



#### 4.0

### NATURE AND EXTENT OF CONTAMINATION

This section discusses the nature and extent of chemical compounds occurring in air, surface water and sediments, subsurface soils, and ground water at the PVLf. The results of the chemical analyses from samples collected from these mediums have already been discussed in Section 3.0 of this report. This section summarizes these results. This section is divided into two parts. The first part summarizes the results for each of the mediums. Sections 4.1.1 through 4.1.4 discuss the results of the air, surface water and soils, subsurface soils, and ground water samples, respectively. The second portion presents a summary of the extent of contamination for all of the mediums combined. In order to give a more complete picture of the nature and extent of chemical compounds at the PVLf, cross sections with chemical data for several of the mediums are presented.

When discussing the nature and extent of contamination, the discussion typically focuses on the VOCs which are the main chemicals of concern. A number of VOCs, most notably chlorinated VOCs, are known contaminants whose source is the PVLf. Several specific VOCs are typically present in areas known to be contaminated by the PVLf. The results of the other chemicals including the metals, semi-volatile organic compounds, and pesticides are also discussed where appropriate. Although metals are present in the ground water and soils, their concentrations are not excessive in comparison to background or leaching study results, and they are naturally occurring in the environment. Hydrocarbons are also found naturally in the Monterey Formation rocks. The semi-volatile organic compounds and pesticides were rarely detected in the samples.

#### 4.1

### RESULTS OF SITE CHARACTERIZATION

This first section summarizes the results for each of the mediums. Sections 4.1.1 through 4.1.4 discuss the results of the air, surface water and soils, subsurface soils, and ground water samples, respectively.

#### 4.1.1

#### Air

The nature and extent of chemical compounds found in the air at the PVLf are discussed below. The results of the air sampling were previously discussed in Section 3.1. The

chemicals of concern for the air samples are the VOCs and TOC as methane. The results are discussed according to monitoring program and include ambient air, integrated surface gas, boundary probe, neighborhood meter box, and flare emissions.

#### 4.1.1.1 Ambient Air

Ambient air sampling was conducted under two separate programs. The first, or original, program was conducted in September 1990 through August 1991. A total of 96 ambient air samples from four monitoring locations were collected during the original ambient air sampling program. The samples were analyzed for seventeen TACs and TOC as methane. The second, or additional, ambient air sampling program was conducted in June and July 1994. Four ambient air samples from four monitoring locations were collected during the additional ambient air sampling program. The samples were analyzed for 43 VOCs by EPA Method TO-14. The results of the monitoring are given in Section 3.1.3. Sixteen compounds were common to both ambient air sampling programs. Of these compounds, eleven (methylene chloride, chloroform, 1, 1, 1-trichloroethane, carbon tetrachloride, trichloroethylene, tetrachloroethylene, vinyl chloride, benzene, toluene, xylenes, and dichlorobenzenes) were detected in the original ambient air sampling program and five (methylene chloride, 1, 1, 1-trichloroethane, benzene, toluene, and xylenes) were detected in the additional ambient air sampling program. During the original program, vinyl chloride was detected only in the upwind samples; likewise, during the additional program, methylene chloride and 1, 1, 1-trichloroethane were detected only in the upwind samples. A qualitative analysis comparing the ambient air VOC concentrations to the Los Angeles air basin background levels as determined by SCAQMD showed that there were no significant differences. A quantitative analysis comparing upwind and downwind VOC concentrations at the ambient air monitoring locations showed that they were statistically equivalent. Therefore, no emissions attributable to the landfill were identified in the ambient air.

#### 4.1.1.2 Integrated Surface Gas

The integrated surface gas monitoring consisted of taking monthly TOC methane readings from surface gas routes on the South Coast Botanic Garden (57 routes), main site (148 routes), and Ernie Howlett Park (24 routes) from September 1990 to August 1991. An additional 34 months of TOC as methane readings were taken for the main site and South Coast Botanic Garden

from September 1991 to June 1994. The results of the monitoring are given in Section 3.1.4. The integrated surface gas TOC mean concentration of 8.1 ppm was within the range of background TOC levels observed at the ambient air monitoring locations (5 to 9 ppm). A few of the areas at the South Coast Botanic Garden had TOC as methane levels exceeding the SCAQMD Rule 1150.2 limit for inactive landfills of 50 ppm. To correct these high concentration levels, additional gas collection wells were installed at the South Coast Botanic Garden in December 1991. Since the installation of these wells, a significant decrease in TOC concentrations was seen; and since February 1992 there have been no TOC concentrations over 50 ppm for the integrated surface gas monitoring routes. The TOC as methane concentrations were contoured at six month intervals from September 1990 through September 1992. The contours are presented in Exhibits 3.1-2 through 3.1-6. The contours show that the TOC concentrations have been decreasing with time. This is a result of the additional control wells.

In addition to the TOC monitoring of the integrated surface gas routes, two samples taken from randomly selected routes were analyzed each month for TAC compounds. A total of 90 samples taken from September 1990 to June 1994 have been analyzed for the seventeen TAC compounds. The results of the analyses are given in Section 3.1.4. Of the seventeen compounds, six were never detected in the speciated samples. These compounds were chlorobenzene, vinyl chloride, 1,1-dichloroethane, 1,2-dichloroethane, acetonitrile, and benzyl chloride. The remaining TAC compounds that were detected were methylene chloride, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, 1,1-dichloroethylene, trichloroethylene, tetrachloroethylene, benzene, toluene, xylenes, and dichlorobenzenes. A quantitative comparison of the integrated surface gas monitoring TAC results with the upwind background ambient air results showed that there was no statistical difference between these samples.

The findings of the integrated surface gas monitoring program indicated that gas emissions are well controlled at the PVLF. The average TOC levels are within the range found in background ambient air at the site. A few areas at the South Coast Botanic Garden had high TOC levels (greater than 50 ppm), but these levels have dropped since the installation of additional gas control wells in the area. The TAC levels are the same as background ambient air levels indicating that the landfill should not have any effect on ambient air. This result is consistent with the results of the ambient air monitoring program.

#### 4.1.1.3 Boundary Probes

Boundary probe monitoring consists of taking monthly percent methane and oxygen readings from boundary probes located on the South Coast Botanic Garden (63 probes), main site (155 probes), and Ernie Howlett Park (38 probes). Boundary probe monitoring is conducted to comply with the CIWMB postclosure regulations. The results of the monitoring are given in Section 3.1.5. During the duration of the study TOC as methane was detected in 37 of the boundary probes located on the outer borders of the landfill. Of these 37 detections, nineteen had TOC detections ranging from zero to four percent and eighteen had detections above five percent, which is the State and Federal limit. Corrective actions were taken to reduce these detections and a prevention program (see Section 3.1.10) has been implemented to eliminate future methane detections. Overall, the existing gas collection system at the PVLf does an excellent job in controlling off site gas migration.

In addition to measuring the percent methane and oxygen in the boundary probes, randomly selected samples were analyzed for TAC compounds for the remedial investigation. A total of 53 samples taken from September 1990 to June 1994 have been analyzed for the seventeen TAC compounds. The results of the analyses are given in Section 3.1.5. Of the seventeen compounds, five were never detected in the speciated samples. These compounds were carbon tetrachloride, vinyl chloride, acetonitrile, benzyl chloride, and dichlorobenzene. The remaining TAC compounds that were detected were methylene chloride, chloroform, 1,1,1-trichloroethane, 1,1-dichloroethylene, trichloroethylene, tetrachloroethylene, chlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, benzene, toluene, and xylene.

#### 4.1.1.4 Neighborhood Meter Box Monitoring

Neighborhood meter box monitoring consists of taking monthly TOC as methane levels (using an organic vapor analyzer) from water meter boxes at residences bounded by Hawthorne Boulevard, Rolling Hills Road, Crenshaw Boulevard, and the northeastern boundary of the PVLf. The monthly neighborhood meter box monitoring program is conducted to fulfill the requirements of the County DHS. The results of the TOC readings from September 1990 to June 1994 during the remedial investigation are given in Section 3.1.6. With one exception suspected to have been caused by a solvent (possibly paint thinner) dumped into the meter box, the TOC readings have been

consistently below 10 ppm and are comparable to the background ambient air readings taken at the same time.

#### 4.1.1.5 Surface Flux Chamber Sampling

The surface flux chamber sampling program consisted of collecting surface flux chamber samples from 32 field locations. The samples were analyzed for eight VOCs. Two of the eight compounds analyzed for, vinyl chloride and 1,2-dichloroethane, were not detected in any of the surface flux chamber samples. The remaining six of the eight VOCs were identified in at least one of the samples. These compounds included 1,1-dichloroethylene, 1,1-dichloroethane, benzene, trichloroethylene, tetrachloroethylene, and p-dichlorobenzene. Various qualitative and quantitative analyses were used to evaluate the air results and these analyses are discussed in Section 3.1 of this report. A qualitative analysis for four of the detected compounds, 1,1-dichloroethylene, 1,1-dichloroethane, trichloroethylene, and p-dichlorobenzene, showed that these compounds were rarely detected in the samples and when detected the values were close to the detection limit. Also, the QA/QC results for two of these compounds, trichloroethylene and p-dichlorobenzene, had method blank detections of similar or greater concentrations than those found in the regular samples. Based on this information, no evident pattern of contamination from the PVLFF could be identified from these four compounds.

Benzene was detected in every surface flux chamber sample, and tetrachloroethylene was detected in 50 percent of the background and 56.7 percent of the study area samples. A qualitative analysis was made comparing the concentrations of the surface flux chamber samples to those of the Los Angeles air basin and Hawthorne air station levels as determined by SCAQMD. The results showed lower levels of benzene and tetrachloroethylene in the surface flux chamber samples than in either the Los Angeles air basin or the Hawthorne air station samples. A statistical quantitative analysis was also made comparing the background and study area concentrations of benzene and tetrachloroethylene. The results of the analysis showed that for benzene the background samples are representative of a population having higher concentration levels than that of the study area samples. For tetrachloroethylene, the results of the statistical analysis showed that the background and study area populations are statistically equivalent.

#### 4.1.1.6 Landfill Gas Sampling

Landfill gas sampling was conducted under two separate programs. The first, or original, program was conducted in September through August 1991. The second, or additional, program was conducted in June and July 1994. During both landfill gas sampling programs, samples were collected from the two headerlines that collect landfill gas from the PVLFF and transport it to the gas-to-energy facility. One landfill gas sample from each headerline was collected each month of the original and additional landfill gas sampling programs.

The landfill gas analytical results are used to identify VOCs being produced by microbial decomposition of the refuse. The compounds identified in the landfill gas, therefore, are then monitored in the other programs to determine whether landfill gas is impacting the environment. A comparison of the analytical results from the two headerlines showed that most VOC levels and methane and carbon dioxide levels were significantly higher in Header 2, the gas collection headerline, than in Header 1, the gas migration control headerline. This is indicative that the landfill gas collection system is effectively controlling landfill gas migration.

#### 4.1.1.7 Flare Emissions Testing

For the four quarters of the September 1990 through August 1991 monitoring period, flare emissions were tested quarterly and the gas-to-energy was tested once. The results of the tests fell within permit requirements. During 1992, flare emissions were tested once in March 1992 and boiler testing at the gas-to-energy facility was conducted in December 1992. The average destruction efficiency of nonmethane hydrocarbons (NMHC) was determined to be greater than 98 percent in all cases.

#### 4.1.2 Surface Water and Sediment

The nature and extent of chemical compounds in the surface water and sediment at the PVLFF has been evaluated. Analytical results were obtained from 74 total runoff water samples, 73 filtered surface water samples, seven Hawthorne Boulevard storm drain samples, 56 surface soil cover samples, ten lake and stream channel water samples, and nine lake and stream channel sediment

samples. The results of the chemical analyses for these samples were presented in Section 3.2. The conclusions of the sampling is presented below for the metals, volatile organic compounds, semi-volatile organic compounds, and hydrocarbons.

#### 4.1.2.1 Metals

Metals detections were found in all of the surface water and sediment samples. The presence of these metals was not unexpected because the metals are naturally present in soils. In general, the concentrations of metals found in the downgradient total runoff and filtered surface waters samples were typical to those found in the background samples. All metals detected in the total runoff and filtered surface water samples were below hazardous waste action levels for liquids as defined by their STLC values. The metal concentrations found in the soil cover samples and lake and stream channel sediment samples were typical of those found in the typical soils. The metal concentrations found in the Hawthorne Boulevard storm drain and South Coast Botanic Garden lake and stream channel were either non-detected values or below hazardous waste action levels for liquids as defined by their STLC values. Based on the results of the surface water and sediment sampling, the PVLFF is not a source of metals contamination.

#### 4.1.2.2 Volatile Organic Compounds

Volatile organic compounds were rarely found in the surface water and sediment samples. Exhibit 4.1-1 shows the VOC detections found in the surface water and sediment samples. The VOC detections in the total runoff water samples were isolated incidents with no overall pattern identifying a continuous source of contamination. Methylene chloride was detected at background location SS15 and downgradient locations SS1 and SS3 at low concentrations (1.1 to 1.2 ug/l). All of the detections occurred during the same sampling event (January 3, 1991); and the field blank for this batch of samples contained 1.8 ug/l of methylene chloride. Therefore, the methylene chloride results are suspected of being caused by possible laboratory contamination. Dibromochloromethane and bromoform were detected at 0.5 and 0.6 ug/l at location SS4. These compounds are trihalomethanes that are commonly found in drinking water as reaction products of chlorination. The presence of these compounds at location SS4 is probably due to tap water being in the sample. Benzene was detected at background location SS11 and SS16 and downgradient locations SS6, SS7,



SS8, SS9, and SS10 at low concentrations (0.8 to 1.2 ug/l). All of these benzene detections occurred during the same sampling event (February 27, 1991), and the rinsate, field, trip, and duplicate samples taken from this same group of samples also contained benzene at concentrations ranging from 0.5 to 1.6 ug/l. Therefore, the benzene found in these samples is suspected to be a result of possible handling or analysis contamination. Toluene was detected at downgradient location SS5 in one sample at 0.4 ug/l. The source of this toluene detection is not known, but it may be from the vehicle exhaust of trucks or cars driven on the landfill. Benzene, toluene, and ethyl benzene were detected several times at location SS2. This sample point receives runoff from the PVLFF, and street storm drains. Gasoline in street runoff could account for the presence of these compounds in runoff water. The samples of runoff from the PVLFF collected on the same dates did not contain detectable levels of these compounds. Chlorobenzene and 1,2-dichloroethylene were also detected at location SS2 at concentrations of 1.1 ug/l and 3.0 ug/l, respectively. Because these detections occurred on one isolated incident, no apparent pattern of contamination could be identified. The sample results therefore indicate that the landfill cover is not contributing VOC contamination to the total surface runoff water.

