# 5-YEAR REVIEW REPORT
# FOR
# STRINGFELLOW HAZARDOUS WASTE SITE

# GLEN AVON, CALIFORNIA

Prepared for
Contract No. 68-W-98-225/WA No. 044-FRFE-09ZZ
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

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U.S. Environmental Protection Agency
Region IX

**September 2001**

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# List of Acronyms

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirements |
| CAA | Clean Air Act |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COE | U.S. Army Corps of Engineers |
| CSDOC | County Sanitation Districts of Orange County |
| CWA | Clean Water Act |
| DTSC | California Department of Toxic Substances Control |
| EPA | United States Environmental Protection Agency |
| GAC | granular activated carbon |
| gpd | gallons per day |
| gpm | gallons per minute |
| MCL | Maximum Contaminant Level |
| MCLG | Maximum Contaminant Level Goals |
| µg/L | micrograms per liter |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| O&M | operations and maintenance |
| OU | operable unit |
| PCBs | polychlorinated biphenyls |
| POTW | publicly owned treatment works |
| PRPs | potentially responsible parties |
| PTP | Stringfellow Pretreatment Plant |
| RAC | Response Action Contract |

| | |
|---|---|
| RAO | remedial action objective |
| RCRA | Resource Conservation and Recovery Act |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RWQCB | California Regional Water Quality Control Board |
| SARI | Santa Ana Regional Interceptor |
| SDWA | Safe Drinking Water Act |
| SVE | Soil Vapor Extraction |
| TBC | To Be Considered |
| TCE | Trichloroethylene |
| UIC | Underground Injection Control |
| UTS | Universal Treatment Standards |
| VOCs | Volatile Organic Compounds |
| WAM | Work Assignment Manager |

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

MEMORANDUM

September 27, 2001

**SUBJECT:** Five-Year Review for the Stringfellow Superfund Site, Glen Avon, CA
CAT080012826

**FROM:** Bob Fitzgerald, Remedial Project Manager
Site Cleanup Section 4

**THRU:** Loren Henning, Chief
Site Cleanup Section 4

Tom Kremer, Superfund Policy Advisor
Site Cleanup Branch

John Kemmerer, Chief
Site Cleanup Branch

**TO:** Keith Takata, Director
Superfund Division

## I. INTRODUCTION

Attached, please find a copy of the Five-Year Review for the Stringfellow Superfund Site. This Five-Year Review is required by CERCLA (Section 121(c)) and by Section 300.430(f)(4)(ii) of the NCP. This statutory five-year review has been undertaken because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unrestricted use and unlimited exposure.

## II. FIVE-YEAR REVIEW SUMMARY

The Stringfellow site is located in Pyrite Canyon, north of Highway 60, near the community of Glen Avon, in Riverside County, California. From 1956 until 1972, the 17-acre Stringfellow site was operated as a hazardous waste disposal facility. Over 34 million gallons of industrial waste, primarily from metal finishing, electroplating, and pesticide production were deposited in evaporation ponds.

Groundwater at the site contains various volatile organic compounds (VOCs), perchlorate, n-nitrosodimethylamine, and heavy metals such as cadmium, nickel, chromium, and manganese. Soil in the original disposal area is contaminated with pesticides, polychlorinated biphenyls, sulfates, and heavy metals. The original disposal area is now covered by a clay cap, fenced, and guarded by security services.

The Stringfellow site has been addressed in five stages: initial actions and four long-term remedial phases focusing on installation of an onsite pretreatment plant, control of the source of contamination, cleanup of the lower part of Pyrite Canyon, and cleanup of the community wells.

