged as estimated (J or UJ). Quantitation limits for selenium in all samples were flagged as unusable (R).

c) General Chemistry

All MS and MSD analyses for general chemistry parameters met required QC criteria.

8) Surrogate Recovery (Volatile Analysis)

Recoveries (%R) for all surrogate compounds for volatile analysis met laboratory QC criteria.

All volatile surrogate compounds met calibration QC criteria.

9) Internal Standard Recovery (Volatile Analysis)

All internal standard areas were within established method QC limits for volatile analysis.

10) Laboratory Control Sample (Inorganic Analysis)

The Laboratory Control Sample percent recoveries (%Rs) for all parameters for both ICP and AA analyses were within the control limits required by the associated method, except:

Element	%R	QC Limit
Sodium	136.6	75-125

Results for sodium in all samples were flagged as estimated (J or UJ).

11) ICP Serial Dilution (Inorganic Analysis)

The Percent Difference (%D) values for ICP serial dilution analysis were within the method QC limits of less than or equal to 10 percent for all parameters.

12) ICP Interference Check (Inorganic Analysis)

All parameters for the Interference Check Sample were within the control limits of 80 to 120 percent of the true values.

13) Furnace AA (Inorganic Analysis)

All furnace AA analytical spike percent recoveries (%R) met QC criteria, except:

Sample	Element	%R	QC Criteria
91-06307	Selenium	75.1	85-115

The quantitation limit for selenium in sample 91-06307 (MW-3) was flagged as estimated (UJ).

14) Mercury Analysis

All mercury analysis met QC criteria.

15) Sample Analysis

The laboratory initially analyzed 91-06306 (DW-1) for VOCs at a dilution (1:5). The undiluted sample reanalysis was performed past the required holding time. The diluted sample was reported with this case, since no analytes were detected in either analysis.

Data Use

The usefulness of the data is based on the criteria outlined in the USEPA HSED "Laboratory Data Validation Functional Guidelines for Evaluating Organics and Inorganics Analysis" (1988), and the USEPA "Regional Protocol for Organic Sample Holding Times" (December 7, 1990).

Upon consideration of the data qualifications noted above, the data are ACCEPTABLE for use except where flagged with data qualifiers which modify the usefulness of the individual values.

Data Qualifiers

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation limit, adjusted for sample weight/sample volume, extraction volume, percent solids and sample dilution.

ND - The material was analyzed for, but not detected at or above the Laboratory Reporting Limit. This qualifier should be interpreted similarly to the "U" qualifier.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

R - Quality Control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

N - Presumptive evidence of presence of material (tentative identification). Confirmation of the analyte requires further analysis.

NJ - The analysis indicates that the analyte is tentatively identified and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

M - Mass spectral criteria for positive identification were not met. However, in the opinion of the laboratory, the identification is correct based on the analyst's professional judgment.

X - The reported result may be a combination of indistinguishable isomers.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.: DW-1

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6306

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1850

Level: (low/med) LOW Date Received: 03/27/91

% Moisture: not dec. Date Analyzed: 04/11/91

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	3	UJ
67-64-1	Acetone	8	UJ
75-15-0	Carbon Disulfide	5 ~~3~~	~~U~~ U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

DW-1

ab Name: E & E INC. Contract:

ab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

atrix: (soil/water) WATER Lab Sample ID: 6306

ample wt/vol: 5.0 (g/mL) ML Lab File ID: D1850

evel: (low/med) LOW Date Received: 03/27/91

Moisture: not dec. Date Analyzed: 04/11/91

olumn (pack/cap) CAP Dilution Factor: 1.0

umber TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q

5/8/91

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

MW-10

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6304

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1717

Level: (low/med) LOW Date Received: 03/27/91

% Moisture: not dec. Date Analyzed: 04/05/91

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	4	UJ
67-64-1	Acetone	10	UJ
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

MW-10

ab Name: E & E INC. Contract:

ab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

atrix: (soil/water) WATER Lab Sample ID: 6304

ample wt/vol: 5.0 (g/mL) ML Lab File ID: D1717

evel: (low/med) LOW Date Received: 03/27/91

Moisture: not dec. Date Analyzed: 04/05/91

olumn (pack/cap) CAP Dilution Factor: 1.0

umber TICs found: 1 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 110543	Hexane	4.78	7.0	J

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5/6/92

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

MW-3

ab Name: E & E INC. Contract:

b Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

atrix: (soil/water) WATER Lab Sample ID: 6307

mple wt/vol: 5.0 (g/mL) ML Lab File ID: D1720

vel: (low/med) LOW Date Received: 03/27/91

Moisture: not dec. Date Analyzed: 04/05/91

lumn: (pack/cap) CAP Dilution Factor: 25

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	250	U
74-83-9	Bromomethane	250	U
75-01-4	Vinyl Chloride	250	U
75-00-3	Chloroethane	250	U
75-09-2	Methylene Chloride	170	UJ
67-64-1	Acetone	310	J
75-15-0	Carbon Disulfide	120	U
75-35-4	1,1-Dichloroethene	120	U
75-34-3	1,1-Dichloroethane	120	U
540-59-0	1,2-Dichloroethene (total)	470	
67-66-3	Chloroform	120	U
107-06-2	1,2-Dichloroethane	120	U
78-93-3	2-Butanone	250	U
71-55-6	1,1,1-Trichloroethane	120	U
56-23-5	Carbon Tetrachloride	120	U
108-05-4	Vinyl Acetate	250	U
75-27-4	Bromodichloromethane	120	U
78-87-5	1,2-Dichloropropane	120	U
10061-01-5	cis-1,3-Dichloropropene	120	U
79-01-6	Trichloroethene	67	J
124-48-1	Dibromochloromethane	120	U
79-00-5	1,1,2-Trichloroethane	120	U
71-43-2	Benzene	3700	
10061-02-6	trans-1,3-Dichloropropene	120	U
75-25-2	Bromoform	120	U
108-10-1	4-Methyl-2-Pentanone	250	U
591-78-6	2-Hexanone	250	U
127-18-4	Tetrachloroethene	29	J
79-34-5	1,1,2,2-Tetrachloroethane	120	U
108-88-3	Toluene	1600	
108-90-7	Chlorobenzene	120	U
100-41-4	Ethylbenzene	740	
100-42-5	Styrene	120	U
1330-20-7	Xylene (total)	3500	

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

MW-3

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6307

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1720

Level: (low/med) LOW Date Received: 03/27/91

% Moisture: not dec. Date Analyzed: 04/05/91

Column (pack/cap) CAP Dilution Factor: 25

Number TICs found: 11 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN HYDROCARBON	1.53	600	J
2.		UNKNOWN HYDROCARBON	1.92	220	J
3.		UNKNOWN	2.22	300	J
4.		UNKNOWN HYDROCARBON	2.70	380	J
5.	110543	Hexane	4.81	200	J
6.		UNKNOWN HYDROCARBON	6.59	600	J
7.		Alkylated Benzene Isomer	21.85	380	J
8.		Alkylated Benzene Isomer	22.54	220	J
9.		Alkylated Benzene Isomer	22.91	780	J
10.		Alkylated Benzene Isomer	24.08	220	J
11.		dihydro 1H-Indene Isomer	24.86	380	J

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5/8/91

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

RB-1

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6305

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1718

Level: (low/med) LOW Date Received: 03/27/91

% Moisture: not dec. Date Analyzed: 04/05/91

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	34	UJ
67-64-1	Acetone	8	J
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

RB-1

ab Name: E & E INC. Contract:

ab Code: EANDE Case No.: 9100_696 SAS No.: SDG No.:

atrix: (soil/water) WATER Lab Sample ID: 6305

ample wt/vol: 5.0 (g/mL) ML Lab File ID: D1718

evel: (low/med) LOW Date Received: 03/27/91

Moisture: not dec. Date Analyzed: 04/05/91

olumn (pack/cap) CAP Dilution Factor: 1.0

umber TICs found: 1 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 110543	Hexane	4.81	5.0	J

5/6/91

TEST CODE :WEDB 1 JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
TEST NAME : ETHYLENE DIBROMIDE UNITS : UG/L
SAMPLE ID LAB : EE-91-06306 MATRIX: WATER
SAMPLE ID CLIENT: DW-1

PARAMETER	RESULTS	Q	QNT. LIMIT
Ethylene Dibromide	ND		0.010

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT

TEST CODE :WEDB 1 JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
TEST NAME : ETHYLENE DIBROMIDE UNITS : UG/L
SAMPLE ID LAB : EE-91-06304 MATRIX: WATER
SAMPLE ID CLIENT: MW-10

PARAMETER	RESULTS	Q	QNT. LIMIT
Ethylene Dibromide	ND		0.010

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT

5/8/91

TEST CODE :WEDB 1 JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
TEST NAME : ETHYLENE DIBROMIDE UNITS : UG/L
SAMPLE ID LAB : EE-91-06307 MATRIX: WATER
SAMPLE ID CLIENT: MW-3

PARAMETER	RESULTS	Q	QNT. LIMIT
Ethylene Dibromide	ND		1.0

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT

5/8/91

TEST CODE :WEDB 1 JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
TEST NAME : ETHYLENE DIBROMIDE UNITS : UG/L
SAMPLE ID LAB : EE-91-06305 MATRIX: WATER
SAMPLE ID CLIENT: RB-1

PARAMETER	RESULTS	Q	QNT. LIMIT
Ethylene Dibromide	ND		0.010

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT

5/8/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06304 MATRIX: WATER
SAMPLE ID CLIENT: MW-10

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Total Alkalinity	260		1.0	MG/L CACO3
Alkalinity Bicarbonate	260		NA	MG/L CACO3
Chloride	81		1.0	MG/L
COD	26		5.0	MG/L
Fluoride Total	ND		0.10	MG/L
Total Hardness	490		1.0	MG/L CACO3
Ammonia Nitrogen	0.10		0.020	MG/L
Petroleum Hydrocarbons	ND		1.0	MG/L
Phosphorus Total	0.34		0.010	MG/L
Sulfide	ND		1.0	MG/L
Solids Dissolved	770		10	MG/L
TOC	4.5		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/8/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06305 MATRIX: WATER
SAMPLE ID CLIENT: RB-1

