3.0 SITE INVESTIGATION

This section presents the rationale for sampling activities and the analytical parameters to implement the Sample Plan. The sampling activities will focus attention on three specific areas. The areas include the plume area, the municipal wells, and the source area.

In accordance with the URS Sample Plan dated 02/19/92 and the revised Sample Plan dated 06/02/92, fourteen (14) source area groundwater monitoring wells, at seven locations, and one plume area well were installed. Undisturbed core samples were collected during well drilling from selected locations and submitted to a laboratory for chemical analysis. Each source area well location consisted of a nested pair of groundwater monitoring wells designated A and B in a single well boring. Each well casing penetrated the aquifer to a different depth to aid in delineating the vertical distribution of contaminants within the aquifer. The plume area well was screened at ten discrete intervals and a Waterloo® multiple sampling system was installed in the well. Water samples were collected from the fourteen source area wells and the 10 sample intervals in the plume area well. In addition to the wells installed for this investigation, 25 existing municipal and monitoring wells were sampled.

3.1 SOURCE AREA

Seven nested well pairs consisting of two wells per boring were installed in the source area (Figure 3-1). A general description of the well locations is provided below. The rationale for the matrices sampled, number of sampling points for each nested-pair, and selection of laboratories performing the sample analysis is similar for each well pair.

The EPA Environmental Services Branch (ESB) provided the Field Analytical Support Program (FASP) mobile laboratory for quick turnaround of soil and groundwater VOC and TPH analysis. Verification of these results was accomplished through EPA Region IX laboratory analyses of split-sample fractions.

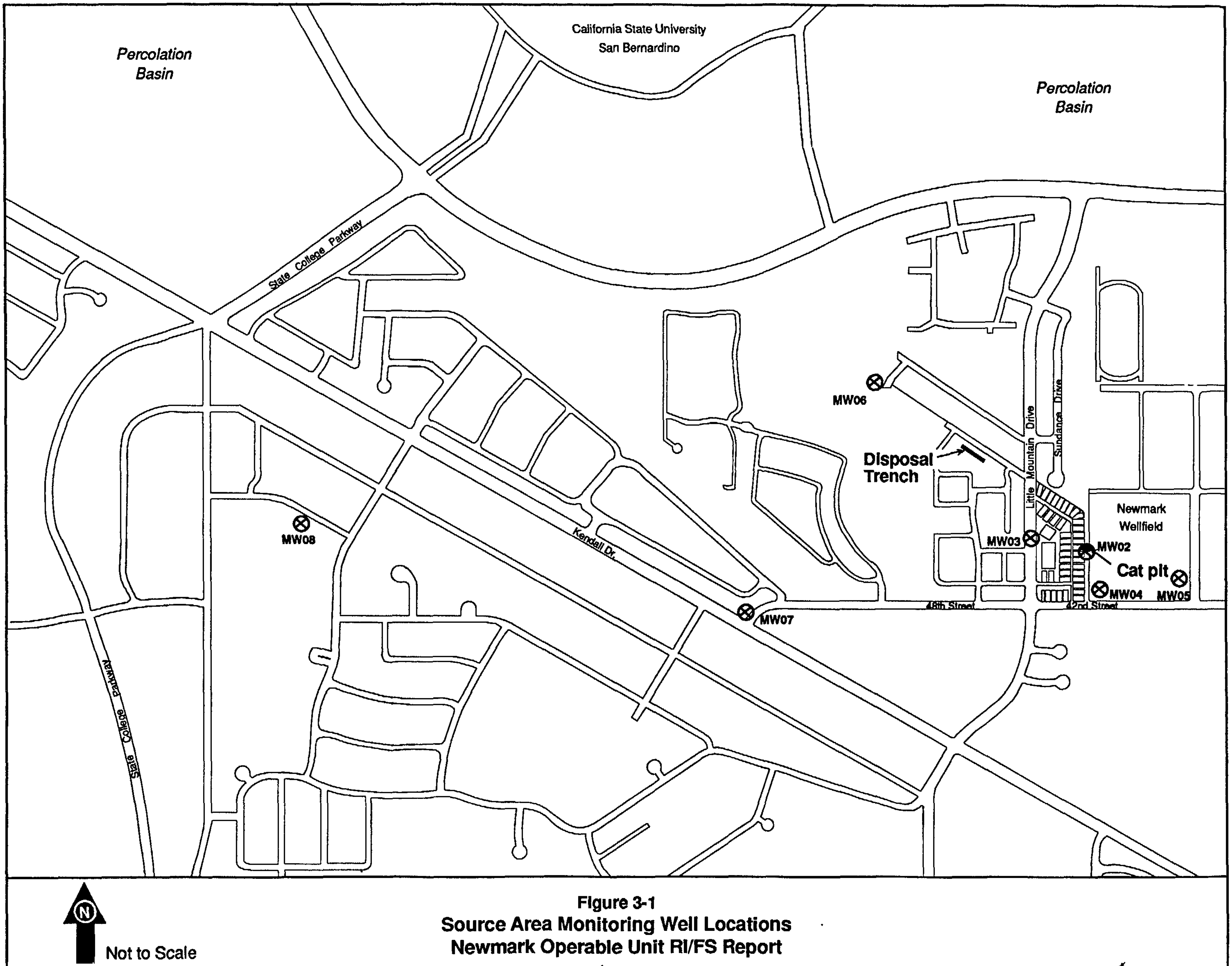


Figure 3-1
Source Area Monitoring Well Locations
Newmark Operable Unit RI/FS Report

URS #156 8/92

Though TCE and PCE are the primary contaminants of concern in the evaluation of the analytical results, data on the remaining constituents from EPA Method 624 analyte list and other analyses scheduled are required for the design of potential treatment alternatives.

3.1.1 Source Area Well Location Rationale

The monitoring well location rationale was based upon the evaluation of historical aerial photographs, site availability and best professional judgement as described below. All source area well pairs were constructed with the deep well at the aquifer/bedrock interface and the shallow well in the upper 25% of the aquifer. This provides sampling points in the upper and lower portions of the aquifer to assess the vertical distribution of contaminants.

Monitoring wells MW02A/B

Monitoring wells MW02A/B are located within the access road of the San Bernardino County Flood Control Channel adjacent to the suspected disposal area referred to as the Cat pit. The purpose of these wells is to examine the soil profile at the suspected source of contamination and to collect water samples.

Monitoring wells MW03A/B

Monitoring wells MW03A/B are located within the right-of-way of Little Mountain Drive, upgradient of the Cat pit, and downgradient of the suspected disposal trench identified in the 1959 aerial photographs (EMSL 1990). These wells are designed to be upgradient of the Cat pit suspected source in order to assess whether there may be additional sources. The purpose of soil and groundwater sampling will be to identify potential contaminants that may have originated from the disposal trench, and collect chemical data, water level data, and subsurface geologic information. These wells, if not contaminated, would have served as upgradient monitoring wells. However, water contamination was detected through mobile laboratory analysis and nested-pair MW06A/B was installed to serve as upgradient monitoring wells.

Monitoring wells MW04A/B

Monitoring wells MW04A/B are located in the southwest corner of the Newmark Wellfield on the north side of 42nd Street, east of the Flood Control Channel. The purpose of these wells is to aid in delineating potential downgradient migration and concentrations of contaminants of concern.

Monitoring wells MW05A/B

Monitoring wells MW05A/B are located north of 42nd Street in the southeast corner of the Newmark Wellfield property. The purpose of these wells is to aid in delineating potential downgradient migration and concentrations of the contaminants of concern. Additionally, data from monitoring wells MW04A and MW04B and monitoring wells MW05A/B may be used in designing an interim extraction well.

Monitoring wells MW06A/B

Monitoring wells MW06A/B were installed because water samples collected from monitoring wells MW03A/B indicated the presence of contamination. These wells are located northwest of the Cat pit and suspected disposal trench. The wells are intended for upgradient monitoring and sampling.

Monitoring wells MW07A/B

Monitoring wells MW07A/B are located within a city-owned landscaped area at the northern corner of the intersection of Kendall Drive and 48th Avenue. The purpose of these wells is to: collect water samples at a point upgradient and cross-gradient of recently installed monitoring wells in order to evaluate whether additional contaminant sources may exist; and to study potential groundwater movement toward the Newmark study area from the west.

Monitoring wells MW08A/B

Monitoring wells MW08A/B are located within the sidewalk on the south side of Windsor Drive adjacent to Kendall School property. This location is approximately one-quarter mile east of an area where the highest TCE and PCE soil gas concentrations were found during an August 1989 study (RWQCB 1991). This well is located approximately midway between two bedrock highs, Shandin Hills and Wiggins Hill, in an area believed to be the bedrock low. This area should be most likely area to encounter groundwater contamination. These wells are located upgradient of monitoring wells (MW02A/B through MW06A/B) to evaluate whether there may be additional sources northwest of Shandin Hills. The purpose of groundwater sampling was to identify potential contaminants that may have originated from sources upgradient of the Newmark study area, and collect chemical data, water level data, and subsurface geologic information. These wells may serve as a potential upgradient monitoring point in the future. Additionally, groundwater levels from these wells may be used to aid in calibration of the ongoing groundwater modeling activities associated with the project.