The Stringfellow site has been divided geographically into four zones. Zone 1, the Onsite/Upper Mid-Canyon Area, includes the original 17-acre disposal area in the northern uppermost part of Pyrite Canyon. Zone 2, the Mid-Canyon Area, is the middle reach of Pyrite Canyon extending approximately 800 feet south of Zone 1. The Lower Canyon Area, referred to as Zone 3, is the lower reach of Pyrite Canyon extending approximately 2,400 feet south of Zone 2 to Highway 60. Zone 4, the Glen Avon Community, includes the area of Glen Avon south of Highway 60 and downstream of Pyrite Canyon, and extends to the leading edge of the groundwater plume, currently approximately 22,000 feet southwest of the former Stringfellow site (located in Zone 1).

To date, four Records of Decision (RODs) providing interim remedial actions have been issued by EPA for the Stringfellow site. The first ROD (July 22, 1983) directed completion of several initial abatement activities, including fencing, erosion control, interim source control, and off-site hauling and disposal of contaminated liquids. The second ROD (July 18, 1984) directed construction of an on-site pretreatment plant to treat contaminated groundwater, and included installation of an expanded extraction system in Zone 2. The third ROD (June 25, 1987) directed installation of a groundwater barrier system in the lower canyon area, and installation of peripheral surface channels to direct upgradient surface water runoff. The fourth ROD (September 30, 1990) directed dewatering of the original disposal area (Zone 1), installation of a groundwater extraction system in the community area, field testing of soil vapor extraction, and field testing of reinjection of treated groundwater in the upper canyon area.

The remedies in all four zones are performing as intended by the decision documents. Institutional and access controls are in place and effective in preventing exposure in Zones 1, 2, and 3 at the site. However, institutional controls in Zone 4 are incomplete in preventing exposure to perchlorate contamination. The California Department of Toxic Substances Control (DTSC) has recently identified 15 households in Zone 4 which still rely on private drinking water wells. DTSC expects these households will be provided with bottled drinking water by the end of September 2001 and plans to connect them to water from a public utility in nine months. A protectiveness determination of the remedy at Zone 4 cannot be made at this time until further information is obtained. It is expected that this information will be available by March 2002, at which time a protectiveness determination will be made.

In addition, there is an identified need for more comprehensive remedial measures to ensure long-term effectiveness and permanence of the remedy in Zone 1. Remedial measures to optimize dewatering and other source control in Zone 1 have been identified in a Draft Supplemental Feasibility Study and will be included in the next site ROD. It is anticipated that investigations and possible improvements to the existing groundwater extraction systems (i.e.,

additional monitoring or extraction wells) may be successful in accelerating the achievement of the remedial action objectives for the groundwater remedy in Zones 2 and 3. These improvements are currently being developed by (DTSC), as part of the current remedial operations.

## III CONCLUSION

I certify that the remedies selected for Zones 1, 2, and 3 of this site remain protective of human health and the environment. A protectiveness determination for Zone 4 of this site will be made in March 2002. Based on the expected continuing presence of contamination at this site at levels which preclude unlimited use and unrestricted exposure, the next Five-Year Review will be written within five years from the signature date of this review.

Approved by: Keith Takata Date: 9-27-01

Keith Takata, Director
Superfund Division

Attachment: Five-Year Review Report for Stringfellow Hazardous Waste Site

# 5-Year Review Summary Form

## SITE IDENTIFICATION

**Site name :** Stringfellow Hazardous Waste Superfund Site

**EPA ID:** CAT080012826

**Region:** IX **State:** CA **City/County:** Glen Avon / Riverside County

## SITE STATUS

**NPL status:** ■ Final ☐ Deleted ☐ Other (specify) _____

**Remediation status** (choose all that apply): ☐ Under Construction ■ Operating ☐ Complete

**Multiple OUs?** ■ YES ☐ NO **Construction completion date:** N/A

Has site been put into reuse? ☐ YES ■ NO

## REVIEW STATUS

**Reviewing agency:** ■ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

**Author name:** Bob Fitzgerald

**Author title:** Remedial Project Manager **Author affiliation:** EPA Region IX

**Review period:** 08/09/2000 to 08/31/2001

**Date(s) of site inspection:** none conducted for this review

**Type of review:** ■ Statutory
☐ Policy (☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion)

**Review number:** ☐ 1 (first) ■ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

**Triggering action:**
☐ Actual RA Operation of Groundwater ☐ Actual RA Start at OU#_____
Remedial Systems ■ Previous 5-Year Review Report
☐ Construction Completion
☐ Other (specify) _____