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Total Alkalinity	ND		1.0	MG/L CACO3
Alkalinity Bicarbonate	2.1		NA	MG/L CACO3
Chloride	21		1.0	MG/L
COD	ND		5.0	MG/L
Fluoride Total	ND		0.10	MG/L
Total Hardness	1.0		1.0	MG/L CACO3
Ammonia Nitrogen	ND		0.20	MG/L
Petroleum Hydrocarbons	ND		1.0	MG/L
Phosphorus Total	ND		0.010	MG/L
Sulfide	ND		1.0	MG/L
Solids Dissolved	ND		10	MG/L
TOC	ND		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/8/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06306 MATRIX: WATER
SAMPLE ID CLIENT: DW-1

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Total Alkalinity	250		1.0	MG/L CACO3
Alkalinity Bicarbonate	250		NA	MG/L CACO3
Chloride	77		1.0	MG/L
COD	31		5.0	MG/L
Fluoride Total	ND		0.10	MG/L
Total Hardness	510		1.0	MG/L CACO3
Ammonia Nitrogen	0.19		0.020	MG/L
Petroleum Hydrocarbons	ND		1.0	MG/L
Phosphorus Total	0.88		0.010	MG/L
Sulfide	ND		1.0	MG/L
Solids Dissolved	770		10	MG/L
TOC	31		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/8/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06307 MATRIX: WATER
SAMPLE ID CLIENT: MW-3

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Total Alkalinity	480		1.0	MG/L CAC03
Alkalinity Bicarbonate	560		NA	MG/L CAC03
Chloride	49		1.0	MG/L
COD	88		5.0	MG/L
Fluoride Total	0.18		0.10	MG/L
Total Hardness	510		1.0	MG/L CAC03
Ammonia Nitrogen	ND		0.020	MG/L
Petroleum Hydrocarbons	3.6		1.0	MG/L
Phosphorus Total	1.4		0.010	MG/L
Sulfide	ND		1.0	MG/L
Solids Dissolved	580		10	MG/L
TOC	20		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
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L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06306 MATRIX: WATER
SAMPLE ID CLIENT: DW-1

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Silver	(ICP)	ND		10	UG/L
Arsenic	(FU)	ND		50	UG/L
Barium	(ICP)	88		20	UG/L
Calcium	(ICP)	120000		500	UG/L
Cadmium	(ICP)	ND		5.0	UG/L
Chromium Total	(ICP)	ND		10	UG/L
Copper	(ICP)	13		20	UG/L
Iron	(ICP)	10000		50	UG/L
Mercury	(Vap)	ND		0.20	UG/L
Potassium	(ICP)	6400		700	UG/L
Magnesium	(ICP)	44000		500	UG/L
Manganese	(ICP)	3400		10	UG/L
Sodium	(ICP)	65000	R	500	UG/L
Lead	(FU)	10	R	5.0	UG/L
Selenium	(FU)	ND	R	5.0	UG/L
Silicon	(ICP)	22000		100	UG/L
Zinc	(ICP)	72		10	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
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L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/8/9

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06304 MATRIX: WATER
SAMPLE ID CLIENT: MW-10

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Silver	(ICP)	ND		10	UG/L
Arsenic	(FU)	21		5.0	UG/L
Barium	(ICP)	98		20	UG/L
Calcium	(ICP)	120000		500	UG/L
Cadmium	(ICP)	ND		5.0	UG/L
Chromium Total	(ICP)	17		10	UG/L
Copper	(ICP)	16		20	UG/L
Iron	(ICP)	15000		50	UG/L
Mercury	(Vap)	ND		0.20	UG/L
Potassium	(ICP)	6400		700	UG/L
Magnesium	(ICP)	46000		500	UG/L
Manganese	(ICP)	3200		10	UG/L
Sodium	(ICP)	63000	J	500	UG/L
Lead	(FU)	12	J	5.0	UG/L
Selenium	(FU)	ND	R	5.0	UG/L
Silicon	(ICP)	23000		100	UG/L
Zinc	(ICP)	80		10	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
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L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/6/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06307 MATRIX: WATER
SAMPLE ID CLIENT: MW-3

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Silver	(ICP)	ND		10	UG/L
Arsenic	(FU)	92		5.0	UG/L
Barium	(ICP)	250		20	UG/L
Calcium	(ICP)	100000		500	UG/L
Cadmium	(ICP)	13		5.0	UG/L
Chromium Total	(ICP)	77		10	UG/L
Copper	(ICP)	180		20	UG/L
Iron	(ICP)	50000		50	UG/L
Mercury	(Vap)	0.55		0.20	UG/L
Potassium	(ICP)	7400		700	UG/L
Magnesium	(ICP)	66000		500	UG/L
Manganese	(ICP)	8600		10	UG/L
Sodium	(ICP)	37000	J	500	UG/L
Lead	(FU)	74	J	5.0	UG/L
Selenium	(FU)	ND	R	50	UG/L
Silicon	(ICP)	69000		100	UG/L
Zinc	(ICP)	170		10	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
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NA = NOT APPLICABLE

5/8/91

JOB NUMBER :9100.696

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : MONTEREY APARTMENTS RI/FS
SAMPLE ID LAB :EE-91-06305 MATRIX: WATER
SAMPLE ID CLIENT: RB-1

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Silver	(ICP)	ND		10	UG/L
Arsenic	(FU)	ND		5.0	UG/L
Barium	(ICP)	ND		20	UG/L
Calcium	(ICP)	ND		500	UG/L
Cadmium	(ICP)	ND		5.0	UG/L
Chromium Total	(ICP)	ND		10	UG/L
Copper	(ICP)	ND		20	UG/L
Iron	(ICP)	75	UJ	50	UG/L
Mercury	(Vap)	ND		0.20	UG/L
Potassium	(ICP)	ND		700	UG/L
Magnesium	(ICP)	ND		500	UG/L
Manganese	(ICP)	ND		10	UG/L
Sodium	(ICP)	ND	U	500	UG/L
Lead	(FU)	ND	UJ	5.0	UG/L
Selenium	(FU)	ND	R	5.0	UG/L
Silicon	(ICP)	140		100	UG/L
Zinc	(ICP)	ND		10	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
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L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/8/91

ecology and environment, inc.

101 YESLER WAY, SEATTLE, WASHINGTON, 98104, TEL. 206/624-9537

International Specialists in the Environment

MEMORANDUM

DATE: June 24, 1991

TO: Brian Sato, Project Officer, Ecology, Bellevue

THRU: Peter Jowise, Program Manager, E & E, Seattle PJ

FROM: David A. Ikeda, Chemist, E & E, Seattle DI
Lila Transue, Senior Chemist, E & E, Seattle LT

SUBJ: Validation of Groundwater Analytical Data for VOC, TPH and Lead Analyses (Delivery Group 9100.718) Phase 1 Remedial Investigation - Monterey Apartments Site

REF: Contract Number C0089007
Job Number: WB6210

CC: John L. Roland, Project Manager, E & E, Seattle
Laura Lowe, Ecology, Olympia

The Quality Assurance (QA) review of 10 samples collected from Monterey Apartments has been completed. Ten water samples were analyzed at low level for volatile organic compounds (VOCs) listed in United States Enviromental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste," SW-846, Third Edition, 1986 (SW-846), Method 8240; Lead (SW-846, Method 7421); and Total Petroleum Hydrocarbons (TPHs) (EPA "Methods for the Chemical Analysis of Water and Waste," EPA-600/4-79-020, March 1983 [EPA-600/4-79-020], Method 418.1) by Ecology and Environment, Inc. Analytical Services Center of Buffalo, New York. The samples were numbered:

Laboratory Number	Station Number	Laboratory Number	Station Number
91-06800	MW-2U	91-06805	MW-7
91-06801	MW-4U	91-06806	MW-8
91-06802	MW-4	91-06807	MW-11
91-06803	MW-5	91-06808	RW-2
91-06804	MW-6	91-06809	MW-9

No sample from this delivery group underwent matrix spike (MS) and matrix spike duplicate (MSD) analysis for VOCs or TPHs. MS and MSD

results from Delivery Group 9100.696 (Monterey Apartments) were used to qualify the data for this Delivery Group. Samples 91-06801 (MW-4U) and 91-06807 (MW-11) underwent duplicate and MS analysis for lead.

Data Qualifications

The following comments refer to the laboratory performance in meeting the Quality Control (QC) specifications outlined in the Monterey Apartments Phase I Remedial Investigation (RI) Quality Assurance Project Plan (QAPjP), SW-846 Methods 8240 and 7421, and EPA-600/4-79-020 Method 418.1 following EPA Hazardous Site Evaluation Division (HSED) "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis" (February 1, 1988); EPA HSED "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis" (July 1, 1988) and the EPA "Regional Protocol for Organic Sample Holding Times" (December 7, 1990).

1) Timeliness

Sample Number	Sample Date	Rec'd Date	VOC Anal.	TPH Anal.	Lead Anal.
91-06800	3/27/91	3/29/91	4/04/91	4/17/91	4/22/91
91-06801	3/28/91	3/29/91	4/03/91	4/17/91	4/19/91
91-06802	3/28/91	3/29/91	4/03/91	4/17/91	4/19/91
91-06803	3/27/91	3/29/91	4/03/91	4/17/91	4/22/91
91-06804	3/28/91	3/29/91	4/04/91	4/17/91	4/22/91
91-06805	3/27/91	3/29/91	4/03/91	4/17/91	4/22/91
91-06806	3/28/91	3/29/91	4/03/91	4/17/91	4/22/91
91-06807	3/27/91	3/29/91	4/04/91	4/17/91	4/22/91
91-06808	3/27/91	3/29/91	4/04/91	4/17/91	4/22/91
91-06809	3/28/91	3/29/91	4/04/91	4/17/91	4/22/91

Rec'd - Received
VOC - Volatile Organic Compounds
TPH - Total Petroleum Hydrocarbon
Anal. - Analysis Date

All samples met regional holding time criteria for volatiles, total petroleum hydrocarbons, and lead.

2) Instrument Tuning (VOC Analysis)

All tuning check compound mass abundances and ratios were within method-required limits for volatile analysis.

3) Initial Calibration

a) VOC Analysis

All System Performance Check Compounds (SPCCs) were within method QC limits for the initial calibration with average Relative Response Factors (RRFs) above 0.05 for volatiles. All Calibration Check Compounds (CCCs) were within QC limits for the initial calibration with Percent Relative Standard Deviations (RSDs) below 30 percent.