There were no detections of VOCs in the Hawthorne Boulevard storm drain water samples. Therefore, this would indicate that this storm drain is not intercepting VOC contaminated ground water. VOCs were detected in only one of the 34 soil cover samples. Toluene and xylene were detected at location SC16 at concentrations of 20 and 30 ppb. The source of these compounds may be vehicle exhaust from trucks and cars driven on the landfill. The soil cover does not appear to be a source of VOC contamination. There were no detections of VOCs in the South Coast Botanic Garden lake and stream water samples except for location LW-7, which was a tap water sample. This sample contained chloroform, bromodichloromethane, dibromochloromethane, and bromoform which are common trihalomethanes found in tap water as reaction products of chlorination. There were no detections of VOCs in the South Coast Botanic Garden lake and stream channel sediment samples.

The VOC detections in the surface water and sediment samples were isolated incidents with no overall pattern identifying a continuous source of contamination. Several of the VOC detections found in the surface water and sediment samples are believed to come from sources other than the landfill. Most of the VOC detections were BTEX compounds commonly found in gasoline and vehicle exhaust. Several of the VOC detections were trihalomethanes commonly found in tap

water. Based on the sampling results, the surface water and sediment from the PVLFF does not contribute to off site VOC contamination.

#### 4.1.2.3 Semi-Volatile Organic Compounds

The semi-volatile organic compounds were rarely found in the surface water and sediment samples. There were several detections of diethylhexyl phthalate, butylbenzyl phthalate, and phenol in the total runoff water samples. The comparative statistical analysis showed that the concentrations of these compounds in the downgradient samples were statistically equivalent to the concentrations found in the background samples. No semi-volatile compounds were detected in the Hawthorne Boulevard storm drain samples.

Semi-volatile organic compounds were detected in several of the soil cover samples. The compounds detected were PAHs. Soil cover samples SC6, SC53, SC54, SC55, and SC56 obtained from an area near the third bench access road had the highest concentrations of PAH compounds. These samples were obtained along the edge of an access road which incorporated recycled asphalt pavement, and it was noted that all of the samples contained pieces of asphalt. A sample of the broken-up asphalt from the side of the road was also analyzed. The results from the asphalt sample were compared to those obtained from the soil cover samples. The comparison showed that the PAH compounds and concentrations found in the soil samples were similar to those found in the asphalt sample. Based on this information, the PAH concentrations found in these soil samples are likely a result of the asphalt from the road material and not the waste disposed of at the PVLFF. The soil samples from the Equestrian Center, South Coast Botanic Garden lake and stream area, and main site horse trail had minor detections of PAH compounds at low concentrations. These detections were sporadic, with no associated trends.

Diethylhexyl phthalate was detected in one of the ten South Coast Botanic Garden lake and stream channel water samples. Diethylhexyl phthalate was detected in sample LW-4 with a concentration of 29 ug/l. Because this was the only sample detection and because phthalates are commonly found in the environment, this detection is not indicative of contamination associated with the wastes disposed at the PVLFF. No semi-volatile organic compounds were detected in the South Coast Botanic Garden lake and stream channel sediment samples.

The semi-volatile organic compound detections in the surface water and sediment samples were isolated incidents with no overall pattern identifying a continuous source of contamination, with the exception of the PAHs detected in the soil cover samples obtained near the third bench access road. The semi-volatile organic compounds found in the runoff samples were determined to be statistically equivalent in the background and downgradient samples. Several PAHs were found in the soil samples obtained near the third bench access road. These PAH detections are likely the result of asphalt from the road material and are not associated with the waste disposed at PVLf. No semi-volatile organic compounds were detected in the Hawthorne Boulevard storm drain samples or in the South Coast Botanic Garden lake and stream channel sediment samples. Only one semi-volatile organic compound (diethylhexyl phthalate) was detected in the South Coast Botanic Garden lake and stream water samples.

#### 4.1.2.4 Hydrocarbons

Hydrocarbons were rarely found in the surface water and sediment samples. There were nine hydrocarbon detections in the 54 down-canyon total runoff water samples and two hydrocarbon detections in the twenty background total runoff samples. These detections were all at relatively low concentrations of 0.05 to 1.0 mg/l and may be due to naturally occurring hydrocarbons present in the Monterey Formation rocks.

Hydrocarbons were detected in twelve of the 56 soil cover samples with concentrations ranging from 0.2 to 11 mg/kg. Because the Monterey Formation is a source rock for the oil in the Los Angeles area, the detection of these compounds is not unexpected. Therefore, the detection of these hydrocarbons is not evidence of contamination emanating from the PVLf. No hydrocarbons were detected in the Hawthorne Boulevard storm drain water samples, the South Coast Botanic Garden lake and stream water samples, and the South Coast Botanic Garden lake and stream sediment samples.

#### 4.1.3 **Subsurface Soils**

The nature and extent of chemical compounds in the subsurface soils at the PVLf was evaluated. Analytical results were obtained from 156 subsurface soil samples. The 156 subsurface

soil samples included 53 background soil samples, 85 down-canyon soil samples, and eighteen landfill-gas affected samples. The eighteen landfill-gas affected samples were obtained from boreholes located on or adjacent to the landfill and are therefore suspected of being affected by landfill gas contact. Therefore, these landfill-gas affected samples were excluded from any evaluation. The results of the chemical analyses for these samples were discussed in Section 3.5. The conclusions are presented below for metals, VOCs, semi-VOCs, and hydrocarbons.

#### 4.1.3.1 Metals

Metals were detected in all of the subsurface soil samples. The metals detected occur naturally in the soils and the soil concentrations found were typical to those found in the common soils. The qualitative and quantitative analysis of the metals showed that any differences between the background and down-canyon metal sample population were a result of random fluctuations in soil characteristics and not an indication of landfill contamination. Based on the results of the subsurface soil sampling, the PVLf is not a source of metals contamination.

#### 4.1.3.2 Volatile Organic Compounds

The volatile organic compounds detected in the subsurface soil samples included methylene chloride, trihalomethanes, BTEX compounds and other chlorinated VOC compounds. The results of the detections for these compounds were discussed in Section 3.5. Methylene chloride was detected in three of the 85 downcanyon samples. Trihalomethanes were detected in one of 42 background samples and in ten of 85 downcanyon samples. The detections of these compounds are shown in Exhibit 3.5-1. The detections were sporadic and could not be contoured. The concentrations of the these VOCs were at low values and are probably due to laboratory contamination or a combination of irrigation water percolation and contamination from tap water.

Benzene, toluene, ethyl benzene, and xylene compounds (BTEX) were detected in eight of 42 background samples and in twelve of 85 downcanyon samples. The detections of these BTEX compounds are shown in Exhibit 3.5-2. The detections were sporadic and could not be contoured. Because the BTEX compounds were detected sporadically and at relatively low concentrations, and because the distribution of the compounds in relation to the PVLf boundary was

not characteristic of landfill contamination, the Sanitation Districts do not believe these detections are a result of contamination emanating from waste in the PVLf. The BTEX compounds in the soil are believed to be naturally occurring and/or a result of activities not associated with the landfill.

Other chlorinated VOCs found in the subsurface soil samples include 1,1,1-trichloroethane, trichloroethylene, 1,1-dichloroethane, 1,1,2-trichloroethane, 1,2-dichloroethane, cis-1,3-dichloropropene, and 1,1,2,2-tetrachloroethane. These chlorinated VOCs were detected in four of 42 background samples and in fifteen of 85 background samples. The detections of these chlorinated compounds are shown in Exhibit 3.5-3. The detections were sporadic and could not be contoured. The VOC detections are at low concentrations ranging from 0.01 to 0.17 mg/kg. A comparison of these detections with those found in ground water samples showed that there was no correlation between the VOC detections in the soil samples and those found in the ground water. It is therefore assumed that these random detections may potentially be a result of landfill gas contact with subsurface soil or are not related to the landfill at all.

#### 4.1.3.3 Semi-Volatile Organic Compounds

Thirteen semi-VOCs were detected in the 156 soil samples. Two of these compounds were phthalates which are ubiquitous plasticizers found in the environment and are common laboratory contaminants. The remaining eleven compounds were PAHs. Because the PAHs were detected sporadically, and because the distribution of the PAH compounds in relation to the PVLf boundary was not characteristic of landfill contamination, the Sanitation Districts do not believe the detections indicate landfill effects.

#### 4.1.3.4 Hydrocarbons

Hydrocarbons were detected in three of 85 background samples and eleven of 51 down-canyon samples. The concentrations were at relatively low concentrations ranging from 0.02 mg/kg to 18 mg/kg. Because the Monterey Formation is a source rock for oil in the Los Angeles area, the detections of these compounds were not unexpected. The distribution of these compounds in the soils in relation to the PVLf boundary does not show a pattern that was characteristic of contamination emanating from the landfill. Because these compounds occur naturally and because

their distribution occurred randomly, the Sanitation Districts do not believe the detections indicate landfill effects.

#### **4.1.4 Ground Water**

The nature and extent of chemical compounds in the ground water samples at the PVLF has been evaluated and the results discussed in Section 3.6. The ground water monitoring system currently in existence at the PVLF includes two sumps, fourteen subsurface barrier monitoring wells, 52 saturated zone monitoring wells, and nine lysimeters. To determine the nature and extent of ground water contamination, the main focus of Section 3.6 is on metals and VOC concentrations found in the 34 downgradient wells that are actively monitored on a quarterly basis. The semi-volatile organic compounds and pesticides were rarely found in the ground water samples, and are not considered to be a result of contamination emanating from the waste in the PVLF. Therefore, the conclusions presented below will focus on the metals and VOC results from these downgradient monitoring wells.

##### **4.1.4.1 Metals**

The metals were present in all of the ground water samples taken from the downgradient monitoring wells. Because the soils in the area of the PVLF naturally contain metals, the metal concentrations found in the ground water were not unexpected. Besides occurring naturally, another possible source of the metals in the ground water is leachate containing dissolved metals generated from the waste in the PVLF. Several quantitative and qualitative analytical methods were used to determine if the metal concentrations present in the downgradient ground water samples are typical of those that would occur naturally or if they are a result of possible leachate contamination.

The initial qualitative analytical method consisted of comparing the downgradient metal concentrations to the background metal concentrations. Because of the orientation of the PVLF with respect to the structural orientation of the underlying strata, it was determined that the upgradient ground water monitoring wells at the PVLF could not provide background water quality for the downgradient monitoring wells.

In lieu of background water quality, other available data were used to evaluate the landfill's potential effects on the downgradient ground water quality. These included contaminant isopleth maps, results of soil equilibrium and mineral leaching studies, and the results of statistical trend analysis. The results of these analysis showed that the metals concentrations observed in the downgradient monitoring wells were generally within the ranges observed in the soil equilibrium and mineral leaching studies. The metals isopleth maps also showed that for most of the metals, the landfill was not a source of metals contamination. Based on the isopleth maps, the Sanitation Districts believe that arsenic is most likely part of the contaminant plume moving off site from the landfill along Hawthorne Boulevard. Exhibit 4.1-2 shows the extent of arsenic contamination in the ground water. The arsenic contamination correlates to those areas with arsenic concentrations greater than the drinking water MCL of 0.05 mg/l. As shown in Exhibit 4.1-2, monitoring wells M06A, M07A, and PV-3 located in the Hawthorne Boulevard plume area had arsenic concentrations greater than 0.05 mg/l.

#### 4.1.4.2 Volatile Organic Compounds

The presence of volatile organic compounds in the ground water is the best indicator of contamination resulting from the PVLf. Several of the VOCs are not naturally occurring compounds and their most likely source is in the landfill. Some VOCs do occur naturally or can come from sources other than the landfill. For example, BTEX (benzene, toluene, ethyl benzene, and xylenes) and other hydrocarbon compounds may be present in the oil bearing formations of the Monterey Formation. The BTEX compounds are also present in gasoline; and therefore, may be found in the air from automobile exhaust or in street runoff water from minor gasoline leaks or spills. Some VOCs such as methylene chloride are common laboratory contaminants. Also trihalomethane compounds (i.e., chloroform, bromoform, and dichlorobromomethane) are commonly found in tap water at levels higher than in environmental samples.

VOC contamination potentially emanating from the PVLf can be differentiated from VOC contamination emanating from one of these other sources discussed above. VOCs emanating from the PVLf will generally have three characteristics. First, the VOC contamination will include several chlorinated VOCs that are present in the landfill gas. These chlorinated VOCs typically include tetrachloroethylene, trichloroethylene, dichloroethanes, vinyl chloride, and chlorobenzene.

Secondly, when VOC contamination resulting from the landfill is present, several of the VOC compounds will be present as opposed to just one of the compounds being present. Third, the VOC concentrations will be contourable and will show a pattern of contamination that would be expected from the landfill (i.e., greater concentrations of VOCs at and near the landfill, and decreasing levels further from the landfill).