3.1.2 Well Boring Geophysics

Once the well boring had been completed and before the installation of the wells, a series of geophysical logs were run in each boring. Geophysical logs (Appendix B) were run as follows:

- Electric Log with Specific Potential (SP) - Total depth to base of conductor casing
- Gamma Ray Log - Total depth to base of conductor casing
- Guard Resistivity Log - Total depth to base of conductor casing
- Caliper Log - Total depth to base of conductor casing
- Temperature Log - Total depth to base of conductor casing

The Electric Log with SP is useful in verifying the electrical values seen on the Gamma Ray/Guard Resistivity log. Although the values on the electrical log are muted, correlations can be made and electrical resistivity values can be cross-referenced. The SP log is not of much analytical value in alluvial deposits but does provide information useful in correlating electrical logs between different wells.

The Gamma Ray/Guard Resistivity log is useful in defining the lithology of the boring when correlated with the sample log. Direct comparisons can be made and individual zones can be defined.

The Caliper log is vital in determining the quality and reliability of the balance of the logging data. If the caliper indicates a smooth, consistent sized boring, then the data are valid and would not need any corrections for deviated boring size. Additionally, the caliper log is used to estimate volume of sand pack and seal material needed to complete well construction.

The Temperature log measures well boring temperature and the differential temperature between the drilling fluid in the boring versus the temperature of the drilled rock formation. Variances in temperature (formation temperature is lower than well bore temperature) are good indications of water bearing zone.

Geophysical logs were reviewed for characteristic signals or patterns which would correspond to the varying lithologic conditions found in the area. These logs were compared to the soil/rock samples collected so the lithology drilled could be further identified on the logs. The combination of fresh water mud rotary drilling and the discontinuity of strata made interpretations of the geophysical logs and their relation to coarse-grained, high transmissive, water bearing zones versus fine-grained (silts and clays), lower transmissive zones difficult.

3.1.3 Suspected Source Area Well Installation

Upon completion of geophysical logging at each monitoring well, all geologic, hydrogeologic and geophysical data available were combined and a detailed analysis of the well was performed. Based on the results of this analysis, screen intervals were chosen for each monitoring well. Table 3-1 presents

Table 3-1

MONITORING WELL DATA
SUSPECTED SOURCE AREA

Well	Elevation Ground Surface (ft)	Elevation Top of Casing (ft)	Depth to Water (ft)	Elevation Static Water Level (ft)	Screened Interval (ft)		Total Depth (ft)
					From	To	
MW02A	1,413.75	1,413.15	221.68	1,191.47	280	300	422
MW02B		1,413.16	222.39	1,190.77	370	390	
MW03A	1,418.21	1,417.50	219.58	1,197.92	240	260	395
MW03B		1,417.49	220.28	1,197.21	340	360	
MW04A	1,410.72	1,410.05	219.68	1,190.37	265	275	427
MW04B		1,410.00	220.21	1,189.79	385	395	
MW05A	1,403.58	1,402.85	217.17	1,185.68	278	298	520
MW05B		1,402.87	217.21	1,185.66	432	452	
MW06A	1,435.88	1,435.45	224.20	1,211.25	250	270	367.50
MW06B		1,435.41	225.34	1,210.07	320	340	
MW07A	1,436.03	1,435.55	227.65	1,207.90	305	325	561
MW07B		1,435.53	222.28	1,213.25	486	506	
MW08A	1,475.07	1,474.23	242.65	1,231.58	275	295	521
MW08B		1,474.19	251.07	1,223.12	470	490	

the construction data for the suspected source area wells, and Figure 3-2 presents the typical well construction. Typically the A and B screened intervals are separated by 50 to 175 feet. In accordance with the sample plan, the deeper B monitoring wells at locations MW02, MW03, MW04, MW06, MW07, and MW08 were screened at, or just above, the aquifer/bedrock interface.

Monitoring well MW05 was the only exception to the sample plan. Well boring MW05 was scheduled for a maximum total depth of 500 feet bgs, the anticipated depth to bedrock. The well was drilled to a total depth of 520 feet without encountering bedrock. The decision was made to drill no deeper and proceed with constructing the well. MW05B was screened from 432 to 452 feet bgs. Geophysical log signature across the screened interval consisted of elevated resistivity on both the guard resistivity log and on the E-log (16 inch and 64 inch normal). The elevated resistivity was identified as a silty sand on the boring log.

Just below the screened interval in well boring MW05 (approximately 453 to 470 feet bgs), a sharp drop in both the guard and E-log (16 inch and 64 inch normal) resistivity occurred. This change in resistivity indicated the presence of a zone with a lower porosity and permeability. The zone is identified on the boring log as a silty clay. Because the clay horizon could potentially retard downward migration of contaminants, the decision was made to screen MW05B at the sand/clay interface.

Each shallow A monitoring well was screened in the upper 25% of the aquifer. Within the top 25% of the aquifer, a screen interval was chosen to provide high enough porosity and permeability (sand or gravel) to allow sufficient water flow for sampling. Wherever possible, a screened interval was chosen that overlaid a lower porosity and permeability horizon (clay or silt) to allow sampling of groundwater at the sand/clay interface. Descriptions of the shallow screened intervals for MW02A through MW08A are provided below.

MW02A: Screened from 280 to 300 feet bgs. The geophysical log signature consisted of multiple 2- to 4-foot horizons of high (190 OHM/meter [OHM/M]) and moderate (118 OHM/M) guard resistivity. The boring log identified sediments in this interval as silty sands. No substantial silt or clay horizon was present in the upper 25% of the aquifer.