All non-SPCCs had average RRFs of greater than or equal to 0.05 in the initial volatile calibration.

All non-CCCs had percent RSDs less than or equal to 30 percent for the initial volatile calibration, except:

Date	Fraction	Compound	Associated %RSD	Samples
1/30/91	VOC	Acetone	32.8	All

For samples associated with the corresponding calibration and volatile compound listed above, positive results and sample quantitation limits were flagged as estimated quantities (J or UJ), as a high RSD is indicative of poor system linearity.

b) Lead Analysis

Lead (furnace AA) results for the initial calibration verification fell within the control limits of 90 to 110 percent of the true values.

c) TPH Analysis

The correlation coefficient for TPH analysis was within laboratory QC limits of greater than 0.995 for the initial calibration.

4) Continuing Calibrations

a) VOC Analysis

All SPCCs were at or above the RRF criteria of 0.05 for volatiles. All CCCs were at or below the Percent Difference (%D) limits of 25 percent for the volatile continuing calibrations.

All non-SPCCs had RRF(50)s greater than or equal to 0.05 for continuing volatile calibrations, except:

Date	Time	Fraction	Compound	RRF	Associated Samples
1/30/91	0033	VOC	2-Butanone	0.044	*

* Samples 91-06802 (MW-4), 91-06803 (MW-5), and 91-06805 (MW-7)

For samples associated with the corresponding calibration and volatile compound listed above, the positive results were flagged as estimated quantities (J). Quantitation limits for the compound listed above were flagged as unusable (R).

All non-CCCs that were detected in the samples had %D values for the continuing calibration of less than or equal to 25 percent, except:

Date	Time	Fraction	Compound	%D	Samples
4/04/91	1145	VOC	Carbon Disulfide	43.7	*

* Samples 91-06800 (MW-2U), 91-06804 (MW-6), 91-06808 (RW-2), and 91-06809 (MW-9)

For samples associated with the corresponding calibration and volatile compound listed above, positive results were flagged as estimated quantities (J).

b) Lead Analysis

All lead results (furnace AA) for continuing calibration verifications fell within the control limits of 90 to 110 percent of the true value.

c) TPH Analysis

Daily TPH standard analyses fell within laboratory quality control limits.

5) Blanks

Frequency criteria were met for all laboratory blank analyses.

a) VOC Analysis

The following compounds were detected in laboratory blanks at levels above laboratory reporting limits (LRL).

Blank ID	Fraction	Compound	Conc. µg/L	Associated Samples
VBLKW1	VOC	Methylene Chloride	3	*
		Acetone	20	*
		Xylene	2	*
VBLKW2	VOC	Methylene Chloride	4	**
		Acetone	8	**
VBLKW3	VOC	Methylene Chloride	7	***
		Acetone	27	***

* Samples 91-06802 (MW-4), 91-06803 (MW-5), and 91-06805 (MW-7)
** Samples 91-06801 (MW-4U) and 91-06806 (MW-8)
*** Samples 91-06800 (MW-2U), 91-06804 (MW-6), 91-06807 (MW-11), 91-06808 (RW-2), and 91-06809 (MW-9)
Conc. - Concentration

Reported levels of the above compounds in the samples were flagged "UJ" (estimated quantitation limit) if the concentrations were below five times the concentrations found in the appropriate blank (10 times for common solvents).

The following Tentatively Identified Compound (TIC) was identified in the laboratory blank:

Blank ID	Fraction	Compound	RT	Est. Conc.	Associated Samples
VBLKW3	VOC	Hexane	4.78	5.0	*

Est. Conc. - Estimated Concentration
* Samples 91-06800 (MW-2U), 91-06804 (MW-6), 91-06807 (MW-11), 91-06808 (RW-2), and 91-06809 (MW-9)

Reported levels of this compound found in the samples were flagged "UJ" (estimated quantitation limit) if the reported concentration was less than 10 times the concentration found in the appropriate blank.

b) Lead Analysis

No lead was detected in any laboratory blank above the LRL.

c) TPH Analysis

No TPHs were detected in any laboratory blank above the LRL.

6) Duplicate Sample (Lead Analysis)

The Relative Percent Difference (RPD) values for the duplicate sample analysis were within method QC criteria of less than 20 percent.

7) Matrix Spike (Lead Analysis)

The MS Percent Recovery (%R) for lead was outside of the QC limits:

Sample Number	Fraction	Compound	%R	QC Limits
91-06807MS	Metals	Lead	138.5	75-125

All positive results for lead were flagged as estimated (J).

8) Surrogate Recovery (VOC Analysis)

Recoveries (%R) for all surrogate compounds for volatile analysis met laboratory QC criteria.

All surrogate compounds met calibration QC criteria.

9) Internal Standards (VOC Analysis)

All internal standard areas were within established method QC limits.

10) Furnace AA (Lead Analysis)

All furnace AA results met QC criteria.

11) Sample Analysis

Carbon disulfide was not detected in the original VOC analysis of sample 91-06809 (MW-9). The sample was reanalyzed due to a high surrogate recovery, and carbon disulfide was detected. The laboratory suspects that the positive result for carbon disulfide was due to laboratory contamination. Therefore, carbon disulfide results for sample 91-06809 (MW-9) were flagged as estimated (J).

No qualifiers were placed on the data associated with this Delivery Group based on the VOC and TPH MS and MSD analyses performed for Delivery Group 9100.696.

Data Use

The usefulness of the data is based on the criteria outlined in the EPA HSED "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis" (February 1, 1988); EPA HSED "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis" (July 1, 1988); and the EPA "Regional Protocol for Organic Sample Holding Times", (December 7, 1990).

Upon consideration of the data qualifications noted above, the data are ACCEPTABLE for use except where flagged with data qualifiers which modify the usefulness of the individual values.

Data Qualifiers

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation limit. adjusted for sample weight/sample volume, extraction volume, percent solids and sample dilution.

ND - The material was analyzed for, but not detected at or above the laboratory reporting limit. This qualifier should be interpreted similarly to the "U" qualifier.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

R - Quality Control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

N - Presumptive evidence of presence of material (tentative identification). Confirmation of the analyte requires further analysis.

NJ - The analysis indicates that the analyte is tentatively identified and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

M - Mass spectral criteria for positive identification were not met. However, in the opinion of the laboratory, the identification is correct based on the analyst's professional judgment.

X - The reported result may be a combination of indistinguishable isomers.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.: 004GW

Lab Name: E & E INC. Contract:

Lab Code: EHNDE Case No.: 9100_T19 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6800

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 01700

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column: (pack/cap) CAP Dilution Factor: 1.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	5	uJ
67-64-1	Acetone	10	UJ
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloropropene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1E

SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

004GW

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100.T18 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6800

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1700

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column (pack/cap) CAP Dilution Factor: 1.0

CONCENTRATION UNITS:
Number TICs found: 0 (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q

1H

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

005GW

Lab Name: E & E INC. Contract:

Lab Code: E-WIDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6891

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1669

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column: (pack/cap) CAP Dilution Factor: 100

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	1000	U
74-83-9	Bromomethane	1000	U
75-01-4	Vinyl Chloride	1000	U
75-00-3	Chloroethane	1000	U
75-09-2	Methylene Chloride	300	J B
67-64-1	Acetone	900	J B
75-15-0	Carbon Disulfide	500	U
75-35-4	1,1-Dichloroethene	500	U
75-34-3	1,1-Dichloroethane	500	U
540-59-0	1,2-Dichloroethene (total)	500	U
67-66-3	Chloroform	500	U
107-06-2	1,2-Dichloroethane	500	U
78-93-3	2-Butanone	1000	U
71-55-6	1,1,1-Trichloroethane	500	U
56-23-5	Carbon Tetrachloride	500	U
108-05-4	Vinyl Acetate	1000	U
75-27-4	Bromodichloromethane	500	U
78-87-5	1,2-Dichloropropane	500	U
10061-01-5	cis-1,3-Dichloropropene	500	U
79-01-6	Trichloroethene	500	U
124-48-1	Dibromochloromethane	500	U
79-00-5	1,1,2-Trichloroethane	500	U
71-43-2	Benzene	500	U
10061-02-6	trans-1,3-Dichloropropene	500	U
75-25-2	Bromoform	500	U
108-10-1	4-Methyl-2-Pentanone	1000	U
591-78-6	2-Hexanone	1000	U
127-18-4	Tetrachloroethene	500	U
79-34-5	1,1,2,2-Tetrachloroethane	500	U
108-88-3	Toluene	1600	
108-90-7	Chlorobenzene	500	U
100-41-4	Ethylbenzene	1200	
100-42-5	Styrene	500	U
1330-20-7	Xylene (total)	7400	

1E

SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

005GM

Lab Name: E & E INC. Contract:

Lab Code: EMADE Case No.: 9100_T18 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: c301

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 01oo9

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column (pack/cap) CAP Dilution Factor: 100

Number TICs found: 5 CONCENTRATION UNITS: (ug/L or ug/kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 110543	Hexane	4.91	700	NJ
2.	Alkylated Benzene	21.76	1500	NJ
3.	Alkylated Benzene	22.87	1700	NJ
4.	Alkylated Benzene	24.08	600	NJ
5.	Dihydro 1H-Indene Isomer	24.80	1000	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE I.D.