**Triggering action date:** February 10, 1993

**Due date (5 years after triggering action date):** February 10, 1998

# 5-Year Review Summary Form

**Deficiencies:**

There is an identified need for more comprehensive remedial measures to ensure long-term effectiveness and permanence of the remedy in Zone 1. The State's Draft Supplemental Feasibility Study (FS) (Environ, 2000) has described the deficiencies, technical issues, and remedial action objectives (RAOs) associated with source containment, source control, and dewatering issues. Remedial measures to optimize dewatering and other source control in Zone 1 have been identified in the Draft Supplemental FS and will be included in the next site record of decision (ROD).

Recent studies in Zone 2 suggest that the existing extraction wells may not be optimally located for capture of contaminated groundwater in the deeper flow channels and weathered bedrock units. Data from recent investigations of subsurface conditions in Zone 2 indicate that a more detailed review of site conditions may be needed and that modification to the existing system may be warranted to accelerate contaminant capture in the zone.

Similarly, recent studies in Zone 3 suggest that the existing extraction wells may not be optimally located for capture of contaminated groundwater in the deeper flow channels and weathered bedrock units. Data from recent investigations of subsurface conditions in Zone 3 indicate that a more detailed review of site conditions may be needed and that modification to the existing system may be warranted to accelerate contaminant capture in the zone.

Institutional controls in Zone 4 are incomplete in preventing exposure to perchlorate contamination. Although the characterization of perchlorate contamination in groundwater has begun, the investigation is still ongoing. Identification and implementation of further remedial actions is pending completion of the perchlorate investigation.

**Recommendations and Follow-up Actions:**

The final version of the Draft Supplemental FS and EPA's proposed plan will be used to develop and select source containment, control, and dewatering remedial alternatives for Zone 1, which will be documented in the next site ROD, currently scheduled for completion by the end of September 2002.

It is anticipated that investigations and possible improvements to the existing groundwater extraction systems (i.e., additional monitoring or extraction wells) may be successful in accelerating the achievement of the remedial action objectives for the groundwater remedy in Zones 2 and 3. These improvements are currently being developed by the California Department of Toxic Substances Control (DTSC), as part of the current remedial operations.

Institutional controls in Zone 4 will be enhanced to ensure that no households are exposed to perchlorate contamination. The perchlorate investigation will be completed and appropriate remedies will be selected and implemented.

## Protectiveness Statement(s):

Zone 1 institutional and access controls are in place and effective in preventing exposure. With respect to source control, additional long-term remedial actions will be selected and implemented in this area of the site as part of the next ROD. The remedial actions in place in Zone 1 are meeting the RAOs. The remedy is protective of human health and the environment.

Zones 2 and 3 institutional and access controls are in place and are preventing exposure. The existing groundwater control/interception systems in these areas are being operated to their full extent. Although future investigations of the Zones 2 and 3 systems have been proposed in the Draft Supplemental FS, site monitoring and remediation data clearly indicate that these remedies are protective of human health and the environment

Regarding groundwater plume management in Zone 4, the implemented groundwater extraction system is operating and functioning as intended in the ROD. However, institutional controls in Zone 4 are incomplete in preventing exposure to perchlorate contamination. A protectiveness determination of the remedy at Zone 4 cannot be made at this time until further information is obtained. DTSC will provide sampling data from 15 Zone 4 households with private drinking water wells and data will be compared to the California Department of Health Services perchlorate drinking water action level of 18 parts per billion. DTSC will complete its investigation of Zone 4 households with private drinking water wells, sample well water from those households identified, and provide sampling data. It is expected that these actions will be completed by March 2002, at which time a protectiveness determination will be made.