To determine the nature and extent of the VOC ground water contamination, this discussion focuses on nineteen of the main VOCs. These VOCs were the most prevalent VOCs found in the ground water and also included any VOCs that had state MCLs. To determine the extent of the VOC contamination, VOC concentration isopleths were plotted for ground water samples taken during the third quarter of 1990, the second quarter of 1992, the fourth quarter of 1993, and the second quarter of 1994. These contours are shown in Exhibits 3.6-30 through 3.6-62. Exhibits 4.1-3 through 4.1-6 show the envelope of VOC contamination for the third quarter of 1990, the second quarter of 1992, the fourth quarter of 1993, and the second quarter of 1994. VOCs were detected in nearly all on site downgradient monitoring wells, with the exception of the northeast boundary monitoring wells. The highest on site VOC concentrations are found in the barrier monitoring wells.

The extent of off site VOC contamination occurs within two different plumes. The first plume occurs near Hawthorne Boulevard and the second, consisting of two components, occurs near Crenshaw Boulevard and Rolling Hills Road. The Hawthorne Boulevard plume shows VOC contamination occurring in off site monitoring wells M24A, M25A, M49A and PV-3 and on site monitoring wells P4-6, P410, M06A, M06B, and M07A. The most prevalent VOCs found in the Hawthorne Boulevard plume are 1,2-dichloroethane, 1,1-dichloroethane, chlorobenzene, vinylchloride, benzene, and trans-1,2-dichloroethylene. The contaminant concentration isopleths for these compounds were plotted and discussed in Section 3.6. For the second quarter of 1994, the range of concentrations for the most prevalent VOCs in the Hawthorne Boulevard plume were as follows:

- 1,2-Dichloroethane concentrations ranged from 200 ug/l at P4-6 located on site of the PVLF to 13 ug/l at M49A, 3.3 ug/l at PV-3, and 0.6 ug/l at M24A located off site of the landfill; and was not detected at off site well M25A;



- 1,1-Dichloroethane concentrations ranged from 91 ug/l at M06B located on site of the PVLF to 9.3 ug/l at M49A, and 1.6 ug/l at PV-3 located off site of the PVLF; and was not detected at off site wells M24A, and M25A;
- Chlorobenzene concentrations ranged from 840 ug/l at M06A located on site of the PVLF to 11.0 ug/l at M49A and 0.85 ug/l at PV-3 located off site of the PVLF; and was not detected at off site wells M24A, and M25A;
- Vinyl chloride concentrations ranged from 1300 ug/l at M06B located on site of the PVLF to 56 ug/l at M49A located off site of the PVLF; and was not detected at off site wells PV-3, M24A, and M25A;
- Benzene concentrations ranged from 42 ug/l at M06B located on site of the PVLF to 4.1 ug/l at M49A located off site of the landfill; and was not detected at off site wells PV-3, M24A, and M25A; and
- trans-1,2-Dichloroethylene concentrations ranged from 22 ug/l at P4-6 located on site of the PVLF to 1.4 ug/l at M49A located off site of the PVLF; and was not detected at off site wells PV-3, M24A, and M25A.

As shown in the contaminant concentration isopleths, the boundary of the plume off site of the PVLF was defined by the envelope of wells with no VOC detections. The highest VOC concentrations within the plumes were taken from monitoring wells located on the site, and the VOC concentration values decreased rapidly in the off site wells as the distance between the monitoring wells and PVLF boundary increased.

The second plume of VOC contamination, consisting of two components and called the Crenshaw Boulevard plume, occurs at the eastern corner of the main site along Crenshaw Boulevard and at the eastern corner of the South Coast Botanic Garden along Rolling Hills Road. The Crenshaw Boulevard plume shows VOC contamination occurring in off site monitoring wells M37A, M69B (AB6), and M70B (AB7) and on site monitoring wells M38A, M39A, M44A, and M53B (RFB16). The most prevalent VOCs found in the Crenshaw Boulevard plume are methylene chloride, trichloroethylene, tetrachloroethylene, chlorobenzene, vinyl chloride, 1,1-dichloroethane, 1,2-dichloroethane, and benzene. The contaminant concentration isopleths for these compounds were plotted and discussed in Section 3.6. For the second quarter of 1994, the range of concentrations for the most prevalent VOCs in the Crenshaw Boulevard plume were as follows:

- Methylene chloride concentrations ranged from 82 ug/l at M53B (RFB16) located on site of the PVLF to 20 ug/l at M70B (AB7) and 7.35 ug/l at M69B (AB6) located off site of the landfill; and was not detected at off site well M37A;
- Trichloroethylene concentrations ranged from 87 ug/l at M44A located on site of the PVLF to 13 ug/l at M37A, 17 ug/l at M69B (AB6), and 5.7 ug/l at M70B (AB7) located off site of the landfill;
- Tetrachloroethylene concentrations ranged from 36 ug/l at M53B (RFB16) located on site of the PVLF to 6.4 ug/l at M37A, 10 ug/l at M70B (AB7), and 6.1 ug/l at M69B (AB6) located off site of the landfill;
- Chlorobenzene concentrations ranged from 20 ug/l at M40A located on site of the PVLF to 23.5 ug/l at M69B (AB6) located off site of the landfill; and was not detected at off site wells M37A and M70B (AB7);
- Vinyl chloride concentrations ranged from 33 ug/l at M44A located on site of the PVLF to 29 ug/l at M69B (AB6), 2.4 ug/l at M37A, and 2.5 ug/l at M70B (AB7) located off site of the landfill;
- 1,1-Dichloroethane concentrations ranged from 12 ug/l at M53B (RFB16) located on site of the PVLF to 3.2 ug/l at M37A and 8.3 ug/l at M69B (AB6) located off site of the landfill; and was not detected at off site well M70B (AB7);
- 1,2-Dichloroethane concentrations ranged from 150 ug/l at M44A to 31.5 ug/l at M69B (AB6) located off site of the landfill; and was not detected at off site wells M37A and M70B (AB7); and
- Benzene concentrations ranged from 8.3 ug/l at M53B (RFB16) to 2.2 ug/l at M69B (AB6) and 0.6 ug/l at M70B (AB7) located off site of the landfill; and was not detected at off site wells M37A.

Generally speaking, the VOC concentration values found in the Crenshaw Boulevard VOC contamination plume are lower than those found in the Hawthorne Boulevard VOC contamination plume.

#### 4.1.4.3 Sampling Program for Dioxins

The sampling program for dioxins consisted of obtaining 50 samples from eleven downgradient monitoring and extraction wells and one on site sump, and 15 samples from three upgradient monitoring wells. The results of the dioxins monitoring are given in Section 3.6.2. Dioxins and furans were detected on the first sampling event in two ground water samples taken from Sump 7 and monitoring well M30B. Examination of the sampling data collected during the first sampling event showed that the equipment blank obtained with this batch of samples also had dioxin and furan detections. All other samples obtained for the monitoring program including six more samples taken from Sump 7 and six more samples taken from monitoring well M30B had no detections of dioxins or furans. The one time detections of dioxins and furans in Sump 7 and monitoring well M30B were not corroborated by subsequent sampling and may have been a result of sampling or laboratory error.

#### 4.2 **SUMMARY OF EXTENT OF CONTAMINATION**

To provide a clearer picture of the nature and extent of contamination that occurs at the PVLf, geologic cross sections with chemical data were constructed. Because the contaminants of concern consist of volatile organic compounds, the cross sections focus on the main VOCs. In order to get a clear picture of all the mediums that are contributing to contamination, the contour sections include the results from ambient air samples, speciated surface gas samples, speciated boundary probe samples, surface flux chamber samples, surface soil samples, subsurface soil samples (sediment samples), soil pore water samples, and ground water samples collected from open boreholes. The samples and the sample periods used in the cross sections are discussed below.

##### Ambient Air Samples

All four of the ambient air sampling locations are included in the cross sections. The cross sections include the samples with the highest VOC concentrations taken from the air samples during the last four months of 1990. The VOCs with detections and their corresponding range of values are given below.

<u>VOC</u>	<u>Range of Values</u>
trichloroethylene	0.1 - 0.2 ppb
tetrachloroethylene	0.6 - 1.3 ppb
trichloroethane	2.5 - 4.1 ppb
benzene	0.7 - 3.4 ppb
toluene	3.7 - 7.4 ppb
xylenes	3.3 - 5.5 ppb
chlorobenzene	ND - 0.7 ppb
TOC as methane	4 - 20 ppm

#### Surface Flux Chamber Samples

The surface flux chamber samples include all 32 of the surface flux chamber samples obtained in September 1993. The VOCs with detections and their corresponding range of values are given below.

<u>VOC</u>	<u>Range of Values</u>
1,1-dichloroethylene	ND - 0.04 ppb
trichloroethylene	ND - 0.08 ppb
tetrachloroethylene	ND - 0.42 ppb
1,1-dichloroethane	ND - 0.10 ppb
benzene	0.04 - 1.1 ppb
dichlorobenzene	ND - 0.41 ppb

#### Speciated Surface Gas Samples

The speciated surface gas samples include samples taken over a two year period from September 1990 through January 1993. The samples on the cross sections include 25 of the 38 routes that were sampled during this period. For routes that had more than one sample taken in this time period, the sample with the highest VOC concentrations was included in the cross sections. The VOCs with detections and their corresponding range of values are given below. The samples representing the thirteen routes that were not included in the cross sections had VOC concentrations within the ranges given below.

<u>VOC</u>	<u>Range of Values</u>
trichloroethylene	ND - 0.1 ppb
tetrachloroethylene	ND - 3.8 ppb
trichloroethane	ND - 6.4 ppb
benzene	ND - 5.9 ppb
toluene	ND - 9.7 ppb
xylenes	ND - 7.9 ppb
TOC as methane	3 - 72 ppm

#### Speciated Boundary Probe Gas Samples

The speciated boundary probe samples include samples taken over a two year period from September 1990 through January 1993. The samples on the cross sections include twenty of the 23 boundary probes that were sampled during this period. For probes that had more than one sample taken in this time period, the sample with the highest VOC concentrations was included in the cross sections. The VOC compounds with detections and their corresponding range of values are given below. The samples representing the three boundary probes that were not included in the cross sections had VOC concentrations within the ranges given below.

<u>VOC</u>	<u>Range of Values</u>
trichloroethylene	ND - 26 ppb
tetrachloroethylene	ND - 270 ppb
1,1-dichloroethane	ND - 80 ppb
trichloroethane	ND - 29 ppb
benzene	ND - 13 ppb
toluene	ND - 70 ppb
xylenes	ND - 181 ppb
chlorobenzene	ND - 16 ppb
TOC as methane	1 - 16 ppm

#### Surface Soil Cover Samples

The surface soil cover samples were taken during October 1990. The samples include nineteen of the 34 soil cover samples that were sampled during this period. The VOCs with detections

and their corresponding range of values are given below. The samples representing the fifteen soil cover samples that were not included in the cross sections had no VOC detections.

<u>VOC</u>	<u>Range of Values</u>
toluene	ND - 20 ppb
xylenes	ND - 20 ppb

#### Sediment (Subsurface Soil) Samples

The sediment samples include samples obtained during the remedial investigation and SWAT drilling programs. A total of 122 sediment samples from 35 different locations (boreholes RFB1 through RFB40 and RFBL1 through RFBL3) were collected during the remedial investigation in June through September 1990. A total of 25 sediment samples were collected from 22 different locations (M23A through M49A) that were drilled from June 1987 through October 1987. The samples on the cross sections include 96 of the 122 remedial investigation samples and 22 of the 25 SWAT samples. Also included in the cross sections are 27 of the 34 subsurface soil samples which were collected as part of the additional remedial investigation in December 1993 and January 1994. The VOCs with detections and their corresponding range of values are given below. The 26 remedial investigation samples, three SWAT samples, and seven additional remedial investigation samples that were not included in the cross sections had VOC concentrations within the ranges given below.

<u>VOC</u>	<u>Range of Values</u>
vinyl chloride	ND - 50 ppb
1,1-dichloroethylene	ND - 10 ppb
trichloroethylene	ND - 20 ppb
tetrachloroethylene	ND - 50 ppb
1,1-dichloroethane	ND - 20 ppb
1,2-dichloroethane	ND - 250 ppb
trichloroethane	ND - 200 ppb
benzene	ND - 200 ppb
toluene	ND - 800 ppb
xylene	ND - 3100 ppb
dichlorobenzene	ND - 50 ppb

### Soil Pore Water Samples

All nine of the lysimeter locations are included in the cross sections. Lysimeters L1 through L6 data were taken during the second quarter of 1994. The VOCs with detections and their corresponding range of values are given below.

<u>VOC</u>	<u>Range of Values</u>
vinyl chloride	ND - 91 ppb
trichloroethylene	ND - 18 ppb
tetrachloroethylene	ND - 0.70 ppb
1,1-dichloroethane	ND - 0.50 ppb
1,2-dichloroethane	ND - 130 ppb
trichloroethane	ND - 1.3 ppb
benzene	ND - 23 ppb
toluene	ND - 0.70 ppb

### Ground Water Samples

The ground water samples in the cross sections include those collected during the second quarter of 1994 for monitoring wells M06A, M06B, M07A, M23A-M26A, M30B, M32B-M35B, M36A-M46A, M47B, M48A, M49A, PV-3, P4-6, and P410, M51B (RFB4), M52B (RFB13), M53B (RFB16), M54B (RFB20), M56B (RFB24), M57B (RFB25), M58B (RFB26), M59B (RFB27), M60B (29), M61B (RFB31), and M62B (RFBL3), M63B (AB2), M64B (AB1a), M65B (AB3), M66B (AB4), M67B (AB8), M68B (AB9), M69B (AB6), M70B (AB7). The VOCs with detections and their corresponding range of values are given below.