0076M

Lab Name: E & E INC. Contract:

Lab Code: EMCE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: e802

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 01651

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column: (pack/cap) CAP Dilution Factor: 100

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L		Q
74-87-3	Chloromethane	1000	U	
74-83-9	Bromomethane	1000	U	
75-01-4	Vinyl Chloride	1000	U	
75-00-3	Chloroethane	1000	U	
75-09-2	Methylene Chloride	300		B
67-64-1	Acetone	1000	U	B
75-15-0	Carbon Disulfide	500	U	
75-35-4	1,1-Dichloroethene	500	U	
75-34-3	1,1-Dichloroethane	500	U	
540-59-0	1,2-Dichloroethene (total)	500	U	
67-66-3	Chloroform	500	U	
107-06-2	1,2-Dichloroethane	500	U	
78-93-3	2-Butanone	1000	U	R
71-55-6	1,1,1-Trichloroethane	500	U	
56-23-5	Carbon Tetrachloride	500	U	
108-05-4	Vinyl Acetate	1000	U	
75-27-4	Bromodichloromethane	500	U	
78-87-5	1,2-Dichloropropane	500	U	
10061-01-5	cis-1,3-Dichloropropene	500	U	
79-01-6	Trichloroethene	500	U	
124-48-1	Dibromochloromethane	500	U	
79-00-5	1,1,2-Trichloroethane	500	U	
71-43-2	Benzene	10000		
10061-02-6	trans-1,3-Dichloropropene	500	U	
75-25-2	Bromoform	500	U	
108-10-1	4-Methyl-2-Pentanone	1000	U	
591-78-6	2-Hexanone	1000	U	
127-18-4	Tetrachloroethene	500	U	
79-34-5	1,1,2,2-Tetrachloroethane	500	U	
108-88-3	Toluene	12000		
108-90-7	Chlorobenzene	500	U	
100-41-4	Ethylbenzene	500	U	
100-42-5	Styrene	500	U	
1330-20-7	Xylene (total)	9800		

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.
007GW

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9101_T1E SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: e602

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1e91

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column (pack/cap) CAP Dilution Factor: 100

Number TICs found: 4 CONCENTRATION UNITS:
(ug/L or ug/kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN	2.70	800	NJ
2.		Alkylated Benzene	21.85	800	NJ
3.		Alkylated Benzene	22.87	1500	NJ
4.		Dihydro-1H-Indene Isomer	24.80	1000	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

008GW

Lab Name: E & E INC. Contract:

Lab Code: EMNDE Case No.: 9100_715 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6803

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1652

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column: (pack/cap) CAP Dilution Factor: 100

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L		Q
74-87-3	Chloromethane	1000	U	
74-83-9	Bromomethane	1000	U	
75-01-4	Vinyl Chloride	1000	U	
75-00-3	Chloroethane	1000	U	
75-09-2	Methylene Chloride	300	B	
67-64-1	Acetone	1000	UJ	
75-15-0	Carbon Disulfide	500	U	
75-35-4	1,1-Dichloroethene	500	U	
75-34-3	1,1-Dichloroethane	500	U	
540-59-0	1,2-Dichloroethene (total)	500	U	
67-66-3	Chloroform	500	U	
107-06-2	1,2-Dichloroethane	500	U	
78-93-3	2-Butanone	1000	UR	
71-55-6	1,1,1-Trichloroethane	500	U	
56-23-5	Carbon Tetrachloride	500	U	
108-05-4	Vinyl Acetate	1000	U	
75-27-4	Bromodichloromethane	500	U	
78-87-5	1,2-Dichloropropane	500	U	
10061-01-5	cis-1,3-Dichloropropene	500	U	
79-01-6	Trichloroethene	500	U	
124-48-1	Dibromochloromethane	500	U	
79-00-5	1,1,2-Trichloroethane	500	U	
71-43-2	Benzene	5300		
10061-02-6	trans-1,3-Dichloropropene	500	U	
75-25-2	Bromoform	500	U	
108-10-1	4-Methyl-2-Pentanone	1000	U	
591-78-6	2-Hexanone	1000	U	
127-18-4	Tetrachloroethene	500	U	
79-34-5	1,1,2,2-Tetrachloroethane	500	U	
108-88-3	Toluene	1300		
108-90-7	Chlorobenzene	500	U	
100-41-4	Ethylbenzene	900		
100-42-5	Styrene	500	U	
1330-20-7	Xylene (total)	4600	B	

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SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

0036w

Lab Name: E & E INC. Contract:

Lab Code: ENVCE Case No.: 9100_T18 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 5803

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1o92

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/07/91

GC Column: (pack/cap) CAP Dilution Factor: 100

Number TICs found: 4 CONCENTRATION UNITS: (ug/L or ug/kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	2.70	600	NJ
2.	Alkylated Benzene	21.76	1100	NJ
3.	Alkylated Benzene	22.37	1300	NJ
4.	Dimyaroo-1H-Indene Isomer	24.89	900	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

009GW

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: e804

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 01702

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column: (pack/cap) CAP Dilution Factor: 500

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		
74-87-3	Chloromethane	5000	U
74-83-9	Bromomethane	5000	U
75-01-4	Vinyl Chloride	5000	U
75-00-3	Chloroethane	5000	U
75-09-2	Methylene Chloride	9700	B
67-64-1	Acetone	5000	U
75-15-0	Carbon Disulfide	2500	U
75-35-4	1,1-Dichloroethene	2500	U
75-34-3	1,1-Dichloroethane	2500	U
540-59-0	1,2-Dichloroethene (total)	2500	U
67-66-3	Chloroform	2500	U
107-06-2	1,2-Dichloroethane	2500	U
78-93-3	2-Butanone	5000	U
71-55-6	1,1,1-Trichloroethane	2500	U
56-23-5	Carbon Tetrachloride	2500	U
108-05-4	Vinyl Acetate	5000	U
75-27-4	Bromodichloromethane	2500	U
78-87-5	1,2-Dichloropropane	2500	U
10061-01-5	cis-1,3-Dichloropropene	2500	U
79-01-6	Trichloroethene	2500	U
124-48-1	Dibromochloromethane	2500	U
79-00-5	1,1,2-Trichloroethane	2500	U
71-43-2	Benzene	25000	
10061-02-6	trans-1,3-Dichloropropene	2500	U
75-25-2	Bromoform	2500	U
108-10-1	4-Methyl-2-Pentanone	5000	U
591-78-6	2-Hexanone	5000	U
127-18-4	Tetrachloroethene	2500	U
79-34-5	1,1,2,2-Tetrachloroethane	2500	U
108-88-3	Toluene	29000	
108-90-7	Chlorobenzene	2500	U
100-41-4	Ethylbenzene	2500	U
100-42-5	Styrene	2500	U
1330-20-7	Xylene (total)	19000	

IE

SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

00?GW

Lab Name: E & E INC. Contract:

Lab Code: E-NIDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 5804

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1702

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column (pack/cap) CAP Dilution Factor: 500

Number TICs found: 5 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 110?-?-	Hexane	4.81	3000	UJ
2.	Alkylated Benzene	21.??	4500	NJ
3.	Alkylated Benzene	22.37	4000	NJ
4.	UNKNOWN	24.89	4500	NJ
5.	UNKNOWN HYDROCARBON	27.90	7000	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

010GM

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_T18 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6805

Sample Wt/vol: 5.0 (g/mL) ML Lab File ID: D1054

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column: (pack/cap) CAP Dilution Factor: 10

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	100	U
74-83-9	Bromomethane	100	U
75-01-4	Vinyl Chloride	100	U
75-00-3	Chloroethane	100	U
75-09-2	Methylene Chloride	20	U J
67-64-1	Acetone	100	U J
75-15-0	Carbon Disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
540-59-0	1,2-Dichloroethene (total)	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	100	U R
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
108-05-4	Vinyl Acetate	100	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	140	
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	280	
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-Pentanone	100	U
591-78-6	2-Hexanone	100	U
127-18-4	Tetrachloroethene	170	
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-88-3	Toluene	510	
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	130	
100-42-5	Styrene	50	U
1330-20-7	Xylene (total)	1100	

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

9100

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 9805

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C1094

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column (pack/cap) CAP Dilution Factor: 10

Number TICs found: 10 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Alkylated Benzene	21.76	710	NJ
2.	Alkylated Benzene	22.51	110	NJ
3.	Alkylated Benzene	23.87	430	NJ
4.	Alkylated Benzene	24.08	160	NJ
5.	Alkylated Benzene	24.80	370	NJ
6.	Ethyl Dimethyl Benzene Isome	25.71	60	NJ
7.	Ethyl Dimethyl Benzene Isome	25.98	80	NJ
8.	Dihydro methyl 1H-Indene Iso	26.47	60	NJ
9.	UNKNOWN HYDROCARBON	27.91	310	NJ
10.	Dihydro dimethyl 1H-Indene I	28.44	130	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

011GW

Lab Name: E & E INC. Contract:

Lab Code: EMSCE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6806

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1671

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column: (pack/cap) CAP Dilution Factor: 20

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) UG/L	Q
74-87-3	Chloromethane	200	U
74-83-9	Bromomethane	200	U
75-01-4	Vinyl Chloride	200	U
75-00-3	Chloroethane	200	U
75-09-2	Methylene Chloride	74	B
67-64-1	Acetone	200	U
75-15-0	Carbon Disulfide	100	U
75-35-4	1,1-Dichloroethene	100	U
75-34-3	1,1-Dichloroethane	100	U
540-59-0	1,2-Dichloroethene (total)	100	U
67-66-3	Chloroform	100	U
107-06-2	1,2-Dichloroethane	100	U
78-93-3	2-Butanone	200	U
71-55-6	1,1,1-Trichloroethane	100	U
56-23-5	Carbon Tetrachloride	100	U
108-05-4	Vinyl Acetate	200	U
75-27-4	Bromodichloromethane	100	U
78-87-5	1,2-Dichloropropane	100	U
10061-01-5	cis-1,3-Dichloropropene	100	U
79-01-6	Trichloroethene	100	U
124-48-1	Dibromochloromethane	100	U
79-00-5	1,1,2-Trichloroethane	100	U
71-43-2	Benzene	1800	
10061-02-6	trans-1,3-Dichloropropene	100	U
75-25-2	Bromoform	100	U
108-10-1	4-Methyl-2-Pentanone	200	U
591-78-6	2-Hexanone	200	U
127-18-4	Tetrachloroethene	100	U
79-34-5	1,1,2,2-Tetrachloroethane	100	U
108-88-3	Toluene	1200	
108-90-7	Chlorobenzene	100	U
100-41-4	Ethylbenzene	1100	
100-42-5	Styrene	100	U
1330-20-7	Xylene (total)	3500	

IE

SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

011CW

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6306

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1071

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/03/91

Column (pack/cap) CAP Dilution Factor: 20

Number TICs found: 10 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	6.59	360	NJ
2.	UNKNOWN	15.77	820	NJ
3.	Alkylated Benzene	20.44	440	NJ
4.	UNKNOWN HYDROCARBON	22.16	480	NJ
5.	Alkylated Benzene	22.85	780	NJ
6.	Alkylated Benzene	24.06	720	NJ
7.	UNKNOWN	24.81	740	NJ
8.	Dihydro methyl 1H-Indene Iso	26.38	380	NJ
9.	Dihydro Dimethyl 1H-Indene I	29.45	420	NJ
10.	Dihydro Dimethyl 1H-Indene i	29.81	340	NJ

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VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