# 1.0 Introduction

The United States Environmental Protection Agency (EPA) has conducted a 5-year review of the remedial actions implemented at the Stringfellow Hazardous Waste Site (also referred to as "Stringfellow site," "Stringfellow," or "site"), located in Riverside County, California, approximately 50 miles east of Los Angeles. CH2M HILL was contracted under EPA Region IX's Response Action Contract (RAC) to prepare this report, which documents the results of the 5-year review.

The purpose of the 5-year review process is to evaluate whether the remedial measures implemented at the site are protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in 5-year review reports. In addition, 5-year review reports identify deficiencies found during the review, if any, and provide recommendations for addressing them.

By statute, EPA must implement 5-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121(c), as amended, which states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The NCP part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Consequently, this 5-year review has been undertaken because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unrestricted use and unlimited exposure.

This is the second 5-year review for the Stringfellow site. EPA conducted an initial 5-year review in February 1993. No deficiencies were noted at that time. In the first 5-year review, EPA concluded that the existing pump and treat system successfully remediated the immediate threats posed by the site. The triggering action for this statutory review is the date of the first 5-year review, as shown in EPA's WasteLAN database: February 10, 1993.

## 2.0 Site Chronology

The Stringfellow site was listed by the EPA on the Interim Priorities List of Hazardous Waste Sites in October 1981. The site was subsequently proposed for the Superfund National Priorities List (NPL) on December 30, 1982, and was placed on the final NPL on September 8, 1983. State of California regulatory agencies, which have been involved with response and cleanup activities at this site, include the California Regional Water Quality Control Board (RWQCB) and the California Department of Health Services, Toxic Substances Control Division (now known as the California Environmental Protection Agency, Department of Toxic Substances Control [DTSC]). In 1981, DTSC became the lead state agency for Stringfellow-related cleanup and assumed responsibility for maintenance of Stringfellow through a Cooperative Agreement with the EPA.

The chronology of key events for the Stringfellow site is provided below.

**Table 1: Chronology of Site Events**

| Date | Event |
|---|---|
| February 1972 | Site contaminants first detected in groundwater downgradient of waste disposal area. |
| November 1972 | Waste disposal operations at Stringfellow site ceased. |
| 1975 | California RWQCB initiates response actions and studies. |
| 1978 | Controlled release of contaminated water to Pyrite Creek; discharge supervised by RWQCB. |
| 1980 | RWQCB removed 6.3 million (M) gallons of contaminated water and DDT-contaminated soil. |
| 1980 | EPA initial site inspection. 10M gallons of contaminated water removed; containment barriers and surface drainage improvements made. |
| December 1980 | RWQCB adopted Interim Abatement Program. |
| October 1981 | Stringfellow site placed on EPA Interim Priorities List of Hazardous Waste Sites. |
| 1981 | California Department of Health Services became lead agency for Stringfellow site investigation and cleanup. |
| July 22, 1983 | EPA issued first Record of Decision (ROD) (addressed Zones 1 through 4). |
| September 8, 1983 | Stringfellow site placed on EPA NPL. |
| 1983-1984 | “Fast-track” Remedial Investigation/Feasibility Study (RI/FS) conducted by EPA. |
| July 18, 1984 | EPA issued second ROD (addressed Zones 1 and 2). |
| September 18, 1984 | Start of remedial design for Zone 2 groundwater extraction system. |
| October 23, 1984 | Completion of remedial design for Zone 2 groundwater extraction system. |
| November 29, 1984 | Start of remedial action for Zone 2 groundwater extraction system. |
| November 15, 1985 | Completion of remedial action for Zone 2 groundwater extraction system. |