<u>VOC</u>	<u>Range of Values</u>
vinyl chloride	ND - 1300 ppb
1,1-dichloroethylene	ND - 1.8 ppb
1,2-dichloroethylene	ND - 472 ppb
trichloroethylene	ND - 87 ppb
tetrachloroethylene	ND - 36 ppb
1,1-dichloroethane	ND - 91 ppb
1,2-dichloroethane	ND - 240 ppb
1,2-dichloropropane	ND - 12 ppb

benzene	ND - 42 ppb
toluene	ND - 62 ppb
xylenes	ND - 36 ppb
chlorobenzene	ND - 840 ppb
dichlorobenzene	ND - 22.9 ppb

The index map to the geologic cross sections with chemical data is given in Figure 4.2-1. The key to the chemical cross sections with chemical data giving the symbols, chemical abbreviations, and notes to the cross sections is given in Figure 4.2-2. The geologic cross sections with chemical data, a-a' through t-t', are given in Figures 4.2-3a through 4.2-3t, respectively.

The cross sections a-a' through g-g' show the ground water plume of contamination that occurs off of Hawthorne Boulevard. The off site ground water contamination is centered around wells M49A, M24A, and PV-3. The cross sections show that this ground water contamination ends as one fans out away from this plume.

The cross sections c-c', l-l', r-r', and s-s' show the ground water plume of contamination that occurs off of Hawthorne Boulevard. The off site ground water contamination is centered around wells PV-3, M23A, M25A, M49A, M63B (AB2), and M64B (AB1a). The cross sections show that this ground water contamination ends as one fans out away from this plume. The cross sections j-j', l-l', and q-q' show the ground water plume of contamination that occurs off of Crenshaw Boulevard. The off site ground water contamination is centered around wells M36A, M37A, M69B (AB6), and M70B (AB7).

The cross sections show VOC detections in both the ambient air and surface route gas samples. A qualitative analysis of the ambient air and surface route gas samples shows that there are no significant difference between these samples. Both the ambient air and surface route samples had detections of trichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, benzene, toluene, and xylene. The VOC detections are typically at low concentrations (usually less than 10 ppb). As discussed in Section 4.1.1, there were no significant differences between the upgradient ambient air and surface gas route TAC concentrations. Therefore, no emissions attributable to the landfill were identified in the ambient air or surface route samples.

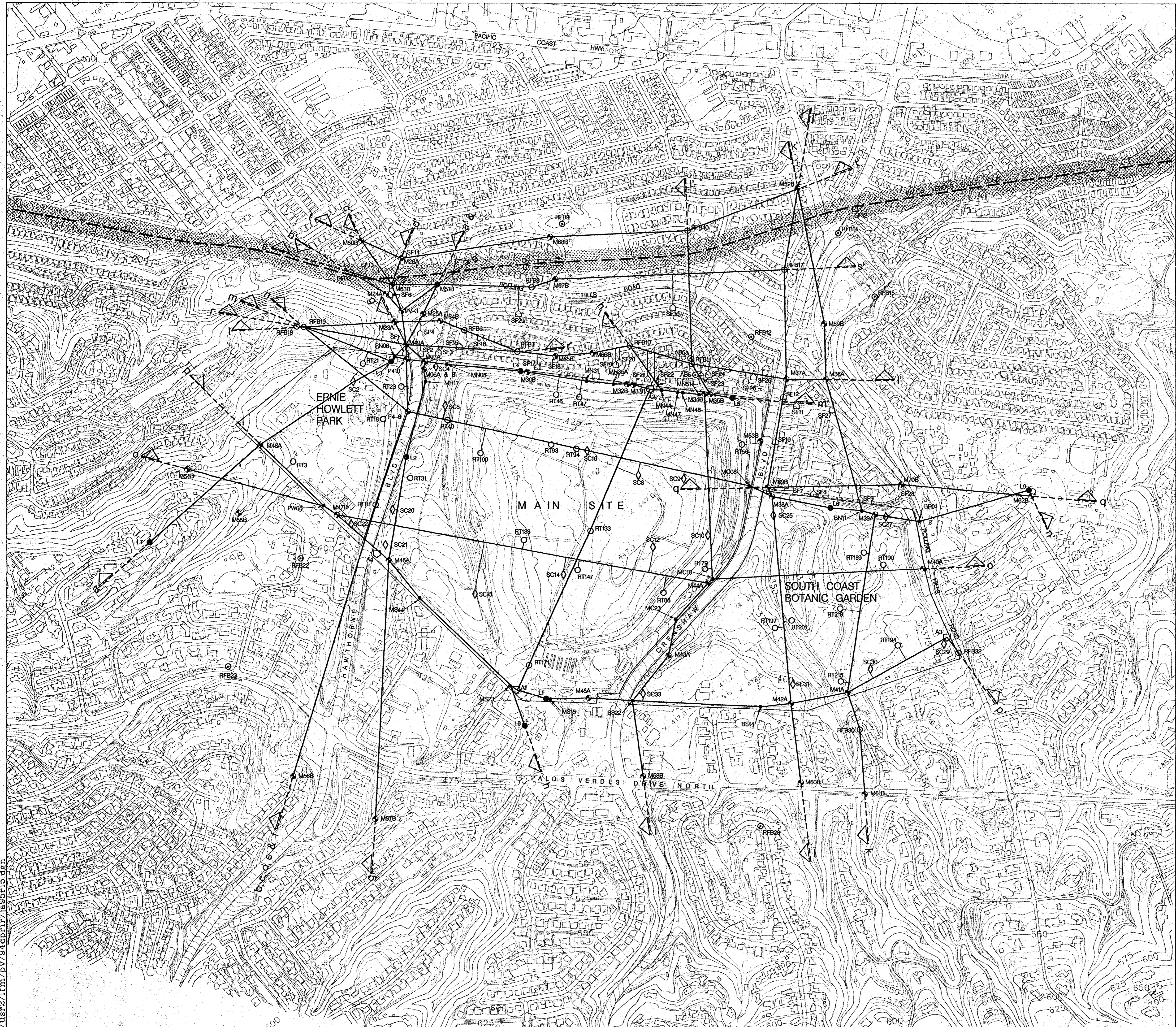


The cross sections also show the VOC detections in the surface flux chamber samples. A comparison of VOCs found in the ground water contaminant plumes and the surface flux chamber samples showed little similarity. The ground water contaminant plume off site of Hawthorne Boulevard had VOC detections of vinyl chloride, 1,2 dichloroethylene, trichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, benzene, and chlorobenzene. The surface flux chamber samples over the Hawthorne Boulevard plume contained only benzene, which was present in all of the surface flux chamber samples including the background samples. The ground water contaminant plume off site of Crenshaw Boulevard had VOC detections of vinyl chloride, 1,1 dichloroethylene, 1,2-dichloroethylene, trichloroethylene, tetrachloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, benzene, toluene, chlorobenzene, and dichlorobenzene. The surface flux chamber samples over the Crenshaw Boulevard plume contained benzene and tetrachloroethylene, but not the other compounds.

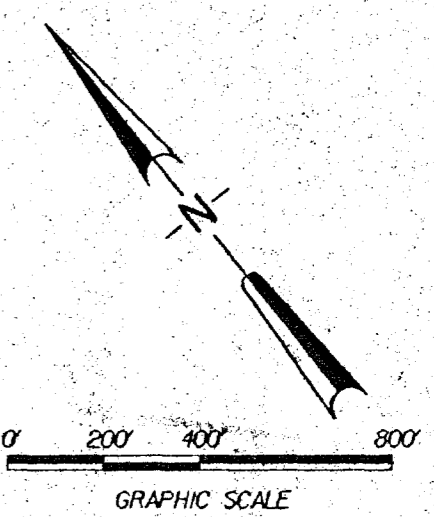
The boundary probe samples in the cross sections detected similar VOCs that were seen in the surface gas and ambient air samples, but the concentrations were generally much higher. Some of the VOCs had concentrations over 200 ppb. Also, the boundary probes in the cross sections had detections of 1,1-dichloroethylene and chlorobenzene that were not detected in the ambient air or surface route samples.

The cross sections contain only one surface soil sample with VOC detections. This sample had low concentrations of toluene and xylenes. The detections of VOCs in the subsurface soil samples were very random and sporadic. As discussed in Section 4.1.3, these sporadic low concentration detections are potentially a result of landfill gas contact with soils at and near the PVLFF or are from a source other than the landfill. Detections of VOCs in the soil pore water samples occurred in three of the nine lysimeters. VOCs were detected in lysimeters located at the PVLFF boundary on the landfill itself; they were not unexpected due to landfill gas contact with these soils. The VOCs detected in the soil pore water were vinyl chloride, trichloroethylene, tetrachloroethylene, 1,1-dichloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, benzene, and toluene.

The cross sections show the VOC contamination that occurs in the ground water plumes near Hawthorne and Crenshaw Boulevards. Where off site contamination occurs in the off site Hawthorne Boulevard plume on the cross sections, there are detections of vinyl chloride, 1,2 dichloroethylene, trichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, benzene, xylene, and



MONITORING WELL NAME	FORMER BORING NAME
M50B	RFB3
M51B	RFB4
M52B	RFB13
M53B	RFB16
M54B	RFB20
M55B	RFB21
M56B	RFB24
M57B	RFB25
M58B	RFB26
M59B	RFB27
M60B	RFB29
M61B	RFB31
M62B	L3
M63B	AB2
M64B	AB1a
M65B	AB3
M66B	AB4
M67B	AB8
M68B	AB9
M69B	AB8
M70B	AB7
L7	L7
L8	L8
L9	L3



- PROPERTY LINE
- ⊙ GROUNDWATER MONITORING WELL LOCATION
- LYSIMETER LOCATION
- ⊕ BORING LOCATION
- SPECIATED BOUNDARY PROBES
- SPECIATED SURFACE GAS ROUTES
- ◇ SURFACE SOIL COVER SAMPLE
- △ SURFACE FLUX CHAMBER SAMPLE
- ▽ AMBIENT AIR MONITORING LOCATION

FIGURE 4.2-1  
INDEX MAP TO GEOLOGIC CROSS SECTIONS WITH CHEMICAL DATA

PALOS VERDES LANDFILL  
REMEDIAL INVESTIGATION REPORT  
SANITATION DISTRICTS, JANUARY 1995

SOURCE: AERIAL PHOTOGRAMMETRY TAKEN  
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SYMBOLS

- ▽ Groundwater Sample
- △ Soil Pore Water Sample
- Sediment Sample
- ⬡ Speciated Boundary Probe Sample
- Speciated Surface Gas
- Route Sample
- ◇ Surface Soil Cover Sample
- ◊ Ambient Air Sample
- ⬠ Surface Flux Chamber Sample

GEOLOGIC ABBREVIATIONS

- LF - Palos Verdes Landfill deposits
- Qo - Overburden
- Qus - Undifferentiated Sand
- Tmm - Malaga Mudstone
- Tmv - Valmonte Diatomite
- Tma - Altamira Shale

CHEMICAL ABBREVIATIONS

The following compounds are plotted:

- VC - Vinyl Chloride
- 1,1 DCE - 1,1 - Dichloroethylene
- 1,2 DCE - 1,2 - Dichloroethylene
- TCE - Trichloroethylene
- PCE - Tetrachloroethylene  
(Perchloroethylene)
- 1,1 DCA - 1,1 - Dichloroethane
- 1,2 DCA - 1,2 - Dichloroethane
- TCA - 1,1,1 - Trichloroethane
- DCP - Dichloropropane
- BZ - Benzene
- TOL - Toluene
- XYL - Xylene
- CBZ - Chlorobenzene
- DCB - Dichlorobenzene
- TOC - Total Organic Carbon  
as Methane

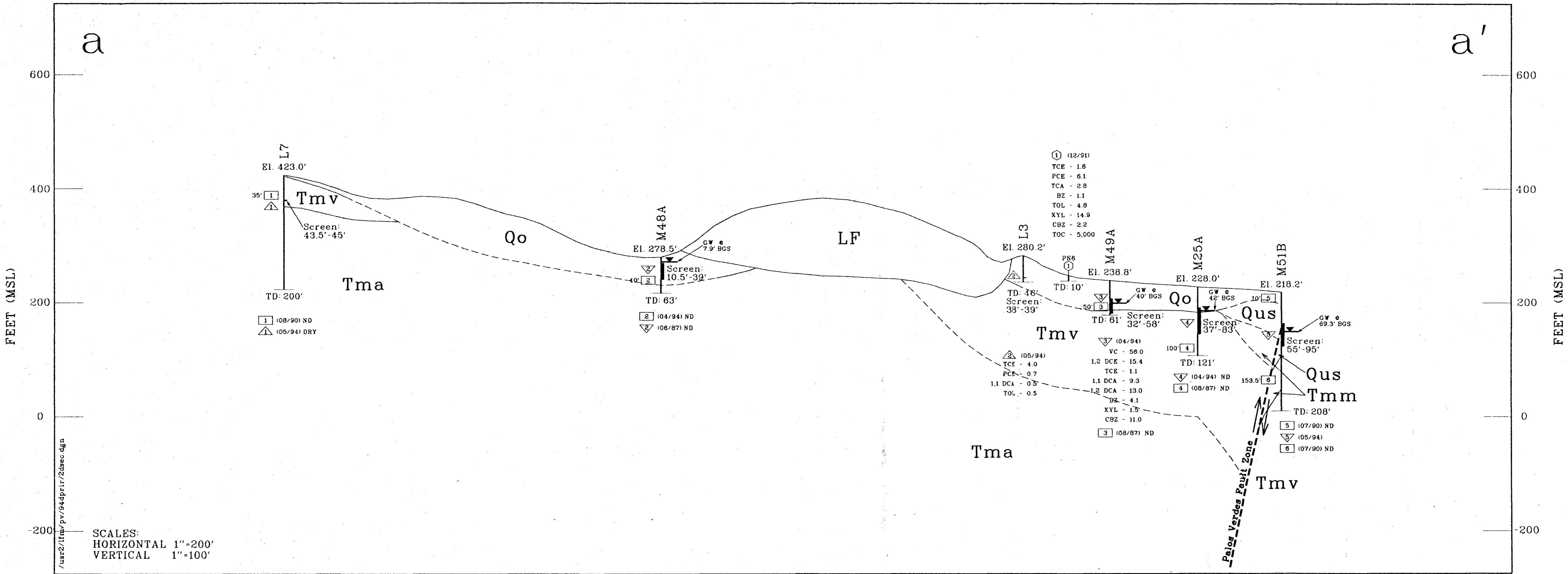
NOTES

- 1) All values are in parts per billion (ppb).
- 2) Soil samples dated 1987 were collected during SWAT investigation; QA/QC associated with the SWAT program was not as complete as that employed during the RI.
- 3) Ground water and soil pore water samples with no depth noted were obtained at the scree screened interval.
- 4) Ground water depths are for January 1994.
- 5) Non-detected values are not plotted.
- 6) The vertical scale is measured in feet from mean sea level (MSL). All other measurements (TD, (TD, screen) are in feet below ground surface.
- 7) GW - Ground water.
- 8) ND - Not detected.
- 9) NE - Not encountered.
- 10) TD - Total depth