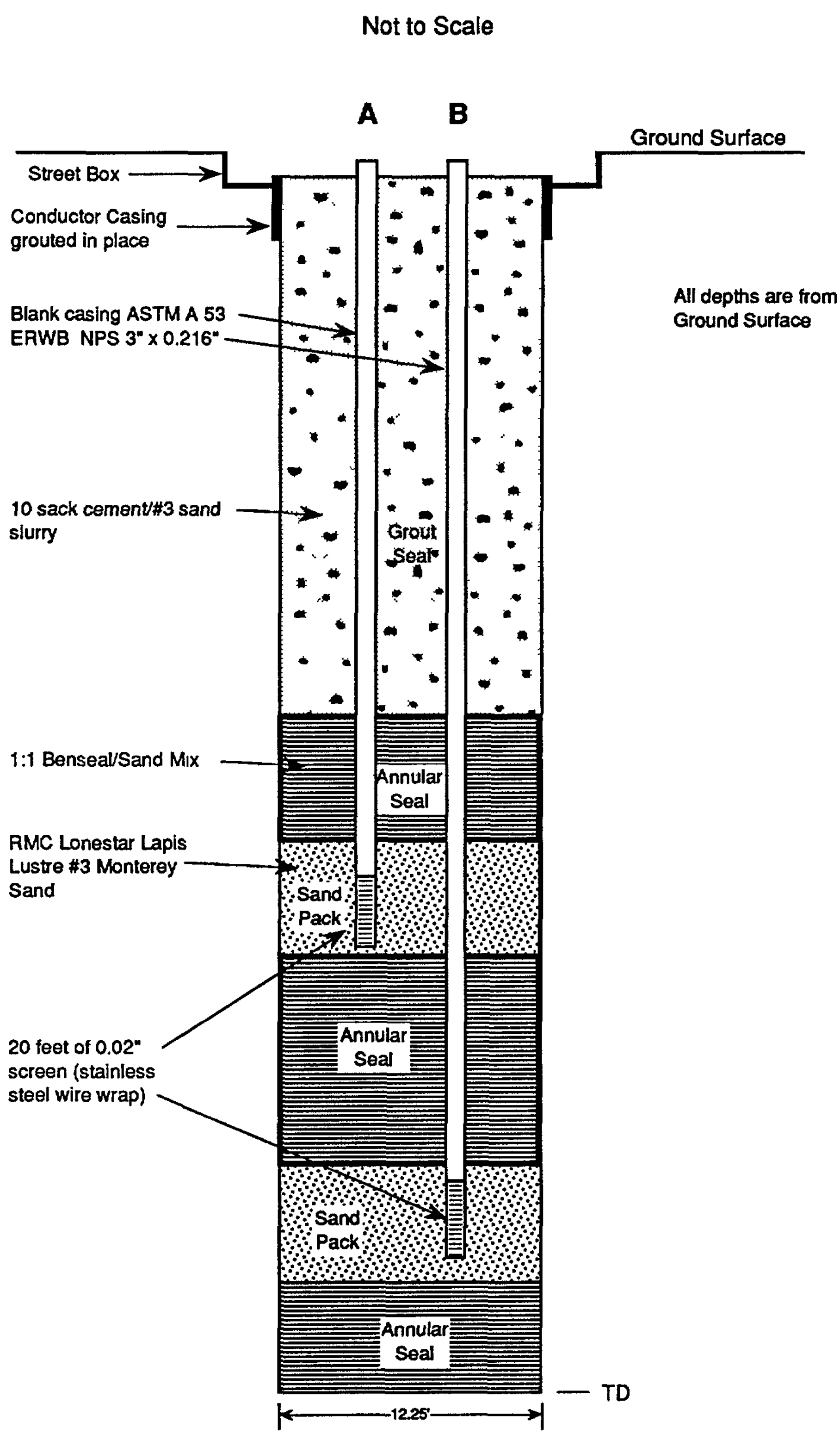


Figure 3-2
Generic Well Construction
Newmark Operable Unit RI/FS Report

MW03A: Screened from 240 to 260 feet bgs. Geophysical log signature consisted of multiple 1- to 2-foot horizons of low (85 OHM/M) to moderate (108 OHM/M) guard resistivity. An increase in guard resistivity between 240 to 249 feet bgs indicated a possible increase in sand content. The screened interval was identified as sandy silt and silty sand on the boring log. A review of the geophysical logs indicated that no substantial zone of sand with minimal fine material was present in the upper 25% of the aquifer.

MW04A: Screened from 265 to 275 feet bgs. Geophysical log signature consisted of moderate guard resistivity ranging from 130 OHM/M to 160 OHM/M. Lithology of the screened interval was identified as a silty sand. No significant clay layer was observed on the geophysical logs or in drill cuttings in the upper 25% of the aquifer.

MW05A: Screened from 278 to 298 feet bgs. Geophysical log signature consisted of multiple 1- to 4-foot horizons of moderate (130 OHM/M) to high (215 OHM/M) guard resistivity. The screened interval was identified as a gravelly sand grading to a silty sand at the bottom. The screened interval overlaid an eight foot horizon which exhibited lower resistivity and was probably a sandy silt or sandy clay horizon.

MW06A: Screened from 250 to 270 feet bgs. Geophysical log signature consisted of two distinct moderate (115 OHM/M) to high (270 OHM/M) guard resistivity intervals, separated by a 3- to 4-foot interval of approximately 150 OHM/M. Boring logs indicated that the lithology of the screened interval consisted of silty sands and silty clay. The screened interval appeared to overlay a sandy clay horizon represented on the guard log as a moderate resistivity interval (100 to 140 OHM/M) from 182 to 276 feet bgs.

MW07A: Screened from 305 to 325 feet bgs. The geophysical log signature consisted of multiple 1- to 2-foot horizons of moderate guard resistivity (140 to 150 OHM/M). Lithology of the screened interval is identified on the boring log as silty sand. No substantial silty or clay horizon was observed in the upper 25% of the aquifer.

MW08A: Screened from 275 to 295 feet bgs. Geophysical log signature consisted of multiple 1- to 2-

foot intervals of low guard resistivity (60 to 100 OHM/M). The boring log identified this interval as silt with sand and silt with clay.

On June 28, 1992 at approximately 8:00 a.m., an earthquake of magnitude 6.5 (on the Richter scale) occurred in the San Bernardino area causing problems during the construction of monitoring well MW08A/B. During the placement of the second annular seal, circulation of the drilling fluids was lost probably due to the squeezing of clays from the formation into the open bore. Additionally, some material from the boring wall appeared to slough into the open boring. Circulation was reestablished and well construction continued. However, because of continued tremors, the decision was made to complete well construction instead of removing the well casings and attempting to refurbish the boring, risking loss.

Once each well had been constructed, it was allowed to stabilize for a minimum of 24 hours prior to development. Each well was developed with a combination of bailing and purging and air lifting techniques. Table 3-2 presents the development data for each well.

3.1.4 Source Area Sampling Rationale

Soil Samples

Soil samples were collected using a 94-millimeter (mm) wire line core barrel sampler and/or a 2½-inch x 10 foot split spoon sampler. Soil samples were collected at approximately 50 to 70 feet below ground surface (bgs) and 110 to 160 feet bgs in MW03A/B, MW04A/B and MW05A/B. Soil samples were collected from 32 to 40 feet bgs, 70 to 77 feet bgs and 192 to 213 feet bgs in MW02. No core samples were collected from MW01, MW06A/B, MW07A/B and MW08A/B since the wells were outside the suspected source area (Figure 3-1). Soil fractions taken from soil core samples were placed in the appropriate number and type of jars for both mobile and EPA Region IX laboratory analysis. In most cases, analytical results from sample fractions submitted for mobile laboratory analysis were verified by EPA Region IX laboratory. A complete description of the soil samples collected for analysis is provided in Appendix A.

Table 3-2

MONITORING WELL DEVELOPMENT DATA

Well	H_2O Volume Removed (Gallons)	Dates	Total Time	Final Parameters			
				Temp °C	Conductivity μohms (1)	pH	Turbidity NTUs (2)
MW01	25,000	3/30/92-4/13/92	59:20	20.4	540	7.8	24.8
MW02A	500	4/2/92	7:30	21.8	410	8.1	20.2
MW02B	2,500	4/2/92-4/3/92	15:30	19.6	580	8.2	18.9
MW03A	700	3/19/92-3/26/92	20:00	17.8	620	8.6	24.6
MW03B	1,300	3/19/92-3/23/92	18:00	17.7	600	8.2	23.8
MW04A	300	3/7/92-3/8/92	6:30	20.6	500	7.6	20.3
MW04B	2,100	3/8/92-3/10/92	17:30	18.7	310	7.3	20.5
MW05A	1,800	3/13/92-3/14/92	14:20	19.4	510	7.8	24.4
MW05B	750	3/15/92	7:30	18.6	620	8.1	6.25
MW06A	2,000	4/10/92-4/17/92	32:00	21.8	490	7.9	24.8
MW06B	1,300	4/13/92-4/14/92	18:00	18.4	590	8.0	33.2
MW07A	3,700	6/25/92	9:00	22.0	550	7.3	2.58
MW07B	3,100	6/24/92	10:20	23.0	530	7.3	9.81
MW08A	2,700	7/3/92-7/6/92	22:15	23.0	480	8.1	82.8[3]
MW08B	7,200	7/3/92-7/6/92	29:50	19.5	600	8.0	98.2[3]

(1) micro-ohms
(2) Nephelometric Turbidity Units
(3) Elevated turbidity was probably due to magnitude 6.5 earthquake on June 28, 1992.

Since field screening of core and grab samples collected from MW02A/B through MW05A/B showed no indication of contamination, all core and grab samples collected were archived. The selection of one sample for laboratory analysis was made when all archive samples from a 100-foot interval had been screened. Since field screening did not indicate the presence of contamination in any of the soil samples, the following rationales were considered in selecting samples for analysis:

- <u>Vertical distribution</u>. If sample type, quality, and recovery permitted, analytical samples were chosen at evenly spaced intervals from ground surface to the groundwater table. This method was used to provide maximum analytical data while minimizing the number of samples required;

- <u>Sample material</u>. If possible, samples consisting of finer-grained sediments were chosen for submittal to the laboratory for analysis. Medium to coarse gravels, cobbles, and boulders were not submitted for analysis. This procedure was followed because of the poor core recovery experienced with the coarse sediments and because there is a higher likelihood that chemical analysis would detect contaminants in the finer-grained sediments;

- <u>Proximity to clay layers</u>. Whenever possible, soil samples collected from the upper portion of a clay horizon or just above the clay horizon were chosen for laboratory analysis. This procedure was followed to provide soil data in sediments which could possibly retard downward migration of contaminants and create an increase in contaminant concentration; and

- <u>Core recovery</u>. Due to the coarse grained nature of the source area, alluvial core recovery was a major factor in sample selection. In most of the core runs attempted, sample recovery was very poor to none at all. Only core samples which provided sufficient volume to complete the required laboratory analysis were selected. Care was also taken to select only core samples which best represent an undisturbed section of the alluvium.

Two (2) samples were selected for analysis by the Field Analytical Support Program (FASP) mobile laboratory, and the EPA Region IX laboratory, from wells MW03A/B, MW04A/B, and MW05A/B. Because MW02A/B was near a suspected source, seven samples were selected for analysis by the FASP mobile laboratory and five were selected for analysis by the EPA Region IX laboratory.