**Table 1: Chronology of Site Events**

| Date | Event |
|---|---|
| 1985 | Onsite Pretreatment Plant startup. |
| June 1987 | Draft RI Report released for public comment. |
| June 25, 1987 | EPA issued third ROD (addressed Zones 1 and 3). |
| September 30, 1987 | Start of remedial design for Zone 3 groundwater extraction system. |
| May 1988 | Potentially responsible parties (PRPs) agreed to construct certain of the third ROD remedial actions in an Administrative Order on Consent. |
| June 1988 | Draft Final FS Report issued. |
| June 1988 | EPA and DTSC issued Proposed Plan to address Zone 4 groundwater contamination. |
| August 31, 1988 | Completion of remedial design for Zone 3 groundwater extraction system. |
| February 1989 | EPA and DTSC issued second Proposed Plan (included long-term continuation of downgradient plume management activities for Zones 2 through 4, and for Zone 1, dewatering coupled with soil vapor extraction (SVE) and installation of an improved cap). |
| March 2, 1989 | Start of long-term response action for Zone 1. |
| March 2, 1989 | Start of remedial action for Zone 3 groundwater extraction system. |
| April 5, 1990 | Completion of remedial action for Zone 3 groundwater extraction system. |
| July 25, 1990 | Start of remedial design for Zone 4 groundwater extraction system. |
| September 30, 1990 | EPA issued fourth ROD (addressed Zones 1 through 4). |
| February 10, 1993 | EPA issued first 5-year review report. |
| September 23, 1993 | Start of remedial action for Zone 4 groundwater extraction system. |
| September 28, 1994 | Completion of remedial design for Zone 4 groundwater extraction system. |
| January 3, 1995 | Completion of remedial action for Zone 4 groundwater extraction system. |
| 1995 | Construction completed on Zone 1 dewatering system (fourth ROD). |
| 1998 | Construction completed on additional components to Zone 4 extraction system. |
| 1998 | DTSC performed additional Zone 4 investigation. |
| 1998-2000 | DTSC performed additional field investigations in Zones 1 through 3. |
| October 1999 | Groundwater extraction system in Zone 1 expanded. |
| April 2000 | DTSC issued Draft Supplemental FS Report for next remedy selection. |
| May 2001 | DTSC detected perchlorate at site and began perchlorate investigation. |

## 3.0 Background

The Stringfellow site is located in Pyrite Canyon, north of Highway 60, near the community of Glen Avon, in Riverside County, California (Figure 1). From 1956 until 1972, the 17-acre Stringfellow site was operated as a hazardous waste disposal facility. More than 34 million gallons of industrial waste, primarily from metal finishing, electroplating, and pesticide production were deposited in evaporation ponds. Spray evaporation procedures were used to decrease the volume of wastes in the ponds.

In 1969, excessive rainfall caused the disposal ponds to overflow and resulted in the contamination of Pyrite Creek and Channel. In 1978, heavy rains caused the California RWQCB to authorize a controlled release of 800,000 gallons of wastewater from the site to prevent further waste pond overflow and massive releases. An additional 500,000 gallons of liquid wastes were removed at the time to a federally approved facility. In 1979 and 1980, heavy rains again threatened releases from the waste ponds. Between the years 1975 and 1980, approximately 6.3 million gallons of liquid wastes and materials contaminated with pesticides were removed from the site.

The neighboring community, Glen Avon, has a population of approximately 14,000 people. A groundwater plume of site-related contaminants exists in the Glen Avon area which has prevented the use of private drinking water wells. However, since 1989, most of the community has received water from public utilities and no longer relies on local area groundwater for drinking water. DTSC detected perchlorate, a salt used in solid rocket fuels, in groundwater throughout the site and began an investigation in May 2001. DTSC has recently identified 15 households in an area of the site with perchlorate contamination which still rely on private drinking water wells. DTSC expects these households will be provided with bottled drinking water by the end of September 2001 and plans to connect them to water from a public utility in nine months. In addition, DTSC anticipates that perhaps another 10 households currently relying on private drinking water wells in areas of perchlorate contamination may be identified during its investigation.