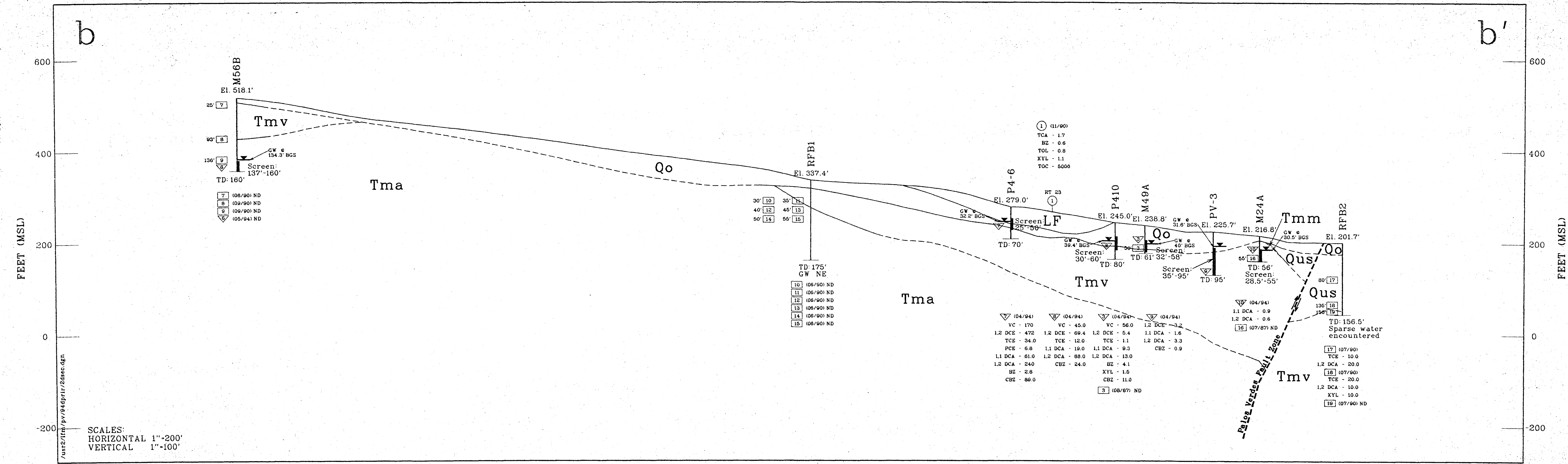
FIGURE 4.2 - 2

**LEGEND FOR GEOLOGIC  
CROSS SECTIONS WITH  
CHEMICAL DATA**

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**FIGURE 4.2-3a**  
**GEOLOGIC CROSS SECTION a-a'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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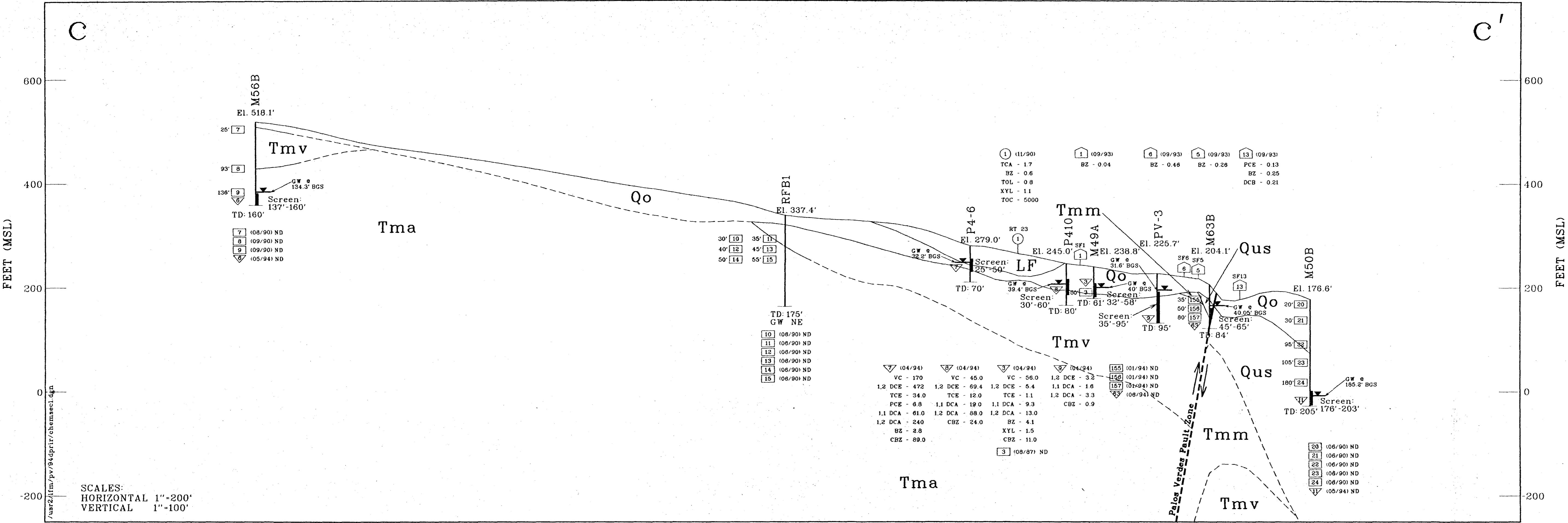


**FIGURE 4.2-3b**  
 GEOLOGIC CROSS SECTION b-b'  
 WITH CHEMICAL DATA

(REFER TO FIGURE 4.2-2 FOR MAP LEGEND)

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**FIGURE 4.2-2c**  
**GEOLOGIC CROSS SECTION c-c'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2 FOR MAP LEGEND)  
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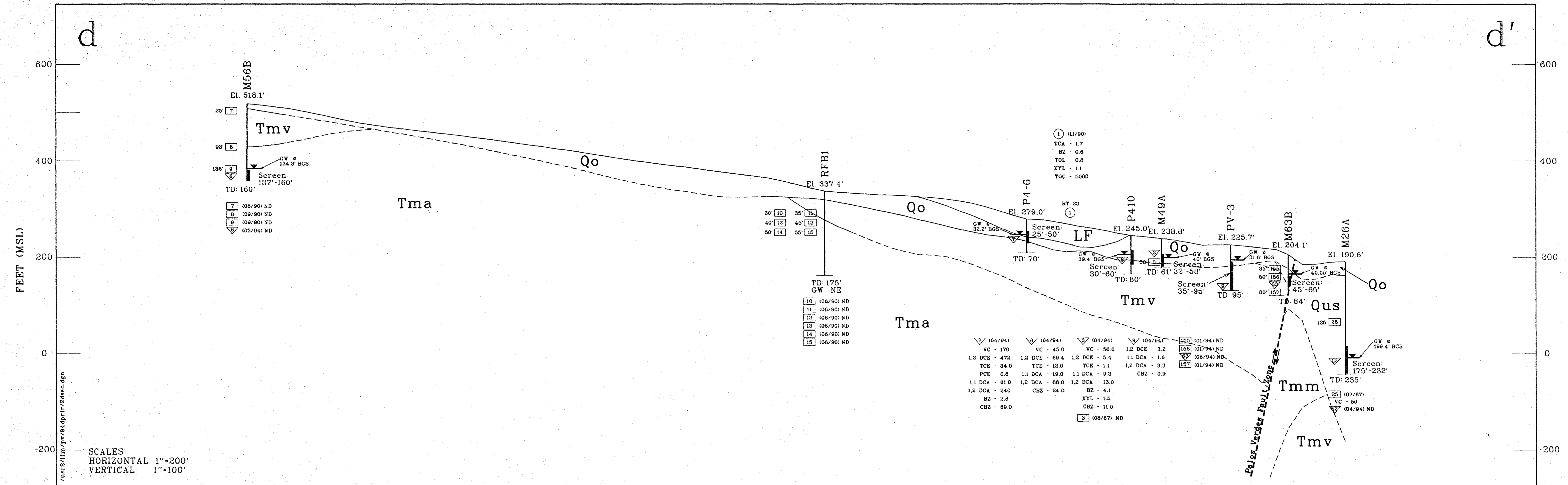


FIGURE 4.2-3d  
 GEOLOGIC CROSS SECTION d-d'  
 WITH CHEMICAL DATA

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

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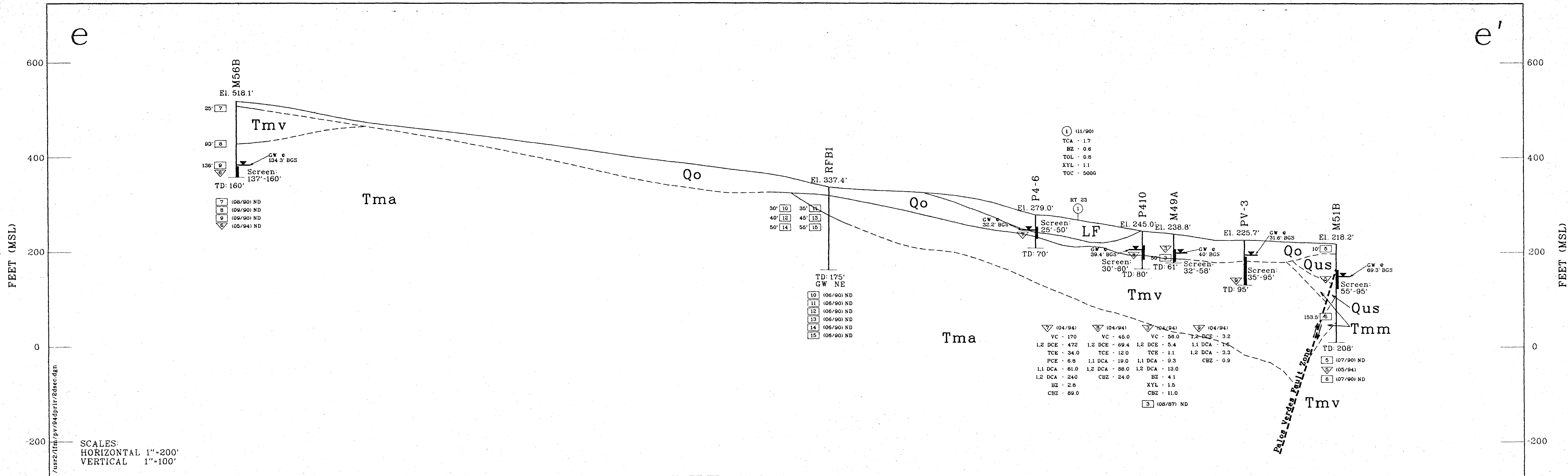
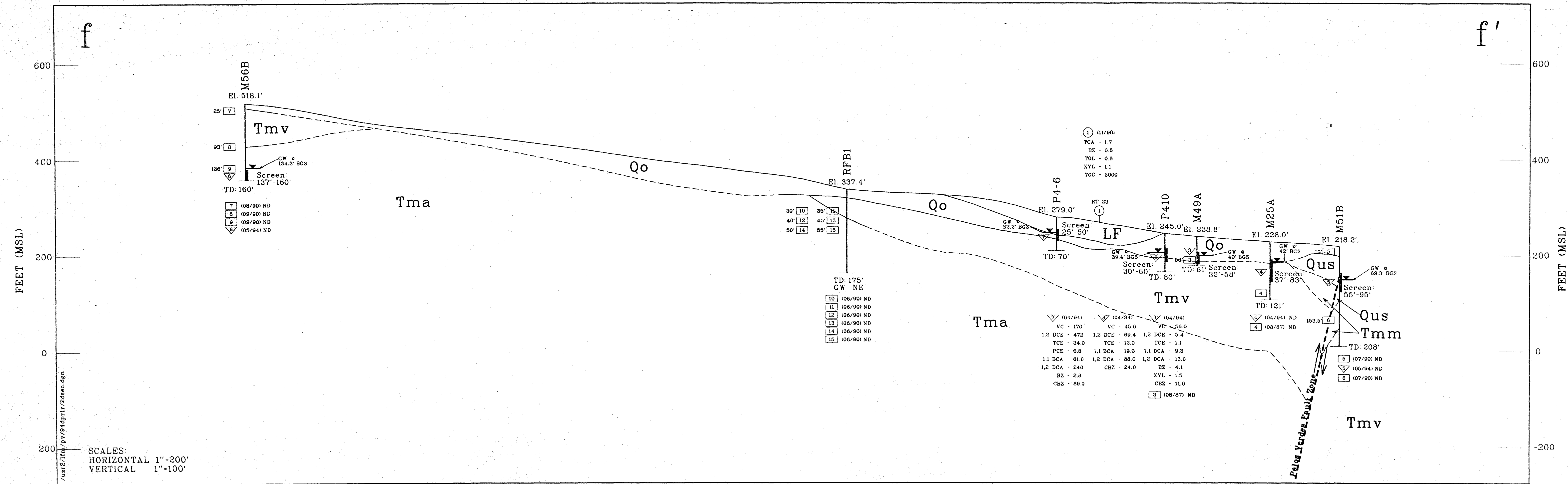
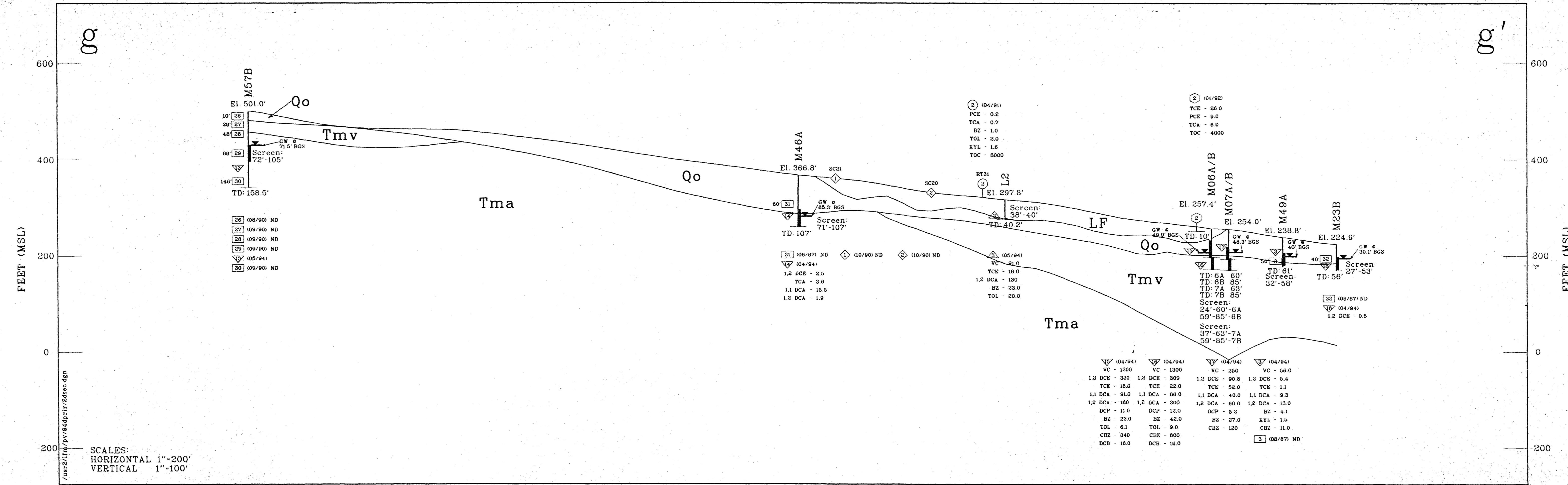