The mobile laboratory analyzed samples for halogenated VOCs, aromatic VOCs, and total petroleum hydrocarbons (TPH). The mobile laboratory analyzed these soil samples to provide:

- Immediate results of possible TCE and PCE soil contamination
- Better criteria for the selection of samples to go to EPA Region IX laboratory
- Field evaluation of depth and extent of soil contamination
- Data for more accurate placement, screen intervals, and sampling intervals of subsequent nested well pairs

The purpose of the EPA Region IX laboratory analysis of the soil sample counterparts was to:

- Provide a larger number of analyses (VOC, semivolatile organic compound [BNA], pesticides and polychlorinated biphenyls [Pest/PCBs], and Total metals plus mercury) of the samples in order to assess contaminants existing from historical site operations; and
- Confirm mobile laboratory VOC results by utilizing EPA methods with lower detection limits.

3.1.5 Groundwater Samples

Once both monitoring wells in a nested-pair were developed, two environmental water samples were collected from each well. One water sample was analyzed by the mobile laboratory for halogenated and aromatic VOCs and TPH and the other analyzed by EPA Region IX laboratory for the full suite of analyses (VOC, BNA, Pest/PCB, TPH, and Total metals plus mercury). The results of mobile laboratory groundwater analysis, in conjunction with borehole geophysical data, and lithologic data, were used to aid in the design of subsequent monitoring wells. The purpose of mobile laboratory analysis of groundwater samples for halogenated VOCs, aromatic VOCs, and TPH is similar to the soil sampling rationale by providing:

- Immediate results and degrees of possible TCE and PCE groundwater contamination
- Field evaluation of the depth and extent of groundwater contamination
- Analyses services within the scope of the limited analytical capabilities of the mobile laboratory

The purpose of the EPA Region IX laboratory analysis of groundwater samples was to:

- Provide analytical results necessary to make a one-time evaluation of potential groundwater contaminants resulting from historical site operations
- Confirm mobile laboratory VOC results by utilizing EPA methods

Complete descriptions of the groundwater sampling techniques are provided in Appendix A, and are summarized below:

Prior to sampling, each well was purged to ensure that native aquifer water was available for sampling. During the purging of the well, physical field parameters (temperature, electric conductivity, pH, and turbidity) were measured and recorded a minimum of two times per casing volume. Purging continued until the parameters stabilized to within 10% for three successive measurements and a minimum of three casing volumes of water was removed. This was necessary to ensure the water in the well boring was representative of the groundwater in the surrounding aquifer. The purging and sampling was done using a 2-inch, variable speed, submersible pump lowered to a depth of 250 feet bgs. At the completion of purging, the discharge line was replaced with a clear poly hose through which the environmental samples were collected.

For sampling, the flow rate was reduced to approximately 100 to 200 milliliters (ml) per minute. The samples were collected by allowing the water from the clear poly hose to flow down the inside of the bottles which were held at an angle to minimize aeration. Samples were collected in the following order:

- Total Metals
- Pesticides/PCBs
- Total Petroleum Hydrocarbons - Gas and Diesel
- Volatile Organics (VOAs)

While sampling the wells, a 250-ml beaker was filled and the physical parameters of the water sample were measured. After completion of sampling, the groundwater samples were labelled and placed in an ice chest cooled with blue ice, transported to the field office under proper chain-of-custody protocol, and submitted to the mobile laboratory or prepared for shipment to the EPA Region IX laboratory for analysis (Newmark Sample Plan, URS 1992).

The mobile laboratory data from the source area groundwater sampling were used for initial screening purposes. The position detection of volatiles in MW03B groundwater sample submitted to the mobile laboratory was utilized in the decision to install monitoring wells MW06A/B, MW07A/B, and MW08A/B. All mobile laboratory source area groundwater data results are included in Appendix G. Only validated EPA Region IX laboratory data was used in the evaluation of treatment technologies and contaminant characterization. Therefore, only EPA Region IX laboratory data are included within this report.

3.2 PLUME AREA

One multi-point monitoring well, MW01, was installed within the plume area (Figure 3-3). MW01 was used to aid in delineating the vertical distribution of the plume rather than to characterize the lateral and vertical extent of the plume. The following criteria were used to determine the position of MW01. The location had to be:

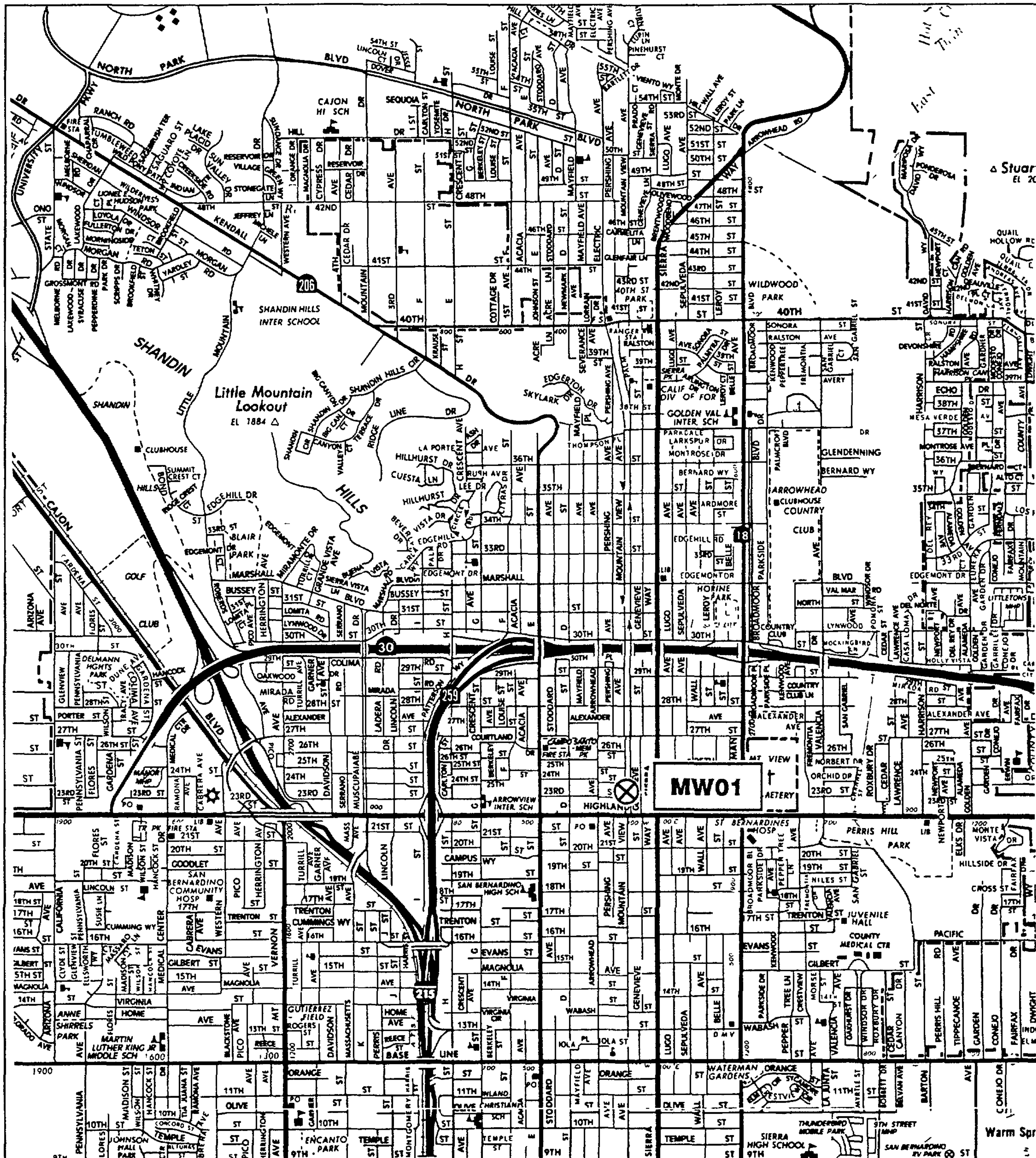


Figure 3-3

Location of Plume Monitoring Well MW01

Newmark Operable Unit RI/FS Report

0 1 2

Scale in Miles

Base Map from Automobile Club of Southern California, 1990.

LEGEND

⊗ = Monitoring Well Location

- On municipal or private property with sufficient working area and in a location that would minimize disruption of municipal and private activities;
- Within the plume; and
- In an area appearing to have the highest potential of encountering elevated levels of TCE and PCE

3.2.1 Plume Well Installation

Several zones within the aquifer with potentially higher yield were identified from the geophysical logs. These zones were selected as intervals to be screened for well completion. A brief description of each screened zone is discussed below. Figure 3-4 presents the well construction diagram and Table 3-3 summarizes the construction details. The temperature logs were not used because a characteristic temperature differential between the potential water-bearing zone and boring fluid was present of all zones screened.

Zone A: Screened from 232 feet bgs. Zone A demonstrated an increasing resistivity value, along with a low gamma ray reading, on the Gamma Ray/Guard log. Both of these readings indicated a zone free of large quantities of clay. The Electric Log showed a muted resistivity while the SP log indicated potentially higher porosity than surrounding material. The Lithology Log identified this zone as silty sand.