012GW

Lab Name: E & E INC. Contract:

Lab Code: E4NDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6809

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1706

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column: (pack/cap) CAP Dilution Factor: 50

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) UG/L		Q
74-87-3	Chloromethane	500	U	
74-83-9	Bromomethane	500	U	
75-01-4	Vinyl Chloride	500	U	
75-00-3	Chloroethane	500	U	
75-09-2	Methylene Chloride	370		B
67-64-1	Acetone	500		B
75-15-0	Carbon Disulfide	1600		J
75-35-4	1,1-Dichloroethene	250	U	
75-34-3	1,1-Dichloroethane	250	U	
540-59-0	1,2-Dichloroethene (total)	250	U	
67-66-3	Chloroform	250	U	
107-06-2	1,2-Dichloroethane	250	U	
78-93-3	2-Butanone	500	U	
71-55-6	1,1,1-Trichloroethane	250	U	
56-23-5	Carbon Tetrachloride	250	U	
108-05-4	Vinyl Acetate	500	U	
75-27-4	Bromodichloromethane	250	U	
78-87-5	1,2-Dichloropropane	250	U	
10061-01-5	cis-1,3-Dichloropropene	250	U	
79-01-6	Trichloroethene	250	U	
124-48-1	Dibromochloromethane	250	U	
79-00-5	1,1,2-Trichloroethane	250	U	
71-43-2	Benzene	1600		
10061-02-6	trans-1,3-Dichloropropene	250	U	
75-25-2	Bromoform	250	U	
108-10-1	4-Methyl-2-Pentanone	500	U	
591-78-6	2-Hexanone	500	U	
127-18-4	Tetrachloroethene	250	U	
79-34-5	1,1,2,2-Tetrachloroethane	250	U	
108-88-3	Toluene	2900		
108-90-7	Chlorobenzene	250	U	
100-41-4	Ethylbenzene	250	U	
100-42-5	Styrene	250	U	
1330-20-7	Xylene (total)	3100		

1E

SAMPLE NO.

012GW

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Lab Name: E & E INC. Contract:

Lab Code: EHNDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6809

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1706

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column (pack/cap) CAP Dilution Factor: 50

Number TICs found: 8 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN	2.70	350	NJ
2.		Alkylated Benzene	21.76	850	NJ
3.		Alkylated Benzene	22.97	750	NJ
4.		Alkylated Benzene	24.04	300	NJ
5.		UNKNOWN	24.80	1200	NJ
6.		Dihydro methyl 1H-Indene Iso	26.42	250	NJ
7.		UNKNOWN HYDROCARBON	27.90	1200	NJ
8.		Dihydro dimethyl 1H-Indene I	29.44	200	NJ

slrola

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

013GW

Lab Name: E & E INC. Contract:

Lab Code: EMADE Case No.: 9100_719 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 0807

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1701

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column: (pack/cap) CAP Dilution Factor: 1.0

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L Q

CAS NO.	COMPOUND		
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	20	U J
67-64-1	Acetone	5	U J
75-15-0	Carbon Disulfide	5	U
75-35-4	1,1-Dichloroethene	5	U
75-34-3	1,1-Dichloroethane	5	U
540-59-0	1,2-Dichloroethene (total)	5	U
67-66-3	Chloroform	5	U
107-06-2	1,2-Dichloroethane	5	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	5	U
56-23-5	Carbon Tetrachloride	5	U
108-05-4	Vinyl Acetate	10	U
75-27-4	Bromodichloromethane	5	U
78-87-5	1,2-Dichloropropane	5	U
10061-01-5	cis-1,3-Dichloropropene	5	U
79-01-6	Trichloroethene	5	U
124-48-1	Dibromochloromethane	5	U
79-00-5	1,1,2-Trichloroethane	5	U
71-43-2	Benzene	5	U
10061-02-6	trans-1,3-Dichloroprocene	5	U
75-25-2	Bromoform	5	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	U
79-34-5	1,1,2,2-Tetrachloroethane	5	U
108-88-3	Toluene	5	U
108-90-7	Chlorobenzene	5	U
100-41-4	Ethylbenzene	5	U
100-42-5	Styrene	5	U
1330-20-7	Xylene (total)	5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

013GW

Lab Name: E & E INC. Contract:

Lab Code: EMNDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 6807

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: 01701

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column (pack/cap) CAP Dilution Factor: 1.0

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q

1
5/10/91

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

SAMPLE NO.

014GW

Lab Name: E & E INC. Contract:

Lab Code: EMNOE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: e808

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1704

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column: (pack/cap) CAP Dilution Factor: 500

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) UG/L	Q
74-87-3	Chloromethane	5000	U
74-83-9	Bromomethane	5000	U
75-01-4	Vinyl Chloride	5000	U
75-00-3	Chloroethane	5000	U
75-09-2	Methylene Chloride	9400	UJ
67-64-1	Acetone	4000	UJ
75-15-0	Carbon Disulfide	2500	U
75-35-4	1,1-Dichloroethene	2500	U
75-34-3	1,1-Dichloroethane	2500	U
540-59-0	1,2-Dichloroethene (total)	2500	U
67-66-3	Chloroform	2500	U
107-06-2	1,2-Dichloroethane	2500	U
78-93-3	2-Butanone	5000	U
71-55-6	1,1,1-Trichloroethane	2500	U
56-23-5	Carbon Tetrachloride	2500	U
108-05-4	Vinyl Acetate	5000	U
75-27-4	Bromodichloromethane	2500	U
78-87-5	1,2-Dichloropropane	2500	U
10061-01-5	cis-1,3-Dichloropropene	2500	U
79-01-6	Trichloroethene	2500	U
124-48-1	Dibromochloromethane	2500	U
79-00-5	1,1,2-Trichloroethane	2500	U
71-43-2	Benzene	19000	
10061-02-6	trans-1,3-Dichloropropene	2500	U
75-25-2	Bromoform	2500	U
108-10-1	4-Methyl-2-Pentanone	5000	U
591-78-6	2-Hexanone	5000	U
127-18-4	Tetrachloroethene	2500	U
79-34-5	1,1,2,2-Tetrachloroethane	2500	U
108-88-3	Toluene	46000	
108-90-7	Chlorobenzene	2500	U
100-41-4	Ethylbenzene	2500	U
100-42-5	Styrene	2500	U
1330-20-7	Xylene (total)	120000	

1E

SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

014GW

Lab Name: E & E INC. Contract:

Lab Code: EANDE Case No.: 9100_718 SAS No.: SDG No.:

Matrix: (soil/water) WATER Lab Sample ID: 0808

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: D1704

Level: (low/med) LOW Date Received: 03/29/91

% Moisture: not dec. Date Analyzed: 04/04/91

Column (pack/cap) CAP Dilution Factor: 500

Number TICs found: 10 CONCENTRATION UNITS: (ug/L or ug/kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN HYDROCARBON	16.52	17000	NJ
2.		UNKNOWN HYDROCARBON	16.82	11000	NJ
3.		Alkylated Benzene	21.76	50000	NJ
4.		Alkylated Benzene	22.88	34000	NJ
5.		Alkylated Benzene	24.81	65000	NJ
6.		Alkylated Benzene	25.71	11000	NJ
7.		Alkylated Benzene	25.98	10000	NJ
8.		Dihydro Methyl 1H-Indene Iso	26.43	10000	NJ
9.		UNKNOWN HYDROCARBON	27.91	60000	NJ
10.		Dihydro dimethyl 1H-Indene I	29.45	14000	NJ

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06800 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA004GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	ND		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06801 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA005GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	4.0		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-~~6080~~ MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06802 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA007GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	12		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06803 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA008GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	6.6		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06804 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA009GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	3900		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06805 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA010GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	7.1		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06806 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA011GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	49		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06807 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA013GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	ND		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06808 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA014GW
SAMPLE LOCATION :

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	4100		1.0	MG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718
In Reference to ~~Case No(s):~~
WB6210 (Monterey Apartments)

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06809 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA012GW
SAMPLE LOCATION : Telephone Record Log

PARAMETER	RESULTS	Q	QNT. LIMIT	UNITS
Petroleum Hydrocarbons	ND	-	1.0	MG/L

Date of Call: ~~May~~ 3, 1991

Laboratory Name: Columbia Analytical Services

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

Lab Contact: John Zeeble

Call Initiated By: _____ Laboratory E+E

5/10/91

In reference to data for the following sample number(s):
MA001SG - MA042SG - MA043GW - MA048GW

Summary of Questions/Issues Discussed:
(1) Corrected datasheets for MA003SG (Ethylbenzene: reported 16J, raw data: 12)
MA014SG (Ethylbenzene: reported 34J, raw data: 35)
MA028SG (Ethylbenzene: reported 5J, raw data: 4.85)
MA032SG Toluene reported value should be >
MA042SG (V-TPH: reported 8.0, raw data: 6.2)
(2) RFs from 1. Cal for BTEX cannot be duplicated (water)
(3) Cont cal for 4/18 (5) reporting limits of 0.5ug/L (water) lowest std at 10ug/L
(4) blank cont. from 4/17 (6) no initial cal data for V-TPH in water?

Summary of Resolution:
(1) Will send corrected data sheets
(2) computer generated curve - best line
(3) no cont. cal - MS/MSD anal. only for this date
(4) not really a "blank", but to clean out system from std. inj.
(5) experimentally calculated D.L. of 0.4 ug/L for Xylene - 7 injections
⇒ 3x std. deviation for 1ug/L std.
(6) Will send raw data

Lila Jeanne
Signature

May 23, 1991
Date

Distribution: (1)Lab Copy, (2)Region Copy, (3)SMO Copy

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06800 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA004GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	60	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06801 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA005GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	16	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06802 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA007GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	63	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5.10.91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06803 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA008GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	29	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06804 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA009GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	1500		5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/23/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06805 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA010GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	24	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06806 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA011GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	54	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06807 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA013GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	11	U	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06808 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA014GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	250	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

5/10/91

JOB NUMBER :9100.718

Ecology and Environment, Inc.
Analytical Services Center

CLIENT : WB-6000 MONTEREY APARTMENTS
SAMPLE ID LAB :EE-91-06809 MATRIX: WATER
SAMPLE ID CLIENT: 9113MA012GW
SAMPLE LOCATION :

PARAMETER		RESULTS	Q	QNT. LIMIT	UNITS
Lead	(FU)	160	J	5.0	UG/L

QUALIFIERS: C = COMMENT ND = NOT DETECTED
J = ESTIMATED VALUE B = ALSO PRESENT IN BLANK
L = PRESENT BELOW STATED DETECTION LIMIT
NA = NOT APPLICABLE

Appendix G

PHASE 1 REMEDIAL INVESTIGATION
SOIL-GAS DATA VALIDATION REPORTING

ecology and environment, inc.