FIGURE 4.2-3e  
 GEOLOGIC CROSS SECTION e-e'  
 WITH CHEMICAL DATA  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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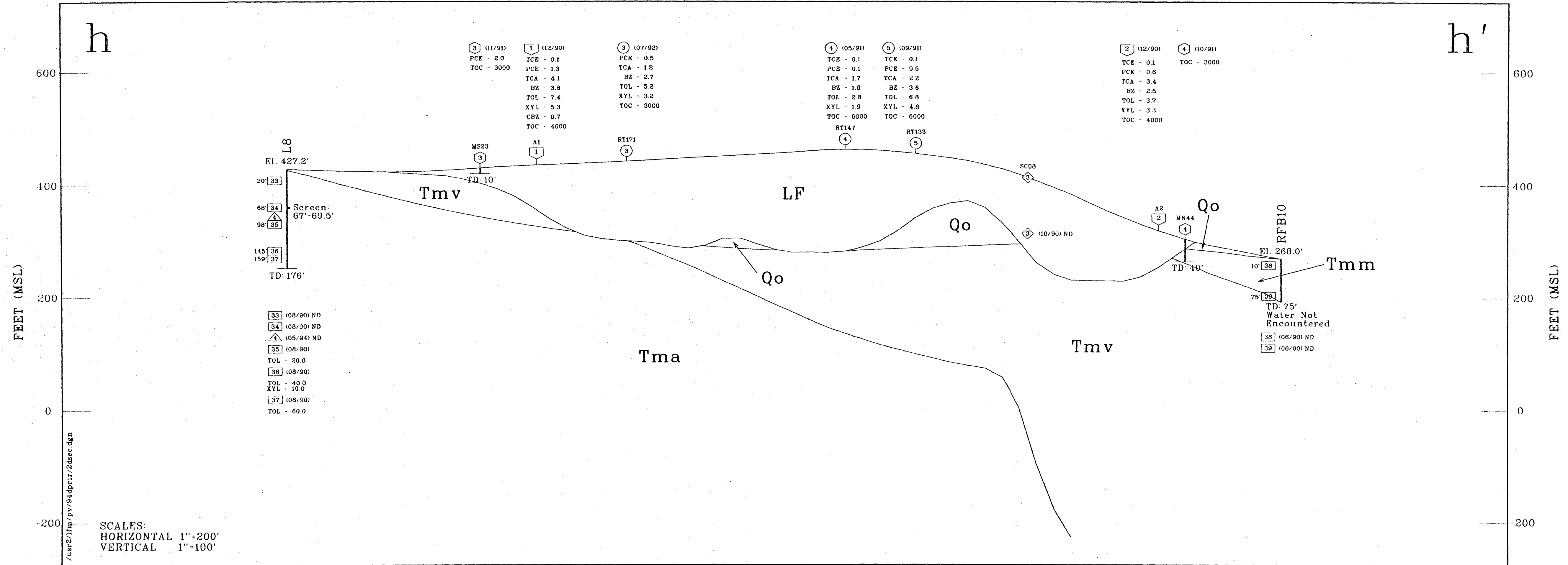




**FIGURE 4.2-3f**  
**GEOLOGIC CROSS SECTION f-f'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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**FIGURE 4.2-3g**  
**GEOLOGIC CROSS SECTION g-g'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2 FOR MAP LEGEND)  
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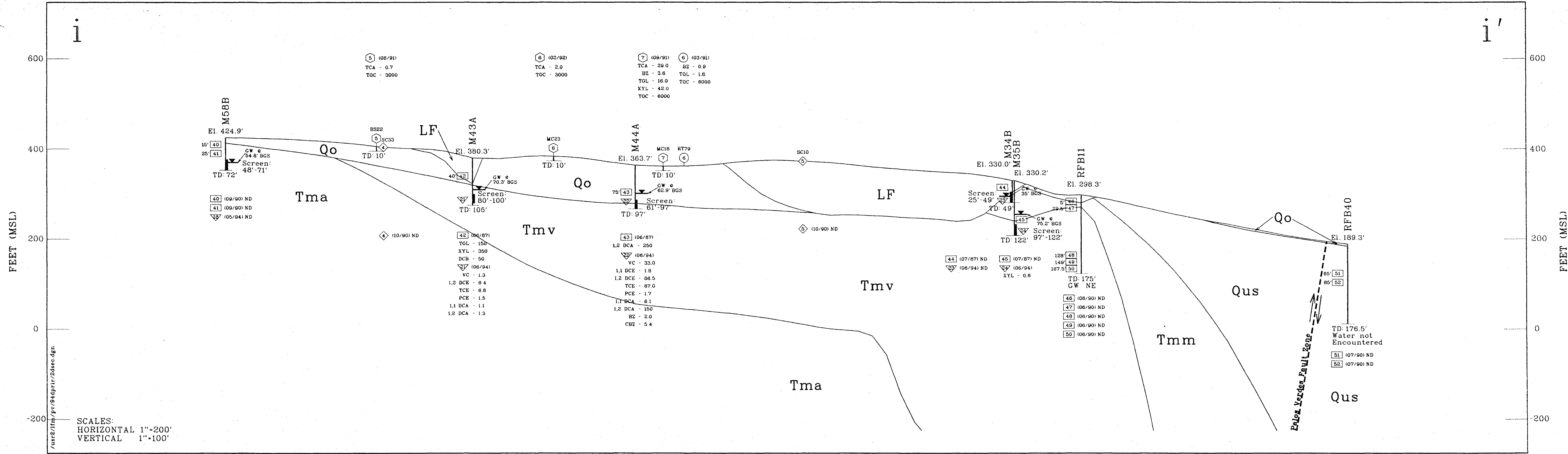
**FIGURE 4.2-3h**  
**GEOLOGIC CROSS SECTION h-h'**  
**WITH CHEMICAL DATA**