Zone B: Screened from 294 feet bgs. This zone was noted by a resistivity spike and low gamma ray reading on the Gamma Ray/Guard log. The resistivity on the Electric Log was muted but the SP log indicated the possibility of good porosity because of low SP values. The lithology of this zone consists of sand with gravel

Zone C: Screen from 380 feet bgs. Zone C displayed a moderate resistivity reading and low gamma ray reading on the Gamma Ray/Guard log. The Electric Log indicated a modest increase in resistivity with possible higher porosity being noted on the SP log. Lithology of this zone was a composite of silty and clayey sand.

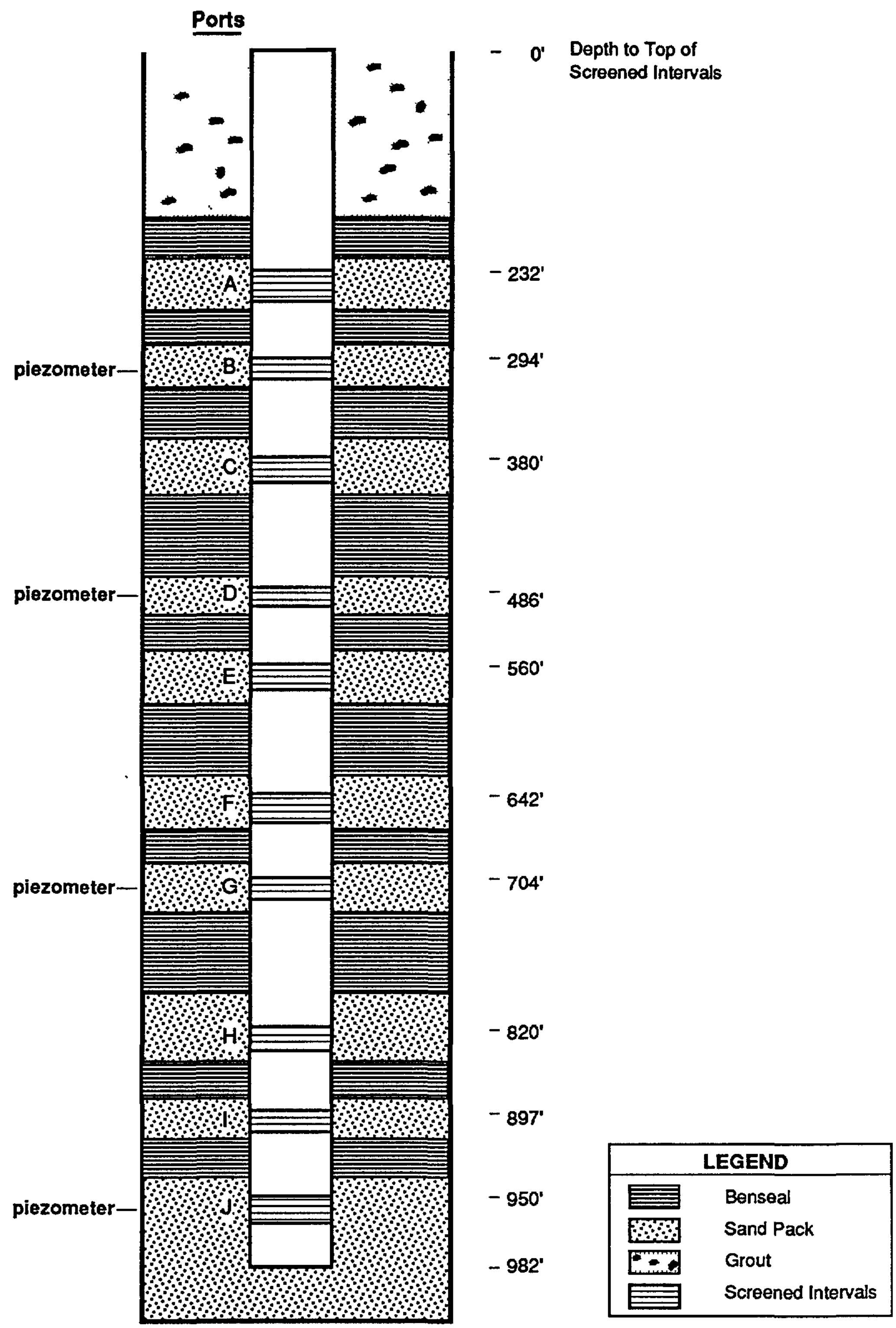


Figure 3-4

MW01 Construction Detail

Newmark Operable Unit RI/FS Report

Not to Scale

Table 3-3

MONITORING WELL MW01
WELL CONSTRUCTION DETAILS

Zone	Top of Zone (ft bgs)	Bottom of Zone (ft bgs)	Elevation Static Water Level (ft msl)	Screened Interval (ft)		Piezometer Elevation (ft)
				To	From	
Grout	3	206				
Benseal	206	226				
A Sand Pack	226	247		232	242	
Benseal	247	288				
B Sand Pack	288	310	963.01	294	304	878.01
Benseal	310	374				
C Sand Pack	374	396		380	390	
Benseal	396	480				
D Sand Pack	480	502	861.28	486	496	687.01
Benseal	502	554				
E Sand Pack	554	576		560	570	
Benseal	576	634				
F Sand Pack	634	660		642	652	
Benseal	660	696				
G Sand Pack	696	719	960.32	704	714	469.51
Benseal	719	810				
H Sand Pack	810	837		820	830	
Benseal	837	885				
I Sand Pack	885	913		897	907	
Benseal	913	941				
J Sand Pack	941	1,000	1,057.4	950	960	221.01

Zone D: Screened from 486 feet bgs. This zone was at a transition point from lower to higher resistivity on both the Electric Log and the Gamma Ray/Guard log. The Lithologic Log did not correlate with the change noted on the Electric Logs. This was attributed to poor sample collection where finer grain material was lost in the drilling fluid and shale shaker. The potential porosity could not be estimated because of a muted SP signal.

Zone E: Screened from 560 feet bgs. This zone was at a transition point from lower to higher resistivity on both the Electric Log and Gamma Ray/Guard log. A definite lithologic change was indicated at this depth and was correlated to the Lithologic Log (silty sand to a clayey sand). The potential porosity could not be estimated because of a muted SP signal.

Zone F: Screened from 643 feet bgs. Zone F contained a sand with little fines as indicated by the high resistivity and low gamma ray reading on the Gamma Ray/Guard log. The potential porosity could not be estimated because of a muted SP signal.

Zone G: Screened from 704 feet bgs. This zone was identified with a high resistivity and low gamma ray reading on the Gamma Ray/Guard log which was indicative of a sand. The SP log indicated possible increased porosity.

Zone H: Screened from 820 feet. A high resistivity spike along with a low gamma ray reading indicated a zone with little fines. The spike was indicative of a lithology change and was confirmed on the Lithology Log as a transition from a silty sand to sand. The potential porosity could not be estimated because of a muted SP signal.

Zone I: Screened from 897 bgs. A high resistivity and a low gamma ray reading indicated a clay free zone. The SP log indicated the potential for increased porosity.

Zone J: Screened from 950 feet bgs. This zone demonstrated a high resistivity on the Gamma Ray/Guard log with a corresponding low gamma ray reading. These two log characteristics revealed a zone which correlated to the Lithology Log of fine to coarse grained sand. The SP log indicated the potential for increased porosity in this zone.

No lithologic or contaminant distribution (see Section 4.2) evidence was found to indicate a confining layer (or impediment to vertical flow) in the data obtained from MW01. Additional data collected from MW01 (analytical results, water level, and general water chemistry) may revise this conclusion.

3.2.2 Waterloo® Sampling System Installation

The Waterloo® groundwater sampling system (the system), produced by Solinst, Ltd., was designed to provide multi-port sampling of a monitoring well constructed with a single casing, screened at a number of depth intervals. The system isolated each screened interval using hydratable packers which were installed above and below each screened interval. Water in each interval was pumped up to the ground surface via non-toxic tubing. The system also allowed for the measurement of the piezometric head at selected intervals through the use of dedicated pressure transducers.

A Waterloo® multiport groundwater sampling and monitoring system was installed in MW01. To eliminate the problems experienced during some past "open boring" installations and use scenarios, the system was installed within 5-inch inside diameter (ID) steel casing and wire-wrap screen. This installation technique will allow for the sampling of a larger interval of saturated zone (ten feet). A complete description of the well installation is provided in Appendix A.

Ten sampling ports and four water level transducers were installed in the monitoring well. The sampling port locations were located in the areas of highest permeability. These areas were selected on the basis of observed alluvial types, characteristics observed during drilling, and the results of geophysical logging of the boring, as described in Appendix A.