101 YESLER WAY, SEATTLE, WASHINGTON, 98104, TEL. 206/624-9537

International Specialists in the Environment

MEMORANDUM

DATE: July 8, 1991

TO: Brian Sato, Project Officer, Ecology, Olympia

THRU: Peter Jowise, Program Manager, E & E, Seattle

FROM: Lila Transue, Chemist, E & E, Seattle

SUBJ: Validation of Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and Volatile Total Petroleum Hydrocarbon (V-TPH) Screening Data
Phase I Remedial Investigation - Monterey Apartments Site

REF: Contract Number: C0089007
Project Number: WB6210

CC: John L. Roland, Project Manager, E & E, Seattle
Laura Lowe, Ecology, Olympia

The Quality Assurance (QA) review of 48 samples collected from Monterey Apartments, Seattle, Washington has been completed. Forty-two soil-gas and six water samples were screened for benzene, toluene, ethylbenzene, xylenes (BTEX), and volatile total petroleum hydrocarbons (V-TPH) by Columbia Analytical Services (CAS) of Bothell, Washington. The samples were numbered:

9114MA001SG	9114MA017SG	9114MA033SG
9114MA002SG	9114MA018SG	9114MA034SG
9114MA003SG	9114MA019SG	9114MA035SG
9114MA004SG	9114MA020SG	9114MA036SG
9114MA005SG	9114MA021SG	9114MA037SG
9114MA006SG	9114MA022SG	9114MA038SG
9114MA007SG	9114MA023SG	9114MA039SG
9114MA008SG	9114MA024SG	9114MA040SG
9114MA009SG	9114MA025SG	9114MA041SG
9114MA010SG	9114MA026SG	9114MA042SG
9114MA011SG	9114MA027SG	9114MA043GW
9114MA012SG	9114MA028SG	9114MA044GW
9114MA013SG	9114MA029SG	9114MA045GW
9114MA014SG	9114MA030SG	9114MA046GW
9114MA015SG	9114MA031SG	9114MA047GW
9114MA016SG	9114MA032SG	9114MA048GW

The samples were analyzed for BTEX and V-TPH by the United States Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Wastes", SW-846, 1986, Method 8020 and modified Method 8015. Modifications to Method 8015 used for analysis of these samples are contained in the State of California Leaking Underground Fuel Tank (LUFT) Task Force Field Manual, Appendix D (October 1989).

1) Timeliness

Sample Number	Sample Date	Rec'd Date	BTEX/V-TPH Analysis
9114MA001SG	3-25-91	3-26-91	3-27-91
9114MA002SG	3-25-91	3-26-91	3-27-91
9114MA003SG	3-26-91	3-26-91	3-27-91
9114MA004SG	3-26-91	3-26-91	3-27-91
9114MA005SG	3-26-91	3-26-91	3-27-91
9114MA006SG	3-27-91	3-27-91	3-28-91
9114MA007SG	3-27-91	3-27-91	3-28-91
9114MA008SG	3-27-91	3-27-91	3-28-91
9114MA009SG	3-28-91	3-28-91	3-29-91
9114MA010SG	3-28-91	3-28-91	3-29-91
9114MA011SG	3-28-91	3-28-91	3-29-91
9114MA012SG	3-28-91	3-28-91	3-29-91
9114MA013SG	3-28-91	3-28-91	3-29-91
9114MA014SG	3-29-91	3-29-91	3-30-91
9114MA015SG	3-29-91	3-29-91	3-30-91
9114MA016SG	3-29-91	3-29-91	3-30-91
9114MA017SG	3-29-91	3-29-91	3-30-91
9114MA018SG	3-29-91	3-29-91	3-30-91
9114MA019SG	3-29-91	3-29-91	3-30-91
9114MA020SG	4-1-91	4-1-91	4-2-91
9114MA021SG	4-1-91	4-1-91	4-2-91
9114MA022SG	4-1-91	4-1-91	4-2-91
9114MA023SG	4-1-91	4-1-91	4-2-91
9114MA024SG	4-1-91	4-1-91	4-2-91
9114MA025SG	4-2-91	4-2-91	4-3-91
9114MA026SG	4-2-91	4-2-91	4-3-91
9114MA027SG	4-2-91	4-2-91	4-3-91
9114MA028SG	4-2-91	4-2-91	4-3-91
9114MA029SG	4-2-91	4-2-91	4-3-91
9114MA030SG	4-2-91	4-2-91	4-3-91
9114MA031SG	4-2-91	4-2-91	4-3-91
9114MA032SG	4-3-91	4-3-91	4-4-91
9114MA033SG	4-3-91	4-3-91	4-4-91
9114MA034SG	4-4-91	4-4-91	4-5-91

Rec'd - Received

1) Timeliness (cont.)

Sample Number	Sample Date	Rec'd Date	BTEX/V-TPH Analysis
9114MA035SG	4-4-91	4-4-91	4-5-91
9114MA036SG	4-4-91	4-4-91	4-5-91
9114MA037SG	4-4-91	4-4-91	4-5-91
9114MA038SG	4-4-91	4-4-91	4-5-91
9114MA039SG	4-5-91	4-5-91	4-8-91
9114MA040SG	4-5-91	4-5-91	4-8-91
9114MA041SG	4-5-91	4-5-91	4-8-91
9114MA042SG	4-5-91	4-5-91	4-8-91
9114MA043GW	4-5-91	4-5-91	4-17-91
9114MA044GW	4-5-91	4-5-91	4-17-91
9114MA045GW	4-5-91	4-5-91	4-17-91
9114MA046GW	4-5-91	4-5-91	4-17-91
9114MA047GW	4-19-91	4-19-91	4-22-91
9114MA048GW	4-19-91	4-19-91	4-22-91

Rec'd - Received

2) Initial Calibration

An initial five point calibration was performed for BTEX analysis. For water samples, the calibration was performed on the photoionization detector (PID), as specified for BTEX analysis in SW-846 Method 8020, using the internal standard method. For soil-gas analyses, the laboratory stated that an artifact, specific to the adsorbent traps used for sample collection, interfered with PID response. As a result, the initial soil-gas calibration was performed on the flame ionization detector (FID) using the external standard method. This was determined to be acceptable by the reviewer, as the PID raw data were available for confirmation of the presence of BTEX compounds. The percent relative standard deviations (%RSDs) for BTEX compounds in both initial calibrations were within the Quality Control (QC) criteria of less than or equal to 30 percent.

A three-point initial calibration was performed for V-TPH analyses using the FID, as specified in the analytical method, for both soil-gas and water analyses. The %RSD was within the QC criteria of less than or equal to 30 percent for the initial V-TPH calibrations.

3) Continuing Calibration

All relative response factors (RRFs) and calibration factors (CFs) for continuing calibrations were within QC criteria of less than or equal to 30 percent for relative percent difference (RPD) when compared to the average RRF or CF from the corresponding initial calibration, except:

Date	Fraction	Compound	Matrix	RPD	Associated Samples
3-28-91	BTEX	Toluene	Soil-Gas	49.2	*
3-28-91	BTEX	m,p-Xylenes	Soil-Gas	49.8	*
3-28-91	BTEX	o-Xylene	Soil-Gas	38.8	*
4-2-91	BTEX	Toluene	Soil-Gas	50.0	**
4-5-91	BTEX	Toluene	Soil-Gas	41.9	***
4-8-91	BTEX	m,p-Xylenes	Soil-Gas	39.4	****
4-8-91	BTEX	o-Xylene	Soil-Gas	35.2	****

*	9114MA006SG through 9114MA008SG
**	9114MA020SG through 9114MA024SG
***	9114MA034SG through 9114MA038SG
****	9114MA039SG through 9114MA042SG

For samples associated with the corresponding calibration and compounds listed above, positive results were flagged as estimated quantities (J).

4) Blanks

Frequency criteria were met for laboratory blank analysis.

No contaminants were detected in any of the laboratory blanks.

5) Surrogate Recovery

The compound 4-Bromofluorobenzene was added to all samples, standards, and QC samples as a surrogate compound for the water matrix. Surrogate recoveries for all water samples met QC criteria of 50 to 150 percent.

A surrogate was not added to soil-gas samples due to matrix effects which occurred upon introduction of the surrogate standard solution onto the adsorbent traps. Instead, the purge and trap system was leak-checked prior to the analysis of each sample, standard, and QC sample to ensure system performance.

6) Matrix Spike and Matrix Spike Duplicate

Sample 9114MA044GW underwent matrix spike (MS) and Matrix Spike Duplicate (MSD) analysis for the water matrix. All recoveries were within CAS acceptance criteria. The MSD recovery for ethylbenzene was outside of the QC limits specified in the Monterey Apartments Phase I Remedial Investigation (RI) Quality Assurance Project Plan (QAPjP) of 60 to 140 percent, with a recovery of 152 percent. No action was taken, as all other recoveries met the QAPjP QC criteria.

All RPD values for the MS and MSD analysis were within the QAPjP QC criteria.

MS and MSD analyses were not performed for the soil-gas matrix, as the entire sample is consumed in the initial analysis. However, a blank spike was analyzed by the laboratory using a gas standard containing approximately 1,000 ng of each BTEX compound. Recoveries were within the project QAPjP QC criteria of 60 to 140 percent.

7) Internal Standard Recovery

All internal standard areas for the water matrix were within the required QC criteria of 50 to 200 percent of the internal standard area from the corresponding calibration.

8) Quantitation Limits

All laboratory quantitation limits were at or below the required practical quantitation limits listed in the Monterey Apartments Phase I RI QAPjP.

For the soil-gas matrix, the laboratory quantitation limits were five times below the lowest level standard analyzed in the initial calibration. The laboratory reported all BTEX and V-TPH values between the laboratory quantitation limits and the instrument detection limits as estimated quantities (J) on the data sheets.