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

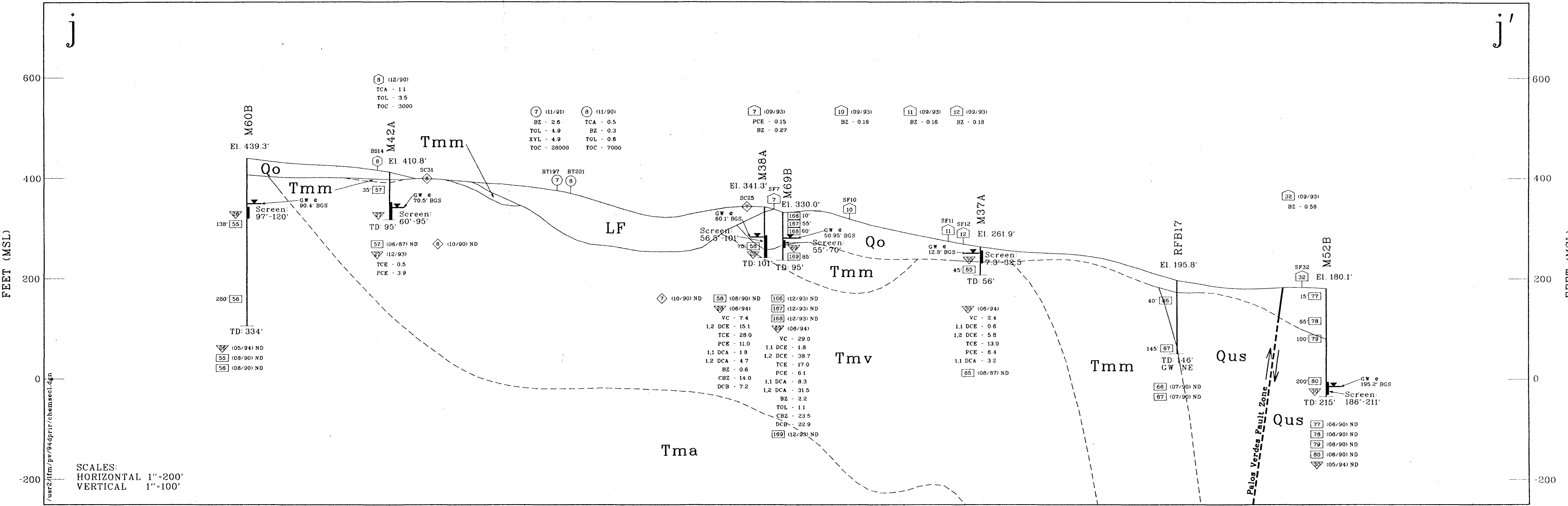
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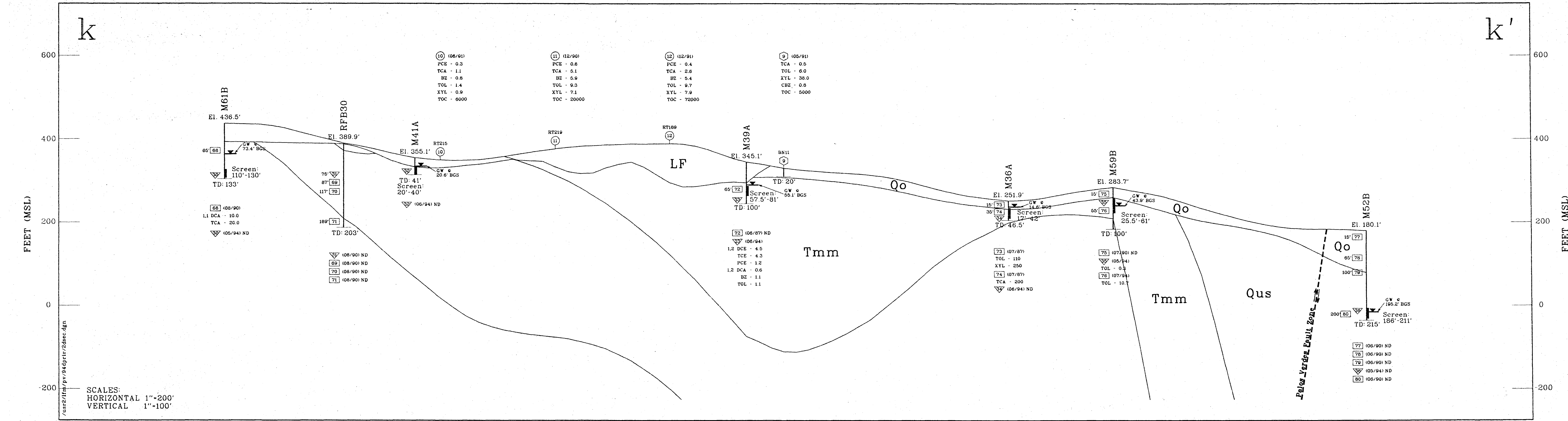
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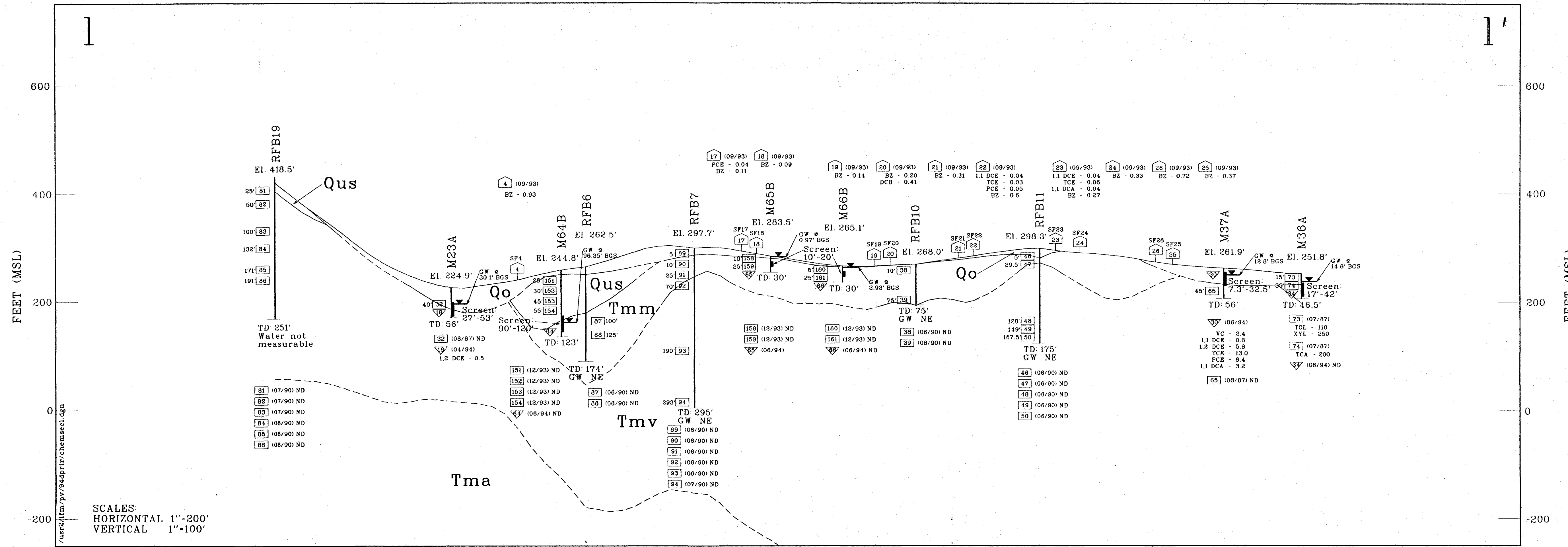
**FIGURE 4.2-3i**  
**GEOLOGIC CROSS SECTION i-i'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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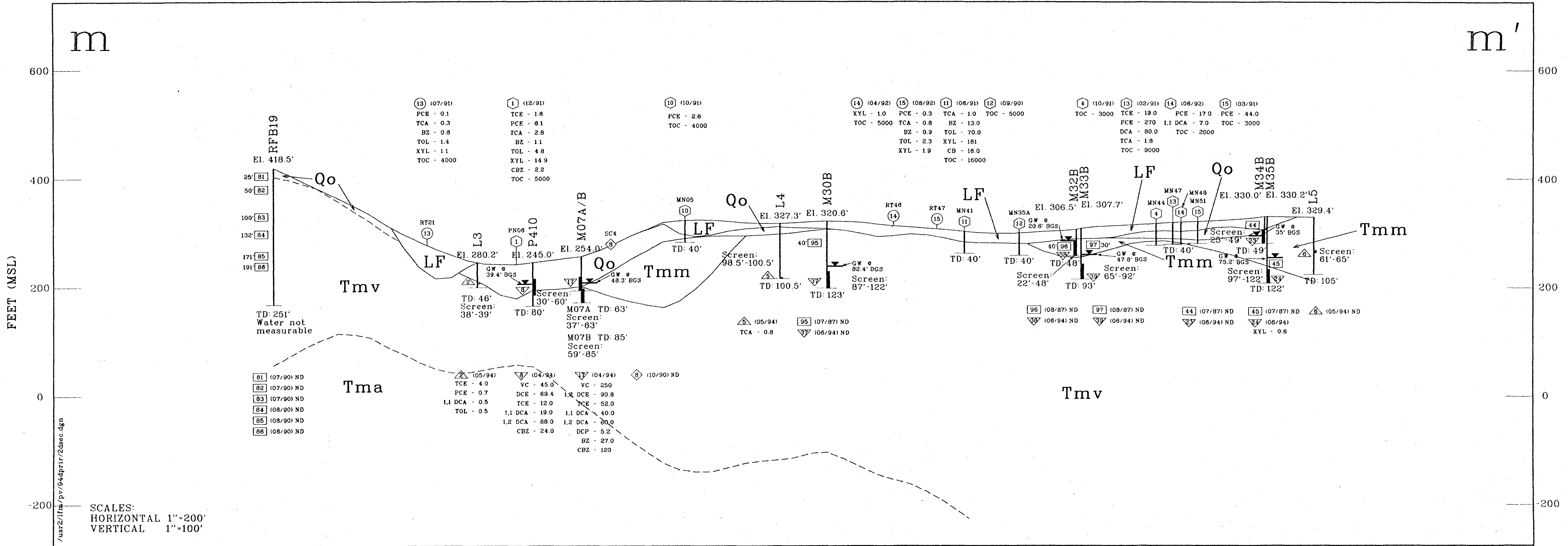
**FIGURE 4.2-2j**  
**GEOLOGIC CROSS SECTION j-j'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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**FIGURE 4.2-3k**  
**GEOLOGIC CROSS SECTION k-k'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2 FOR MAP LEGEND)  
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**FIGURE 4.2-21**  
**GEOLOGIC CROSS SECTION 1-1'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2 FOR MAP LEGEND)  
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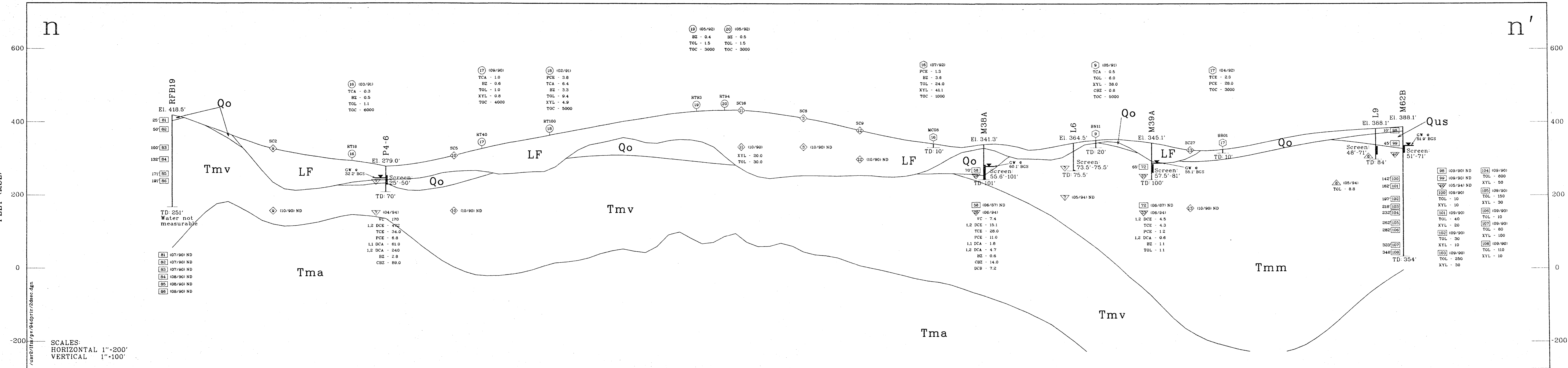
**FIGURE 4.2-3m**  
**GEOLOGIC CROSS SECTION m-m'**  
**WITH CHEMICAL DATA**

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

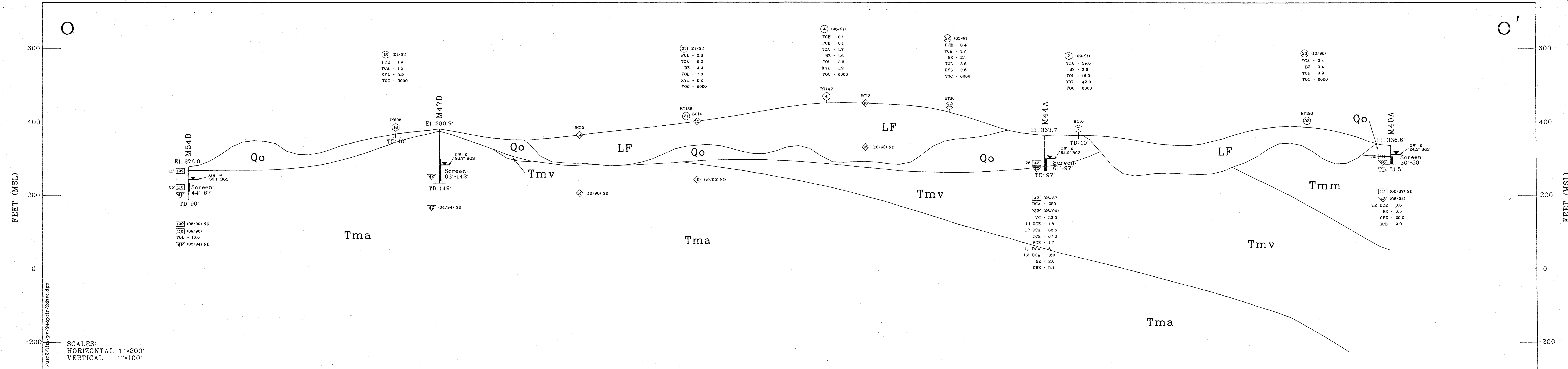
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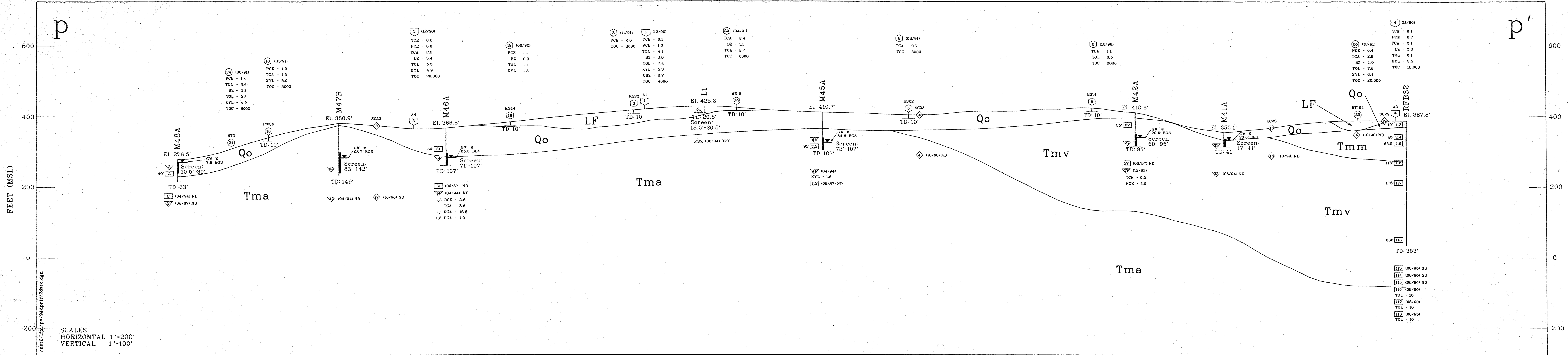
**FIGURE 4.2-3n**  
 GEOLOGIC CROSS SECTION n-n'  
 WITH CHEMICAL DATA  
 (REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)  
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**FIGURE 4.2-3a**  
**GEOLOGIC CROSS SECTION o-o'**  
**WITH CHEMICAL DATA**