3.2.3 Plume Well Sampling

After completion of the installation of MW01, it was developed and sampled. Groundwater samples were collected from the ten individual sampling points. One aliquot of each sample was analyzed by the mobile laboratory for halogenated VOCs, aromatic VOCs, and TPH. The remaining aliquots were analyzed for VOCs, BNAs, Pest/PCBs, TPH, and Total metals plus mercury using the EPA Region IX laboratory and RAS and SAS methods.

Groundwater samples were collected in the following order:

- Total Metals
- Pesticides/PCBs
- Base Neutral Acids (BNAs)
- Total Petroleum Hydrocarbons - Gas and Diesel
- Volatile Organics (VOAs)

These samples were submitted to the EPA Region IX laboratory. Halogenated and aromatic volatile organics and TPH-gas samples were also collected at the same time as the EPA Region IX laboratory samples and were submitted to the FASP mobile laboratory for analysis. Samples were taken from the middle of a slug of water delivered during the nitrogen drive cycle in order to avoid the gas-water interface.

The rationale for the mobile laboratory analysis of groundwater samples for halogenated VOCs, aromatic VOCs, and TPH is to provide:

- Immediate results and degrees of possible TCE and PCE groundwater contamination

- Field evaluation of the depth and extent of groundwater contamination

The purpose of the EPA Region IX laboratory analysis of the groundwater samples is to:

- Provide analytical results necessary to make a one-time evaluation of potential groundwater contaminants resulting from historical site operations

- Confirm mobile laboratory VOC results by utilizing EPA methods

3.3 MUNICIPAL WELL SAMPLES

Municipal wells previously sampled, proven to be contaminated with Target Compound List (TCL) constituents, and wells just outside the area of known contaminants, were sampled during the field investigation. Figure 3-5 and Table 3-4 present locations and information associated with the municipal well sampling. The two categories of wells are further described as follows:

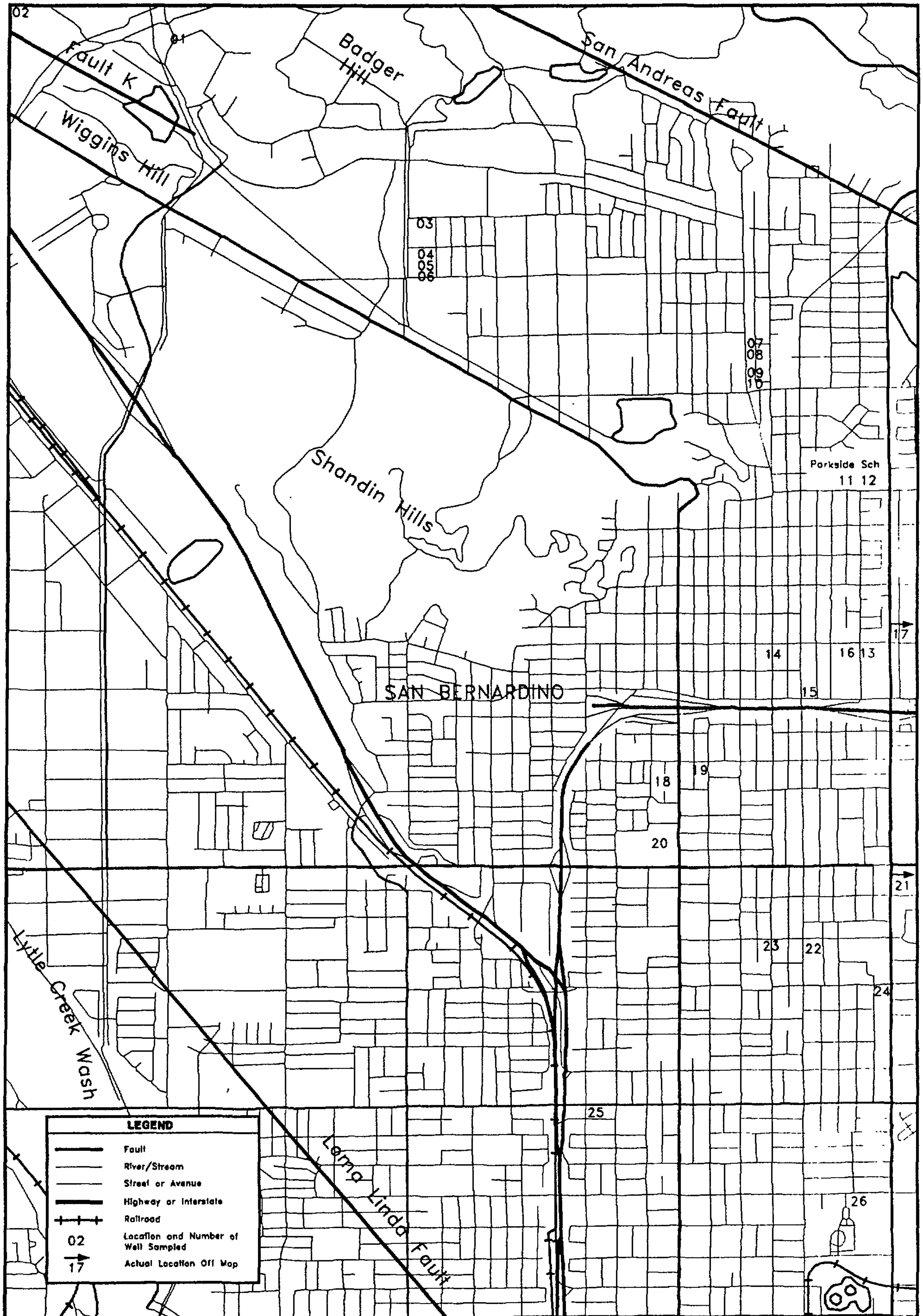
- **Affected municipal water supply wells** - Based upon the results of historical analyses, these wells included all contaminated municipal and Cal EPA wells believed to be affected by the Newmark plume. The analytical data was used to verify previously presented data collected by unknown sampling techniques/protocols and refine the understanding of the distribution of contaminants within the plume.

- **Non-affected municipal wells adjacent to the suspected plume boundaries** - This group of wells represented the next logical progression of wells that would be affected by plume expansion or movement. Sampling of these wells assisted in evaluating and updating the current plume position.

Twenty-six wells were to be sampled but one well could not be sampled because of a pump malfunction. The groundwater samples were analyzed for volatile organic compounds (VOCs) by Contract Laboratory Program (CLP) laboratories using EPA Method 624 using a lower quantitation limit. A lower quantitation limit was necessary for these water samples to assess the condition of municipal wells and detecting potential low concentrations of contaminants in wells not previously identified as contaminated. A complete description of the sampling techniques is included in Appendix A.

3.3.1 Municipal Well Sampling

Twenty municipal wells and five Cal EPA wells were sampled during the month of April 1992. One Cal EPA well scheduled for sampling could not be sampled because the dedicated pump was broken. Two City of San Bernardino Municipal Water Department employees provided assistance during the