Groundwater at the site contains various volatile organic compounds (VOCs), perchlorate, n-nitrosodimethylamine, and heavy metals such as cadmium, nickel, chromium, and manganese. Soil in the original disposal area is contaminated with pesticides, polychlorinated biphenyls (PCBs), sulfates, and heavy metals. The original disposal area is now covered by a clay cap, fenced, and guarded by security services.

The Stringfellow site has been addressed in five stages: initial actions and four long-term remedial phases. These efforts have focused on installation of an onsite pretreatment plant, control of the source of contamination, cleanup of the lower part of Pyrite Canyon, and cleanup of the community wells.

The Stringfellow site has been divided geographically into four zones as follows (see Figure 2):

- **Zone 1–Onsite/Upper Mid-Canyon Area.** This zone includes the original 17-acre disposal area in the northern uppermost part of Pyrite Canyon, extending approximately 600 feet southward of the clay barrier dam.

- **Zone 2–Mid-Canyon Area.** This zone is the middle reach of Pyrite Canyon extending approximately 800 feet south of Zone 1. The mid-canyon extraction wells are located along the southern, downgradient boundary of Zone 2.

- **Zone 3–Lower Canyon Area.** This zone is the lower reach of Pyrite Canyon extending approximately 2,400 feet south of Zone 2 to Highway 60. The lower canyon extraction wells are located along the southern, downgradient boundary of Zone 3.

- **Zone 4–Glen Avon Community.** This zone includes the area of Glen Avon south of Highway 60 and downstream of Pyrite Canyon, and extends to the current leading edge of the groundwater plume, approximately 22,000 feet southwest of the former Stringfellow site (located in Zone 1).

**Groundwater Contamination.** During operation of the Stringfellow site, liquid wastes were placed in unlined ponds located throughout the 17-acre disposal area. Some of the wastes migrated downward, entered the groundwater, mixed with clean groundwater, and moved various distances downgradient, depending upon the chemical and physical interactions with the geologic units. Figure 3 is a schematic cross-section showing subsurface conditions in the upper portion of Pyrite Canyon (Zone 1). Pyrite Canyon is underlain by (1) fill/alluvium, (2) weathered/decomposed granitic bedrock, and (3) unweathered, fractured granitic bedrock. All three underlying units are capable of storing and transmitting varying amounts of groundwater.

Groundwater contamination extends from Zone 1 into the community of Glen Avon in Zone 4 (see Figure 2). Groundwater beneath Zone 1 is contaminated with high concentrations of a large number of soluble organic and inorganic contaminants. Moving southward (down the canyon) to Zone 2, the groundwater is moderately to heavily contaminated with VOCs, heavy metals, and soluble inorganics. The Zone 3 groundwater is minimally to moderately contaminated with VOCs, primarily trichloroethylene (TCE) and chloroform, and soluble inorganics, principally perchlorate and sulfates. The leading edge of the contaminant plume in Zone 4, as defined by the presence of TCE in groundwater, is approximately 11,000 to 12,000 feet south-southwest (downgradient) of Zone 1 at the intersection of Agate Street and Jurupa Road in Glen Avon. The TCE plume width in the Glen Avon area is up to 900 feet. The leading edge of the contaminant plume in Zone 4, as currently defined by the known presence of perchlorate contamination in groundwater, is approximately 21,000 to 22,000 feet south-southwest (downgradient) of Zone 1 at the Santa Ana River. The perchlorate plume is currently under investigation by DTSC.

**Initial Actions.** From 1980 to 1984, three groundwater extraction wells, a subsurface clay barrier structure, and an onsite surface water drainage system with gunite channels were installed by the involved state agencies. All liquid wastes at the surface of the site were removed to a federally approved hazardous waste disposal facility. With the exception of 1,000 cubic yards of DDT-contaminated soil, which were taken to a federally approved facility, contaminated soils from the site were used to fill waste ponds. The surface was graded, covered with clean soil, and seeded. In 1984, the DTSC completed initial cleanup measures including fencing the site, maintaining the existing soil cap, controlling erosion, and disposing of the leachate extracted above and below the onsite clay barrier

dam. In 1989, residences that had been receiving bottled water from the DTSC were connected to the Jurupa Community Services District.