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

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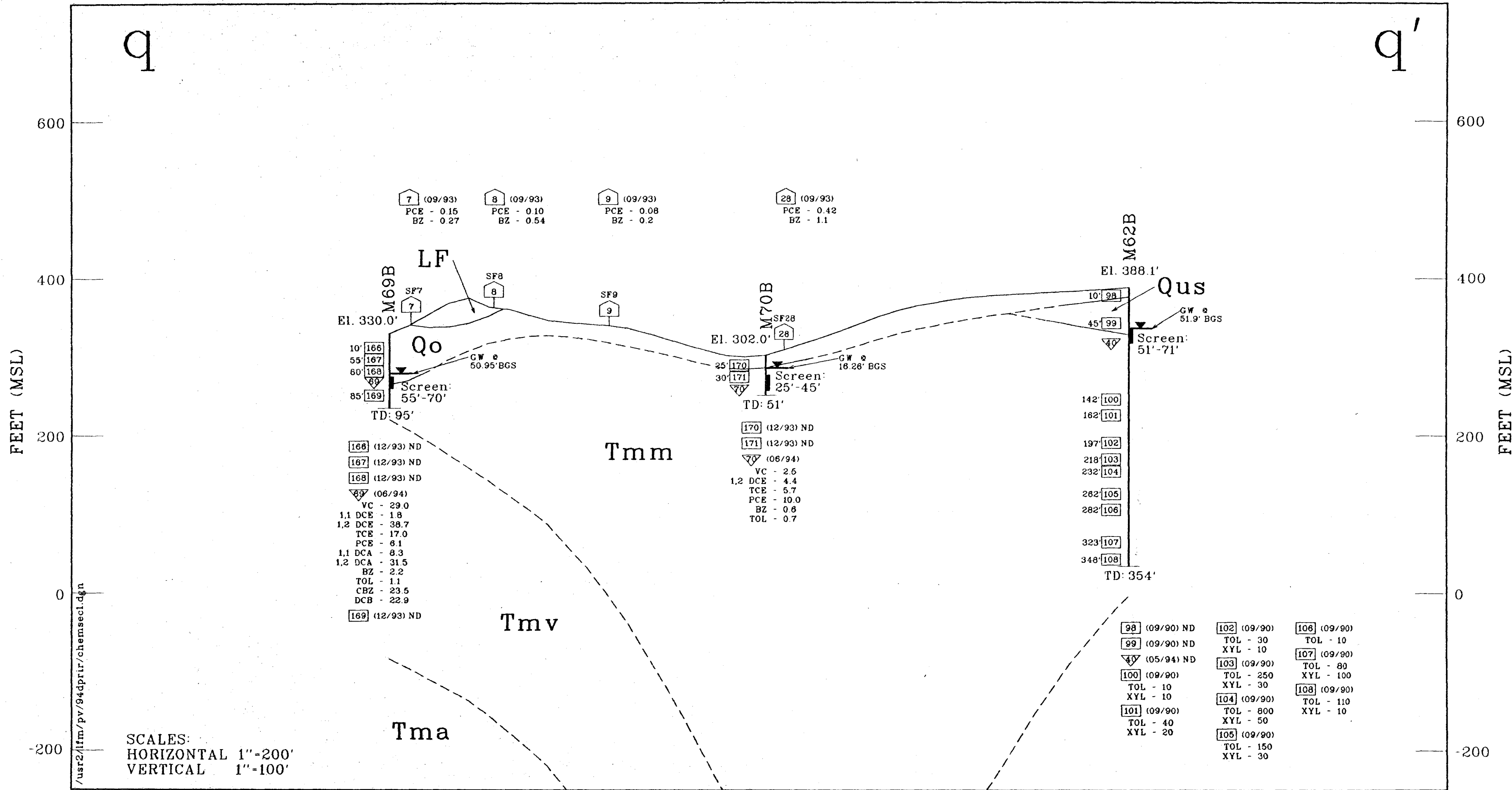


SCALES:  
 HORIZONTAL 1"=200'  
 VERTICAL 1"=100'

**FIGURE 4.2-3p**  
 GEOLOGIC CROSS SECTION p-p'  
 WITH CHEMICAL DATA

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

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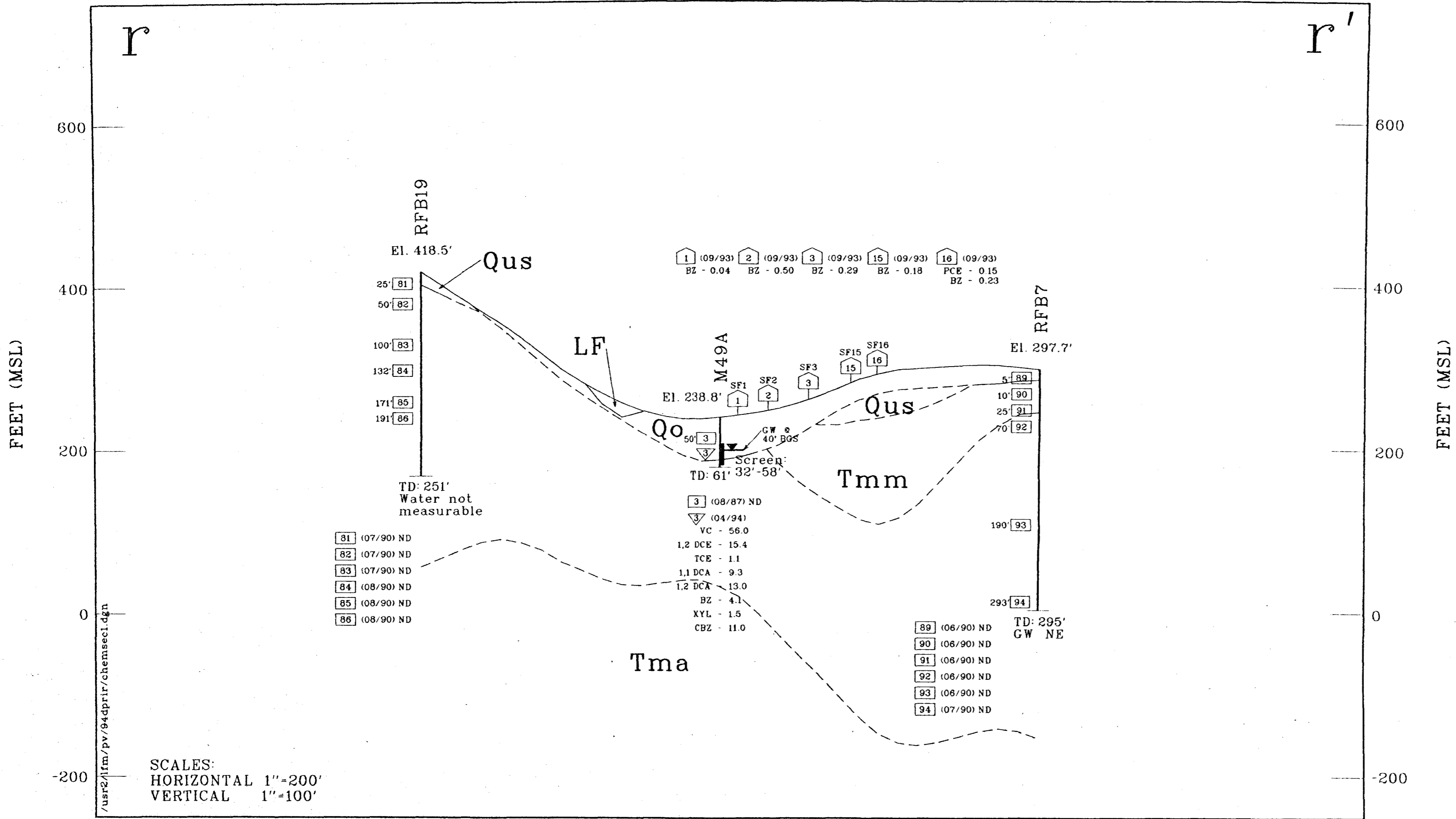


**FIGURE 4.2-2q**  
**GEOLOGIC CROSS SECTION q-q'**  
**WITH CHEMICAL DATA**

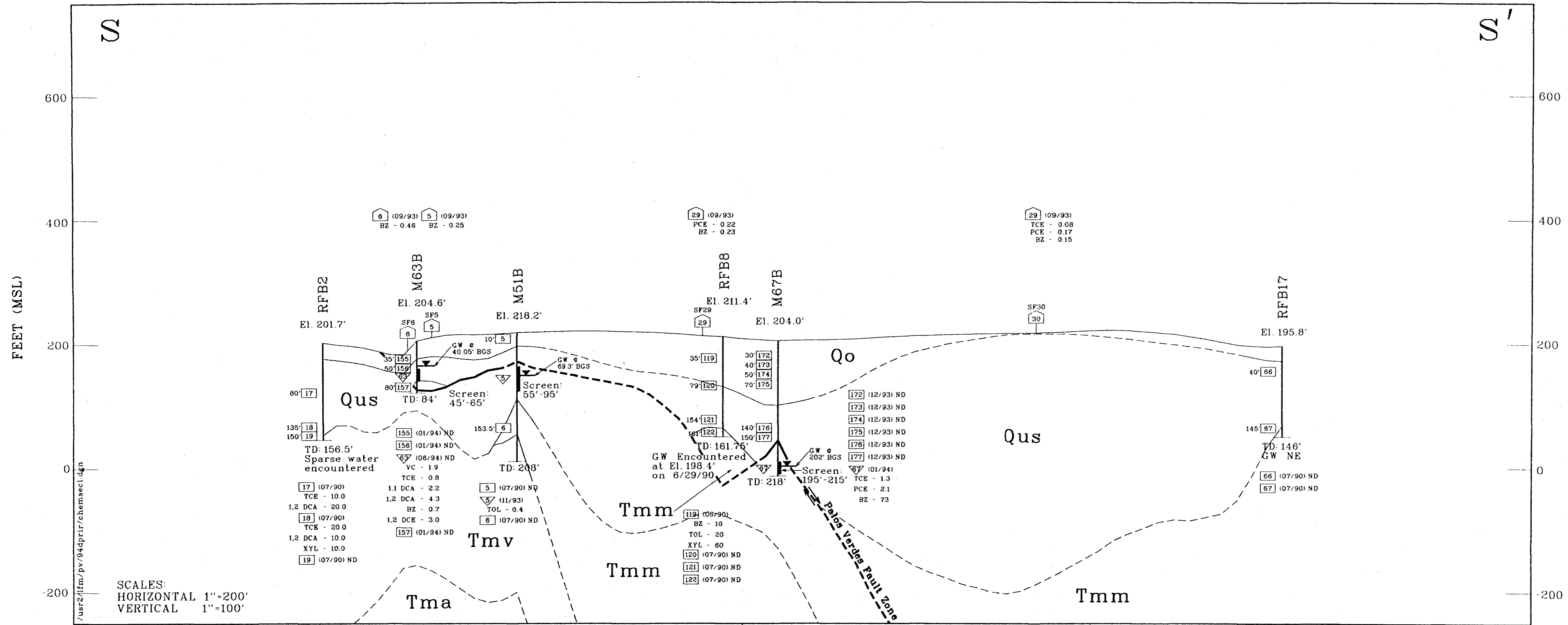
(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

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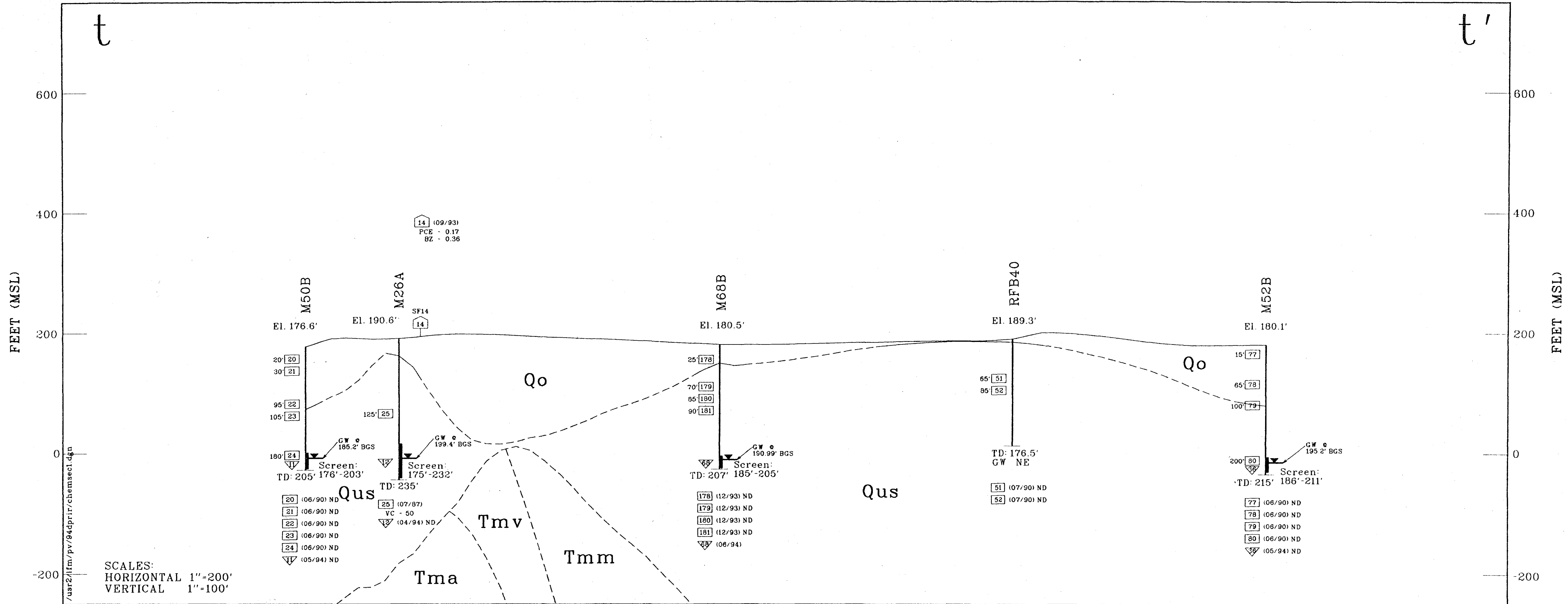
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**FIGURE 4.2-2r**  
**GEOLOGIC CROSS SECTION r-r'**  
**WITH CHEMICAL DATA**  
(REFER TO FIGURE 4.2-2  
FOR MAP LEGEND)  
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**FIGURE 4.2-2s**  
**GEOLOGIC CROSS SECTION s-s'**  
**WITH CHEMICAL DATA**  
 (REFER TO FIGURE 4.2-2 FOR MAP LEGEND)  
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**FIGURE 4.2-2t**  
**GEOLOGIC CROSS SECTION t-t'**  
**WITH CHEMICAL DATA**

(REFER TO FIGURE 4.2-2  
 FOR MAP LEGEND)

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chlorobenzene. Where off site contamination occurs in the Crenshaw Boulevard plume on the cross sections, there are detections of vinyl chloride, 1,1-dichloroethylene, 1,2-dichloroethylene, trichloroethylene, tetrachloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, toluene, chlorobenzene, and dichlorobenzene. Certain VOCs are more prevalent in the ground water samples. Vinyl chloride, 1,1-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, chlorobenzene, and dichlorobenzene are found in the ground water samples but are never detected in the ambient air or surface gas samples. Also, although trichloroethane is detected in the ambient air samples and surface gas samples, it was not detected in any the ground water samples or the landfill gas samples.