URS CONSULTANTS

Newmark Groundwater Superfund Site
Newmark Operable Unit RI/FS Report

ARCS, EPA REGIONS IX & X WA NO 54-10-9LJ5

FIGURE 3-5

Municipal Well Sample Locations

0 750 1500 3000
SCALE IN FEET

Table 3-4

MUNICIPAL WELL INFORMATION SUMMARY

URS Well No.	Well Name	State Well No.	Drilled to Bedrock	Well Diameter (in)	Total Depth (ft)	Screen Intervals (ft bgs)	Depth to Water (ft bgs/ date)	Well Elevation (ft msl)	Calculated (3) Well Volumes (gal)	Well Volume Pumped (gal)	New Depth to Water (ft/date)	Pumping Rate (gpm)	Age of Well (yrs)	Sampling Parameters		
														pH	Temp °C	Conductivity
MUNI-01	C.S.B.* - Devil Canyon #1	1N4W08M01	1	24	285	186 to 236	178.2 / 3-91	1,530.00	6,787	29,850	189.0 / 3-92	995	19	7.28	17.6	380
MUNI-02	C.S.B. - Devil Canyon #2	1N4W07F01	Yes	26	450	177 to 292 306 to 316 356 to 400	162.9 / 3-91	1,621.96	23,919	26,400	159.0 / 3-92	880	62	7.30	20.1	220
MUNI-03	C.S.B. - Newmark #4	1N4W16E04	Yes	20	441	300 to 404	208.8 / 3-91	1,413.57	11,227	58,080	210.0 / 3-92	1,936	25	6.58	18.2	510
MUNI-04	C.S.B. - Newmark #2	1N4W16E02	Yes	20	359.5	148 to 240 252 to 335	194.5 / 3-91	1,405.26	7,119	42,510	213.0 / 3-92	1,417	46	6.63	18.1	610
MUNI-05	C.S.B. - Newmark #1	1N4W16E01	Yes	26 to 233' 12 to 413'	413	--	210.1 / 3-91	1,412.99	16,686	28,980	210.0 / 3-92	966	26	6.36	18.4	590
MUNI-06	C.S.B. - Newmark #3	1N4W16E03	Yes	16	495	232 to 270 283 to 305 331 to 462	203.8 / 3-91	1,407.92	8,985	45,000	209.7 / 3-92	1,500	38	6.61	18.4	480
MUNI-07	DHS** - Electric Drive #1	W1-2	1	5	255	240 - 250			114	120	215.0 / 3-92	10	--	7.7	19.2	490
MUNI-08	DHS - Electric Drive #1	W1-3	1	5	405	390 - 400	--	--	714	716	171.0 / 3-92	10	--	7.7	19.8	500
MUNI-09	DHS - Electric Drive #2	W2-3	Yes	5	435	415 - 425	--	--	822	825	166.0 / 3-92	10	--	7.5	20.4	480
MUNI-10	DHS - Electric Drive #2	W2-1 (275')	Yes	5	275	260 - 270	--	--	--	--	pump broken	--	--	--	--	--
MUNI-11	DHS - Parkdale School	W3-1 (505')	Yes	5	505	490 - 500	--	--	768	770	254.0 / 3-92	10	--	7.5	19.0	540
MUNI-12	DHS - Parkdale School	W3-3	Yes	5	365	350 - 360	--	--	537	540	189.0 / 3-92	10	--	7.5	16.5	460
MUNI-13	C.S.B. - Waterman Ave.	1N4W27A01	No	20	662	258 to 267 295 to 610	250.3 / 2-91	1,244.77	18,954	85,200	272.0 / 3-92	2,840	43	7.0	19.9	510
MUNI-14	C.S.B. - 31st St. & Mt. View	1N4W27B01	Yes	20	577	325 to 553	247.1 / 2-91	1,233.01	15,600	50,490	256.0 / 3-92	1,683	30	7.0	19.7	500
MUNI-15	C.S.B. - 30th St. & Mt. View (Marshall)	1N4W27G01	No	20	523	373 to 523	234.7 / 2-91	1,227.38	13,023	85,530	255.0 / 3-92	2,851	66	7.0	19.2	480
MUNI-16	C.S.B. - Leroy	1N4W27A02	Yes	20	693	450 to 660	243.9 / 2-91	1,239.67	20,169	86,850	278.0 / 3-92	2,895	25	7.1	19.6	520
MUNI-17	C.S.B. - Lynwood	1N4W26E02	No	20	690	320 to 335 344 to 584 629 to 660	264.0 / 2-91	1,236.23	21,333	68,580	251.0 / 3-92	2,286	38	6.9	17.4	450

++ DHS = Cal EPA
-- No Data

Table 3-4 (Cont'd)

MUNICIPAL WELL INFORMATION SUMMARY

URS Well No.	Well Name	State Well No.	Drilled to Bedrock	Well Diameter (in)	Total Depth (ft)	Screen Intervals (ft bgs)	Depth to Water (ft bgs/ date)	Well Elevation (ft msl)	Calculated (3) Well Volumes (gal)	Well Volume Pumped (gal)	New Depth to Water (ft/date)	Pumping Rate (gpm)	Age of Well (yrs)	Sampling Parameters		
														pH	Temp °C	Conductivity
MUNI-18	C.S.B. - 27th Street	1N4W27M02	No	20	749	243 to 259 290 to 410 442 to 456 477 to 717	218.5 / 2-91	1,184.07	25,950	45,840	215.0 / 3-92	1,528	36	7.4	20.1	630
MUNI-19	C.S.B. - North "E" Street	1N4W27M01	Yes	20	785	460 to 756	200.1 / 2-91	1,192.05	27,312	56,310	223.0 / 3-92	1,877	42	7.3	19.8	380
MUNI-20	C.S.B. - 23rd Street	1N4W27N01	No	20	958	354 to 370 428 to 448 494 to 828	171.8 / 2-91	1,174.75	36,642	39,690	204.0 / 3-92	1,323	28	7.3	19.3	600
MUNI-21	C.S.B. - Perris Hill #4	1N4W35C03	Yes	20	314	130 to 215 244 to 291	187.5 / 2-91	1,168.25	5,247	27,090	206.0 / 3-92	903	44	6.7	19.5	570
MUNI-22	C.S.B. - 17th Street	1N4W34G01	No	20	700	494 to 571.5 576.5 to 670	103.3 / 2-91	1,142.01	25,563	52,020	174.0 / 3-92	1,734	44	7.0	19.1	540
MUNI-23	C.S.B. - 16th Street	1N4W34G03	Yes	20	708	490 to 680	185.1 / 2-91	1,135.13	26,049	66,870	172.0 / 3-92	2,229	42	7.1	19.9	550
MUNI-24	C.S.B. - Gilbert Street	1N4W35M03	No	20	685	480 to 603 625 to 685	145.9 / 2-91	1,123.54	25,806	90,000	154.0 / 3-92	3,000	40	7.4	18.6	550
MUNI-25	C.S.B. - 10th & J Street	154W04B04	Yes	20	1215	280 to 1160	145.11 / 2-91	–	50,493	107,400	176.0 / 3-92	3,580	2	7.5	23.7	370
MUNI-26	C.S.B. - 7th Street	154W03J05	No	20	962	552 to 830 861 to 938	113.4 / 2-91	1,057.39	41,211	88,230	114.0 / 3-92	2,941	27	7.2	18.7	460

1 Log was not qualable or contained insufficient information.

++ DHS = Cal EPA
-- No Data

sampling effort. The employees either took static water level measurements, or guided URS personnel to well locations, and operated the wells during sampling activities. Water levels were measured and used to estimate well volumes. Before sampling inactive wells, the pumps were turned on and allowed to run for 30 minutes. Given the capacity of the pumps, this was more than sufficient to purge three volumes from each well. The volume purged was calculated from the flow meter for each well. The static water levels and the calculated and actual purged well volumes are presented in Table 3-4.

Prior to sample collection, a minimum of two sets of field parameters (pH, electrical conductivity, temperature, and turbidity) were recorded on the URS Well Sampling Data sheets. The parameters were measured and recorded until results displayed $< 10\%$ deviation. Water samples were collected from the existing sampling spigot closest to the pump and upstream of any chemical additions. The spigot was decontaminated in accordance with the Newmark Sample Plan (URS 1992). Three 40-ml glass vials were collected for each sample.

The FASP mobile laboratory volatile samples were also collected concurrently with the EPA Region IX laboratory samples at a selected number of well locations. The samples were labeled, placed in an ice chest cooled to 4°C with blue ice, transported to the field office under proper chain-of-custody procedures, and prepared for shipment to the EPA Region IX laboratory for analysis (Newmark Sample Plan, URS 1992). The EPA Region IX laboratory halogenated VOC results for the municipal and Cal EPA wells are presented in Appendix D. The FASP mobile laboratory halogenated results are presented in Appendix G.

3.4 ANALYTICAL METHODS AND DATA QUALITY EVALUATION

EPA Region IX laboratory and FASP mobile laboratory analytical methods used for this investigation are discussed in the following subsections. The investigation is focused on three specific areas. The areas included the municipal wells, the source area, and the plume area. The analytical methods were selected in order to provide information on what contaminants were present and to provide adequate data to support the preparation of the FS and preliminary remedy selection.

Analyses were performed in accordance with the EPA guidelines through the EPA Region IX Laboratory by Field Analytical Support Program (FASP) mobile laboratory using standard and modified published methods. To attain the required detection limits, sample preparation procedures and analytical determinations were modified.

3.4.1 Region IX Laboratory Analyses

The Routine Analytical Services (RAS) and Special Analytical Services (SAS) methods used for analyses of municipal well, source, and plume area samples by the EPA Region IX laboratory are shown in Table 3-5.

EPA Region IX laboratory analyses were used to confirm the mobile laboratory results and provide a larger number of analysis in order to assess possible contaminants existing from historical operations.

RAS and SAS requests were utilized for the samples. A RAS analytical request was submitted for samples that required Contract Laboratory Program (CLP) 3/90 Statement of Work (SOW) analyses for both groundwater and soil samples and a SAS analytical request was performed on specific samples that required low detection limits and other methods not included in the 3/90 SOW.

All RAS analytical methods shown were run under the EPA CLP 3/90 SOW. The SAS analytical method requested for EPA Method 624 utilized a 25-ml purge for all waters while Total Petroleum Hydrocarbons (TPH) utilized a modified EPA Method 8015. The analytical result tables presented in Appendices C and D list the constituents reported for each analytical method utilized for the project.