**Interim Remedial Actions.** To date, four RODs have been issued by the EPA for the Stringfellow site. The first ROD (July 22, 1983) directed completion of several initial abatement activities, including fencing, erosion control, interim source control, and offsite hauling and disposal of contaminated liquids. The second ROD (July 18, 1984) directed construction of an onsite pretreatment plant to treat contaminated groundwater, and included installation of an expanded extraction system in Zone 2. The third ROD (June 25, 1987) directed installation of a groundwater barrier system in the lower canyon area, and installation of peripheral surface channels to direct upgradient surface water runoff. The fourth ROD (September 30, 1990) directed dewatering of the original disposal area (Zone 1), installation of a groundwater extraction system in the community area, field testing of soil vapor extraction, and field testing of reinjection of treated groundwater in the upper canyon area.

# 4.0 Remedial Actions

The following sections summarize, for each zone, the remedial actions selected in the four site RODs, describe the implemented remedial actions, and summarize the operation and maintenance (O&M) activities of the existing remedial systems.

## 4.1 Zone 1 Remedial Actions

**Remedy Selection.** All four site RODs have selected remedial actions to address the hazards and risks posed by the original waste disposal area (Zone 1). These RODs focused primarily on remedial measures involving site fencing, erosion control and surface water management, and controlling the source of contaminants (by waste removal, capping/containment, groundwater barrier and extraction). The primary remedial action objectives (RAO) for Zone 1 were to (1) prevent direct and/or indirect contact with site-related contaminants in soils and surface water; (2) reduce the potential for the release and migration of site contaminants to groundwater; and (3) control, recover, and treat contaminated liquids in Zone 1 using diversion, dewatering, extraction, and onsite pretreatment systems.

**Remedy Implementation.** The components of the remedial actions installed and operating in Zone 1 are summarized in Table 2. The remedial measures selected in the first ROD were undertaken primarily by DTSC under a cooperative agreement with EPA. Improvements and expansion of erosion control systems were completed in accordance with the second and third RODs. The fourth ROD, issued in 1990, directed dewatering in Zone 1 to reduce the potential for further release of site contaminants and initiated an SVE pilot test to evaluate the feasibility of removing VOCs from the vadose zone in the source area. Subsequent to implementation of the remedial actions selected in the site RODs, DTSC has conducted extensive additional investigations and implemented supplemental remedial actions in Zone 1, which included installation of additional groundwater extraction wells. Figure 4 shows the expanded groundwater extraction system in Zone 1 as of October 1999 (Environ, 2000).

**System Operations.** The groundwater and surface-water management systems in Zone 1 are operated and maintained according to the Stringfellow project Operations, Health and Safety, and Contingency Plans. The Zone 1 hydraulic control and dewatering system consists of approximately 30 extraction wells (Figure 4) operating with timed on/off cycles to maintain prescribed pumping water

levels. A downgradient hydraulic control system, consisting of extraction wells, french drain, and horizontal well, is operating in the area of the subsurface clay barrier dam. All groundwater recovered from the Zone 1 extraction systems (designated "A-stream") is treated at the onsite mid-canyon pretreatment plant (described below).