For the water matrix, the laboratory reported all BTEX and V-TPH values at or above the instrument detection limits. This resulted in reported values of BTEX and V-TPH compounds which were at a level 10 to 20 times below the lowest level standard from the initial calibration. Reported values of less than five times below the lowest level standard analyzed in the initial calibration were flagged by the reviewer as estimated quantities (J) for all water samples.

9) Laboratory Contact

The laboratory was contacted on May 23, 1991. See the attached Telephone Record Log.

Data Use

The usefulness of this screening data is based on the criteria outlined in the Monterey Apartments Phase I RI QAPjP and the EPA Region 10 "Regional Protocol for Organic Sample Holding Times" (December 7, 1990).

Upon consideration of the data qualification noted above, the are ACCEPTABLE for use as screening data. Data qualifiers may modify the usefulness of the individual values.

Data Qualifiers

U - The material was analyzed for, but was not detected. The associated numerical value is a method quantitation or detection limit, adjusted for sample weight/sample volume, extraction volume, percent solids and sample dilution.

J - The analyte was analyzed for and was positively identified, but the associated numerical value may not be consistent with the amount actually present in the environmental sample. The data should be seriously considered for decision-making and are usable for many purposes.

UJ - The material was analyzed for, but was not detected. The associated numerical value is an estimated/adjusted quantitation limit. The associated numerical value may not accurately or precisely represent the concentration necessary to detect the analyte in this sample.

R - Quality Control indicates that data are unusable for all purposes. The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Resampling and reanalysis are necessary for verification to confirm or deny the presence of an analyte.

Appendix H

EXPRESS FACILITY TANK TEST REPORT - 1991

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/05/91
Submitted By:	David Ikeda	**Work Order #:**	B911830
Project:	Monterey Apartments/#WB6000		
Sample Matrix:	Water		

BTEX and TPH as Gasoline
EPA Methods 5030/8020/Modified 8015
µg/L (ppb)

	Sample Name:	9114MA043GW	9114MA044GW	9114MA045GW
	Lab Code:	B1830-1	B1830-2	B1830-3
	Date Analyzed:	04/17/91	04/17/91	04/17/91
Analytes	**MRL**			
Benzene	0.5	0.9J	5,040	3,850
Toluene	0.5	13.8	12.3	15.0
Ethylbenzene	0.5	10.2	42.1	51.8
Total Xylenes	1	134	41.2	50.9
TPH as Gasoline	50	3,000	7,400	7,030

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit

6-21-91

Approved by Alan Elliott **Date** 5/17/91

00001

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/05/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/08/91
Project:	Monterey Apartments/#WB6000	**Work Order #:**	B911829
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:	9114
Lab Code:	MA042SG B1829-4

Analytes	Units	PQL	
Benzene	Nanograms	20	54
Toluene	Nanograms	20	77
Ethylbenzene	Nanograms	20	71
Total Xylenes	Nanograms	40	237 J
Volatile Hydrocarbons	Micrograms	1	6

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

ND None Detected at or above the method reporting limit
PQL Practical Quantitation Limit defined for this project

JAJ 6-21-91

Approved by Edna Elliott Date 5/23/91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment, Inc.	Date Received:	04/22/91
Project:	Monterey Apts./#WB6170	Work Order #:	B912086
Sample Matrix:	Water		

BTEX and TPH as Gasoline
EPA Methods 5030/8020/Modified 8015

Sample Name:			9116MA047	9116MA048
Lab Code:			B2086-1	B2086-2
Date Analyzed:			04/22/91	04/22/91
Analyte	**Unit**	**MRL**		
Benzene	µg/L (ppb)	0.5	ND	ND
Toluene	µg/L (ppb)	1	ND	ND
Ethylbenzene	µg/L (ppb)	1	ND	ND
Total Xylenes	µg/L (ppb)	1	ND	1.4 J
TPH as Gasoline	mg/L (ppm)	0.05	ND	ND

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by Colin Elliott Date 5/30/91

JAJ 6-21-91

00001

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/26/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/27/91
Project:	Monterey Apar ents/#WB6170	**Work Order #:**	B911581
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			9133MA001	9113MA002	9113MA003
Lab Code:			B1581-1	B1581-2	B1581-3
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	18J	ND	8J
Toluene	Nanograms	20	*<100	ND	*<100
Ethylbenzene	Nanograms	20	ND	ND	12J
Total Xylenes	Nanograms	40	ND	10J	50
Volatile Hydrocarbons	Micrograms	1	5	ND	10

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
J Estimated value below the PQL but above the 5 nanogram detection limit
***** Elevated PQL because of matrix interferences

JAY 5-21-91

Approved by Chris Elliott Date 5/23/91

00002

17 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 206/577-7222 • Fax 206/636-1068

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/26/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/27/91
Project:	Monterey Apartments/#WB6170	**Work Order #:**	B911581
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			9113MA004	9113MA005	Tube 13
Lab Code:			B1581-4	B1581-5	B1581-6
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	ND	ND	ND
Toluene	Nanograms	20	*<100	ND	15J
Ethylbenzene	Nanograms	20	7J	ND	ND
Total Xylenes	Nanograms	40	ND	ND	15J
Volatile Hydrocarbons	Micrograms	1	16	3	2

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
***** Elevated PQL because of matrix interferences
J Estimated value below the PQL but above the 5 nanogram detection limit

fdj 6-21-91

Approved by Chris Elliott Date 5/10/91

00003

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/26/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/27/91
Project:	Monterey Apartments/#WB6170	**Work Order #:**	B911581
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:	**Tube 19**
Lab Code:	**B1581-7**

Analytes	Units	PQL	
Benzene	Nanograms	20	ND
Toluene	Nanograms	20	ND
Ethylbenzene	Nanograms	20	ND
Total Xylenes	Nanograms	40	ND
Volatile Hydrocarbons	Micrograms	1	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
J Estimated value below the PQL but above the 5 nanogram detection limit

6-21-91

Approved by Chris Elliott Date 5/10/91

00004

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/17/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/28/91
Project:	Monterey Apartments/#WB6000	**Work Order #:**	B911599
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA006SG	MA007SG	MA008SG
Lab Code:			B1599-1	B1599-2	B1599-3
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	ND	ND	ND
Toluene	Nanograms	20	ND	*<100	ND
Ethylbenzene	Nanograms	20	ND	ND	ND
Total Xylenes	Nanograms	40	ND	12J	ND
Volatile Hydrocarbons	Micrograms	1	ND	10	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
***** Elevated PQL because of matrix interferences
J Estimated value below the PQL but above the 5 nanogram detection limit

JAJ 6-21-91

Approved by Alan Elliott Date 5/10/91

00002

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/28/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/29/91
Project:	Monterey Apts. - Phase 1/#WB6	**Work Order #:**	B911650
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA009SG	MA010SG	MA011SG
Lab Code:			B1650-1	B1650-2	B1650-3*
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	8J	16J	2,860
Toluene	Nanograms	20	16J	18J	2,870
Ethylbenzene	Nanograms	20	8J	8J	2,680
Total Xylenes	Nanograms	40	49	33J	7,190
Volatile Hydrocarbons	Micrograms	1	1	4	NA

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

*	Calculated using peak area
PQL	Practical Quantitation Limit defined for this project
J	Estimated value below the PQL but above the 5 nanogram detection limit
NA	Not applicable since this is a BTEX-only field standard

6-21-91

Approved by Chris Elliott Date 5/10/91

00002

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/29/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/30/91
Project:	Monterey Apartments - Phase 1/#WB6000	**Work Order #:**	B911668
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA018SG	(Clean-up Verification) MA018SG
Lab Code:			B1668-4	B1668-5
Analytes	**Units**	**PQL**		
Benzene	Nanograms	20	ND	ND
Toluene	Nanograms	20	14J	ND
Ethylbenzene	Nanograms	20	18J	ND
Total Xylenes	Nanograms	40	80	ND
Volatile Hydrocarbons	Micrograms	1	ND	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
J Estimated value below the PQL but above the 5 nanogram detection limit

6-21-91

Approved by Glenn Elliott Date 5/10/91

00003

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/01/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/02/91
Project:	Monterey Apts. Phase 1/#WB6	**Work Order #:**	B911698
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA020SG	MA021SG	MA022SG
Lab Code:			B1698-1	B1698-2	B1698-3
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	ND	ND	ND
Toluene	Nanograms	20	9J	21 J	ND
Ethylbenzene	Nanograms	20	18J	11J	ND
Total Xylenes	Nanograms	40	50	39J	24J
Volatile Hydrocarbons	Micrograms	1	10	2	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
J Estimated value below the PQL but above the 5 nanogram detection limit

JaJ 6-21-91

Approved by Chris Ellwitt Date 5/10/91

00002

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/28/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/29/91
Project:	Monterey Apts. - Phase 1/#WB6	**Work Order #:**	B911650
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA012SG	MA013SG	MA014SG
Lab Code:			B1650-4	B1650-5	B1650-6
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	ND	22	9J
Toluene	Nanograms	20	ND	30	45
Ethylbenzene	Nanograms	20	7J	51	35
Total Xylenes	Nanograms	40	22J	248	155
Volatile Hydrocarbons	Micrograms	1	ND	2	2

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
J Estimated value below the PQL but above the 5 nanogram detection limit

Approved by Colin Elliott Date 5/23/91

6-21-91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	03/29/91
Submitted By:	David Ikeda	**Date Analyzed:**	03/30/91
Project:	Monterey Apartments - Phase 1/#WB6000	**Work Order #:**	B911668
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			**MA015SG**	**MA016SG**	**MA017SG**
Lab Code:			**B1668-1**	**B1668-2**	**B1668-3**
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	29	22	21
Toluene	Nanograms	20	23	169	48
Ethylbenzene	Nanograms	20	32	41	21
Total Xylenes	Nanograms	40	134	191	73
Volatile Hydrocarbons	Micrograms	1	1	15	3

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project

faj 6-21-91

Approved by Ann Elliott Date 5/10/91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/02/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/03/91
Project:	Monterey Apts. - Phase 1/#WB6	**Work Order #:**	B911721
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA028SG	MA029SG	MA030SG
Lab Code:			B1721-4	B1721-5	B1721-6
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	6J	5J	ND
Toluene	Nanograms	20	~~5J~~ ND	11J	9J
Ethylbenzene	Nanograms	20	ND	10J	ND
Total Xylenes	Nanograms	40	24J	48	20J
Volatile Hydrocarbons	Micrograms	1	ND	ND	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_8-C_{10}.