3.4.2 FASP Mobile Laboratory Analyses

The methods used by the FASP laboratory for analyses of municipal well, source, and plume area samples are shown in Table 3-6. The EPA Region IX Environmental Services Branch (ESB) provided the FASP mobile laboratory for on-site preliminary sample analysis of volatiles concentrations necessary

Table 3-5

EPA REGION IX LABORATORY RAS & SAS ANALYSES

Area	Matrix	Analyses
Municipal Wells	Water	SAS VOA 624 Halogenated Volatile Organics
Source	Water	SAS VOA 624 Halogenated Volatile Organics SAS TPH 8015 Gas and Diesel RAS BNA RAS Pesticides/PCBs RAS Total Metals
	Soil	RAS VOA RAS BNA RAS Pesticides/PCBs RAS Total Metals
Plume	Water	SAS VOA 624 Halogenated Volatile Organics SAS TPH 8015 Gas and Diesel RAS BNA RAS Pesticides/PCBs RAS Total Metals

SAS = Special Analytical Services
RAS = Routine Analytical Services

Table 3-6

FASP MOBILE LABORATORY ANALYSES

Area	Matrix	Analyses
Municipal Wells	Water	Halogenated Volatile Organics
Source	Water	EPA 601 Halogenated Volatile Organics EPA 602 Aromatic Volatile Organics EPA 5020 Total Petroleum Hydrocarbons - Gas EPA 8015 Total Petroleum Hydrocarbons - Diesel
	Soil	EPA 8010 Halogenated Volatile Organics EPA 8020 Aromatic Volatile Organics EPA 5020 Total Petroleum Hydrocarbons - Gas EPA 8075 Total Petroleum Hydrocarbons - Diesel
Plume	Water	EPA 601 Halogenated Volatile Organics EPA 602 Aromatic Volatile Organics EPA 5020 Total Petroleum Hydrocarbons - Gas

to obtain fast screening data. Data results were utilized for decisions about site safety and to provide analytical results necessary to make a one-time evaluation of potential groundwater contaminants. This laboratory is considered a non-CLP laboratory. The groundwater samples from the municipal wells and the soil and groundwater samples from the source and the plume areas were analyzed for halogenated and aromatic volatile organic compounds (VOCs) using EPA Methods 601/8010 and 602/8020, TPH using EPA Method 5020 (headspace for gasoline), and modified EPA Method 8015 (diesel). Selected samples were submitted to EPA Region IX laboratory for confirmation and verification of the preliminary mobile lab analytical results. Data tables in Appendices F and G list the constituents reported for both the volatile and TPH methods utilized for the project.

Mobile laboratory analyses were conducted to provide:

- Immediate results of possible TCE and PCE soil contamination;
- Better criteria for the selection of samples to go to EPA Region IX laboratories;
- Field evaluation of depth and extent of soils contamination; and
- Data for more accurate placement of monitoring well screen intervals, and sampling intervals of subsequent well clusters.

3.4.3 Data Quality Evaluation

During the project planning phase, overall data quality objectives (DQOs) were developed for the project. The extent of the study area, scope of the well installation, use of specific field instruments, and other items related to data collection were considered in terms of the overall project goals. During this process, the required analytical methods and DQOs for these methods were devised. The DQOs for water and soil samples analyzed by the FASP and EPA Region IX laboratories are summarized in Tables 3-7 through 3-10.

Table 3-7

DATA QUALITY OBJECTIVES FOR WATER SAMPLES ANALYZED BY THE MOBILE LABORATORY

Analysis	Method[1]	Units[2]	Targeted Detection Limit[3]	Accuracy[4] %	Precision[5] %	Completeness %
Halogenated Volatile Organics	EPA 601	µg/L	0.5-1.0	70-125	25	85
Aromatic Volatile Organics	EPA 602	µg/L	0.5-20	70-125	25	85
Total Petroleum Hydrocarbons	EPA 5020[6]	µg/L	500	65-125	35	85

(1) Methods for analysis were obtained from EPA 1982 and LUFT 1989.
(2) Units reported in mass/volume.
(3) Derived from FASP mobile laboratory reporting limits.
(4) Derived from FASP mobile laboratory attainable control limits through analytical surrogate recovery and laboratory control samples.
(5) Derived from laboratory relative percent difference between results of field replicate samples.
(6) Headspace method (LUFT 1989). The extracts will be analyzed by GC/FID. This method is equivalent to EPA SW846 Method 3810.

Table 3-8

DATA QUALITY OBJECTIVES FOR SOIL SAMPLES ANALYZED BY THE MOBILE LABORATORY

Analysis	Method[1]	Units[2]	Targeted Detection Limit[3]	Accuracy[4] %	Precision[5] %	Completeness %
Halogenated Volatile Organics	EPA 8010	µg/Kg	20-50	60-125	40	85
Aromatic Volatile Organics	EPA 8020	µg/Kg	50	60-125	40	85
Total Petroleum Hydrocarbons	EPA 5020[6]	µg/Kg	10,000	65-125	40	85

(1) Methods for analysis were obtained from EPA 1986, 1989b; LUFT 1989.
(2) Units reported in mass/volume.
(3) Derived from FASP mobile laboratory reporting limits.
(4) Derived from FASP mobile laboratory attainable control limits through analytical surrogate recovery and laboratory QC.
(5) Derived from laboratory relative percent difference between results of field replicate samples.
(6) Headspace Method (LUFT 1989). The extracts will be analyzed by GC/FID. This method is equivalent to EPA SW846 Method 3810.

Table 3-9

DATA QUALITY OBJECTIVES FOR WATER SAMPLES ANALYZED BY THE EPA REGION IX LABORATORY

Analysis	Method[1]	Units[2]	Targeted Detection Limit[3]	Accuracy [4]	Precision[5]	Completeness %
Volatile Organic Analysis	CLP-SAS EPA 624-M	µg/L	1.0-2.0[6]	61-145%	15%	85
Semivolatile	CLP-RAS 3/90 SOW	µg/L	10-25	9-145%	50%	85
Pesticides/PCBs	CLP-RAS 3/90 SOW	µg/L	0.05-1.0	38-127%	30%	85
Total Petroleum Hydrocarbons	CLP-SAS EPA 8015-M	mg/L	0.05-1.0	58-126%	20%	85
Total Metals	CLP-RAS 3/90 SOW	mg/L	0.001-2.5	75-125%	20%	85
Mercury	CLP-RAS 3/90 SOW	mg/L	0.0002	75-125%	20%	85
pH	Field Measurement	pH Units	-	± 0.3 pH units	± 0.2 pH units	80
Conductivity	Field Measurement	µohm at 25°C	-	-	± 5	85
Temperature	Field Measurement	degrees (°C)	-	± 1° C	± 0.5° C	85

(1) Methods for analyses were obtained from EPA 1989b, 1990a, 1990b; LUFT 1989.
(2) Units reported in mass/volume unless otherwise indicated.
(3) Derived from laboratory reporting limits. TPH laboratory attainable limits derived from RWQCB 1990.
(4) Derived from laboratory attainable control limits through analytical surrogate or matrix spike recovery and laboratory QC.
(5) Derived from laboratory relative % difference between results of field replicate samples or through matrix duplicates.
(6) Range met by purging 5x the volume of the sample required for the analysis. Ten (10) µg/L is acceptable for acetone, 2-butanone, 4-methyl-2-pentanone, and 2-hexanone (EPA 1989b).

Table 3-10

DATA QUALITY OBJECTIVES FOR SOIL SAMPLES ANALYZED BY THE EPA REGION IX LABORATORY

Analysis	Method (1)	Units (2)	Targeted Detection Limit(3)	Accuracy(4) %	Precision(5) %	Completeness %
Volatile Organic Analysis	CLP-RAS 3/90 SOW	μg/Kg	10.0	60-172	25	85
Semivolatile Organic Analysis	CLP-RAS 3/90 SOW	μg/Kg	300-800	11-142	50	85
Pesticides/PCBs	CLP-RAS 3/90 SOW	μg/Kg	1.7-170	23-139	50	85
Metals Mercury	CLP-RAS 3/90 SOW	mg/Kg	0.01-2500 0.02	75-125 75-125	20 20	85 85

(1) Methods for analyses were obtained from EPA 1990a and 1990b.
(2) Units reported in mass/volume unless otherwise indicated.
(3) Derived from laboratory reporting limits.
(4) Derived from laboratory attainable control limits through analytical spike recovery.
(5) Derived from laboratory relative % difference through analytical spikes.

Region IX Laboratory Adherence to Analytical DQOs

For all methods, the EPA Region IX laboratory reported data within the quantitation and detection limit ranges stated in Tables 3-9 and 3-10.

An evaluation of the analytical surrogate or matrix spike recovery and laboratory quality control (QC) matrix by the EPA Region IX laboratory demonstrated the following:

- All surrogates were within the acceptable control limits;
- The laboratory QC matrix spikes for all the organic analyses were within the established control limits requirement in the CLP SOW; and
- All matrix spike and matrix spike duplicate samples for total metals analysis were within the acceptable control limits with the exception of two aluminum, one antimony, three arsenic, three lead, one iron, two selenium and one thallium recoveries. The data results for the environmental samples associated with the matrix spikes are valid and usable for limited purposes only.