PQL Practical Quantitation Limit defined for this project
J Estimated value below the PQL but above the 5 nanogram detection limit
ND None Detected at or above the method reporting limit

JAJ 6-21-91

Approved by Chris Elliott Date 5/10/91

00003

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/02/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/03/91
Project:	Monterey Apts. - Phase 1/#WB6	**Work Order #:**	B911721
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			**MA031SG**
Lab Code:			**B1721-7***
Analytes	**Units**	**PQL**	
Benzene	Nanograms	20	4,260
Toluene	Nanograms	20	6,110
Ethylbenzene	Nanograms	20	5,430
Total Xylenes	Nanograms	40	15,900
Volatile Hydrocarbons	Micrograms	1	NA

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

* Calculated using peak area
PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit
NA Not Applicable since this is a BTEX-only field standard

6-21-91

Approved by Adrienne Elliott **Date** 5/10/91

00004

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/01/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/02/91
Project:	Monterey Apts. Phase 1/#WB6	**Work Order #:**	B911698
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA023SG	MA024SG
Lab Code:			B1698-4*	B1698-5
Analytes	**Units**	**PQL**		
Benzene	Nanograms	20	3,320	83
Toluene	Nanograms	20	2,330	59
Ethylbenzene	Nanograms	20	1,200	73
Total Xylenes	Nanograms	40	2,540	170
Volatile Hydrocarbons	Micrograms	1	NA	11

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

*	Calculated using peak area
PQL	Practical Quantitation Limit defined for this project
ND	None Detected at or above the method reporting limit
NA	Not Applicable since this is a BTEX-only field standard

Approved by Chris Elliott Date 5/10/91

for 6-21-91

00003

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/02/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/03/91
Project:	Monterey Apts. - Phase 1/#WB6	**Work Order #:**	B911721
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA025SG	MA026SG	MA027SG
Lab Code:			B1721-1	B1721-2	B1721-3
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	12J	11J	14J
Toluene	Nanograms	20	11J	8J	17J
Ethylbenzene	Nanograms	20	15J	8J	10J
Total Xylenes	Nanograms	40	52	32J	34J
Volatile Hydrocarbons	Micrograms	1	1	ND	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
J Estimated value below the PQL but above the 5 nanogram detection limit
ND None Detected at or above the method reporting limit

6-21-91

Approved by Chris Elliott Date 5/10/91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/03/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/04/91
Project:	Monterey Apts. - Phase 1/#WB6000	**Work Order #:**	B911756
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA032SG	MA033SG
Lab Code:			B1756-1	B1756-2
Analytes	**Units**	**PQL**		
Benzene	Nanograms	20	*>180,000	ND
Toluene	Nanograms	20	*>24,000	ND
Ethylbenzene	Nanograms	20	2,500	ND
Total Xylenes	Nanograms	40	6,490	ND
Volatile Hydrocarbons	Micrograms	1	*>1,300	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
***** Estimated minimum value since both area and height responses were well above the linear range.
ND None Detected at or above the method reporting limit

Approved by Colin Elliott Date 5/23/91 JAJ 6-21-91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/04/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/05/91
Project:	Monterey Apt. Site/#WB6000	**Work Order #:**	B911783
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA034SG	MA035SG	MA036SG
Lab Code:			B1783-1	B1783-2	B1783-3*
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	549	108	6,490
Toluene	Nanograms	20	106 J	39 J	4,560 J
Ethylbenzene	Nanograms	20	167	143	1,690
Total Xylenes	Nanograms	40	644	892	3,330
Volatile Hydrocarbons	Micrograms	1	23	6	NA

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

* Calculated using peak area
PQL Practical Quantitation Limit defined for this project
NA Not applicable since this is a BTEX-only field standard

JAJ 6-21-91

Approved by Alan Elliott Date 5/10/91

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/04/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/05/91
Project:	Monterey Apt. Site/#WB6000	**Work Order #:**	B911783
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			MA037SG	MA038SG
Lab Code:			B1783-4	B1783-5
Analytes	**Units**	**PQL**		
Benzene	Nanograms	20	2,790	ND
Toluene	Nanograms	20	939 J	ND
Ethylbenzene	Nanograms	20	459	ND
Total Xylenes	Nanograms	40	690	ND
Volatile Hydrocarbons	Micrograms	1	17	ND

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
ND None Detected at or above the method reporting limit

JaJ 6-21-91

Approved by Alan Elliott **Date** 5/10/91

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/05/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/08/91
Project:	Monterey Apartments/#WB6000	**Work Order #:**	B911829
Sample Matrix:	Air		

BTEX and Volatile Hydrocarbons
EPA Methods 5030/Modified 8015/8020

Sample Name:			9114 MA039SG	9114 MA040SG	9114 MA041SG
Lab Code:			B1829-1	B1829-2	B1829-3
Analytes	**Units**	**PQL**			
Benzene	Nanograms	20	41	19J	10J
Toluene	Nanograms	20	25	153	48
Ethylbenzene	Nanograms	20	59	89	60
Total Xylenes	Nanograms	40	319 J	428 J	198 J
Volatile Hydrocarbons	Micrograms	1	2	5	2

NOTE: Volatile hydrocarbons quantitated using gasoline with a fuel hydrocarbon range of C_6-C_{10}.

PQL Practical Quantitation Limit defined for this project
J Estimated value below the PQL but above the 5 nanogram detection limit

JJ 6-21-91

Approved by Chris Ellett Date 5/10/91

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317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 206/577-7222 • Fax 206/636-1068

TANKNOLOGY CORPORATION INTERNATIONAL

5225 Hollister, Houston, Texas 77040-6294 Phone: (713) 690-TANK Fax: (713) 690-2255

Certificate of Tightness

Service Order # 13726 Test date 3-14-91

Underground storage tank system(s) tested and found tight for:

[ ] Tank(s) & Piping, Quan.

[3] Tank(s) Only, Quan.

[1] Piping only. Quan.

Tank Owner/Address MANHATTAN EXPRESS TEXACO, 631 QUEEN ANNE AVE. N., SEATTLE, WA 98119

Test Site Address MANHATTAN EXPRESS TEXACO, 631 QUEEN ANNE AVE. N., SEATTLE, WA 98119

Tank sizes & products tested

TANK #1 10K REG, TANK #2 10K RUN, TANK #3 5K DIE

Piping Tested LINE: 3A

TCI: #0036 - 5/92

WA #000722

Certification # & Expiration Date

Unit Mgr. Signature

Valid only with Corporate Seal

Note: See VacuTect Test Report for tank identification and site location drawing.

Form-Cert.3/89

TANKNOLOGY
TECHNOLOGY FOR TANKS AND THEIR ENVIRONMENT

VacuTect ™ TANK TESTING REPORT

S.O.# 13726

Customer ECOLOGY & ENVIRONMENTAL, INC. Site # Date 3-14-91

Invoice Name/Address ECOLOGY & ENVIRONMENTAL, INC., 101 YESLEY WAY, STE. #600, SEATTLE, WA 98104 Phone (206) 624-9537

Site Name/Address MANHATTAN EXPRESS TEXACO, 631 QUEEN ANNE AVE. N., SEATTLE, WA 98119 Att'n: JOHN L. ROLAND

TANKS												LINES				Leak Det		COMMENTS Note alterations or repairs.
See Diag For Loc. Tank #	Tank Product	Tank Dia.	Tank Gallons	Tank Mat'l ■ ST / FRP/ Lined	Dipped Water Level ■ START / END	Dipped Product Level ■ START / END	Probe Water Level ■ START / END	Water ingress Detected ■ Yes/No	Bubble ingress Detected ■ Yes/No	Ullage Air Ingress Detected ■ Yes/No	Tight (T) or Fail (F)	Line#	Line Mat'l ■ ST / FRP	Deliv Syst. ■ PS / SS	Tight (T) or Fail (F)	Exist LD Pass (P) Fail (F) or NONE	NEW PreTested LD ■ SOLD Yes/No	TANKS and LINES Tested to CFR-40 Parts 280-281 and NFPA 329 Spec's. Other:
1	REG	95	10K	LINED	0	74	0	NO	NO	NO	T	*1A		PS				Exist LD SN:
	Start Time: 1015											1B						New LD SN:
	End Time: 1315				0	74	0					1C						Pump Mfr.: BENNET
												1D						*LINES TESTED TIGHT WITH VACUUM.
2	RUN	95	10K	LINED	0	79	0	NO	NO	NO	T	*2A		PS				Exist LD SN:
	Start Time: 1015											2B						New LD SN:
	End Time: 1315				0	79	0					2C						Pump Mfr.: BENNET
												2D						*LINES TESTED TIGHT WITH VACUUM.
3	DIE	94	5K	ST	0	60	0	NO	NO	NO	T	3A		PS	T			Exist LD SN:
	Start Time: 1430											3B						New LD SN:
	End Time: 1700				0	60	0					3C						Pump Mfr.: RED JACKET
												3D						
4	SUN	94	5K	ST	0	75	0	NO	NO	YES	F	4A		PS				Exist LD SN:
	Start Time: 1430											4B						New LD SN:
	End Time: 1700				0	75	0					4C						Pump Mfr.: WAYNE
												4D						

JOHN BOGLE #0036 - 5/92
WA #000722

TANKNOLOGY Regional Office: 992 Unit Number 30

NOTE: Original VacuTect Data recordings are reviewed by Tanknolgy's Audit Control Department and maintained on file.

TANKNOLOGY CORPORATION INTERNATIONAL
4960-F Allison Parkway • Vacaville, CA 95688
(707) 446-2494 • (800) 826-5837 • FAX (707) 446-2495

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Ecology & Environment	**Date Received:**	04/05/91
Submitted By:	David Ikeda	**Date Analyzed:**	04/17/91
Project:	Monterey Apartments/#WB6000	**Work Order #:**	B911830
Sample Matrix:	Water		

BTEX and TPH as Gasoline
EPA Methods 5030/8020/Modified 8015
µg/L (ppb)

Sample Name:		9114MA046GW
Lab Code:		B1830-4
Date Analyzed:		04/17/91
Analytes	**MRL**	
Benzene	0.5	3.7
Toluene	0.5	ND
Ethylbenzene	0.5	ND
Total Xylenes	1	ND
TPH as Gasoline	50	140

TPH Total Petroleum Hydrocarbons
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by Chris Elliott Date 5/17/91

JAJ 6-21-91

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