**Table 2: Remedial Actions Implemented in Zone 1, Original Disposal Area**

| ROD | Remedial Action / Components |
|---|---|
| ROD 1, July 1983 | Sitewide Fencing<br>Erosion Control<br>• Maintenance of existing cap and surface drainage<br>Source Control<br>• Offsite disposal of leachate<br>• Neutralize acid soils; offsite disposal of DDT-contaminated soils<br>• Clay barrier dam<br>• Groundwater extraction and monitoring wells |
| ROD 2, July 1984 | Erosion Control<br>• Surface drainage improvement<br>Onsite Pretreatment System |
| ROD 3, June 1987 | Erosion Control<br>• Install peripheral drainage channel<br>• Extend existing drainage channels |
| ROD 4, September 1990 | Source Area Dewatering (completed in approximately 1995)<br>• Groundwater extraction well upgradient at barrier dam<br>• Treatment at onsite pretreatment plant<br>• Effluent discharge to Publicly Owned Treatment Works (POTW)<br>• Upgradient interceptor system<br>• Horizontal extraction well<br>• SVE Treatability Test<br>• Pilot test SVE removal of VOCs in unsaturated zone |
| Supplemental Measures 1997-1999 | Additional groundwater extraction and monitoring wells<br>• Hydraulic testing and geophysics |

## 4.2 Zone 2 Remedial Actions

**Remedy Selection.** The remedy selected for Zone 2 in the second ROD was construction of an onsite pretreatment plant (for all site-related contaminated water) and installation of a groundwater extraction and barrier system in Zone 2. The RAO for the groundwater remedial system was to prevent further downgradient migration of contaminated groundwater from Zone 2 to Zone 3. Because specific requirements for the groundwater remedy were not identified in ROD 2, pumping tests and evaluations were later conducted to complete the design of the extraction system.

**Remedy Implementation.** The components of the remedial actions installed and operating in Zone 2 are summarized in Table 3. The Stringfellow Pretreatment Plant (PTP) was constructed in the mid-canyon area of Pyrite Canyon by the PRPs and has been in operation since 1985. The PTP utilizes lime precipitation for metals removal, followed by granular activated carbon (GAC) for removal of

organic contaminants. The PTP treats all contaminated groundwater recovered from extraction systems operating in Zones 1, 2, and 3. Prior to 1998, the treated effluent from the PTP was transported by truck to a pipeline collection point then conveyed to the local POTW, the Santa Ana Regional Interceptor (SARI) industrial wastewater treatment plant. In October 1998, a new PTP effluent pipeline to the POTW was completed. A feasibility study for reinjection of treated groundwater from the PTP was evaluated in accordance with ROD 4.

**Table 3: Remedial Actions Implemented in Zone 2, Mid-Canyon Area**

| ROD | Remedial Action / Components |
|---|---|
| ROD 2, July 1984 | Onsite Pretreatment System<br>• Mid-Canyon pretreatment plant<br>• Extracted groundwater (Zones 1 and 2) treatment<br>• Effluent discharge to POTW<br>• Pretreatment system O&M<br>Midcanyon Interceptor Well System<br>• Seven groundwater extraction wells and 19 monitoring wells |
| ROD 4, September 1990 | Evaluate Feasibility of Reinjection<br>• Field studies of reinjection of treated groundwater into Zones 2 and 3 |

The Zone 2 groundwater extraction system was completed in 1985 and consists of a total of seven extraction wells located near the southern downgradient boundary of Zone 2.

**System Operations.** The groundwater management system in Zone 2 is operated and maintained according to the Stringfellow project Operations, Health and Safety, and Contingency Plans. Treatment processes at the PTP include pH control and metals removal, followed by a GAC adsorption system for VOC removal. Since 1985, the PTP has treated groundwater extracted from the Zone 1 extraction system, and since 1989, has also treated groundwater extracted from the Zone 2 and Zone 3 extraction systems. During 1999-2000, the volume treated from these sources has ranged from 1.8 to 5.0 million gallons per month, depending on the season and the number of wells in operation. All treated wastewater from the PTP is discharged to the Fountain Valley Treatment Plant (a SARI industrial treatment facility), which is operated by the County Sanitation Districts of Orange County (CSDOC). The maximum permitted discharge limit for the PTP is 130 gpm based on the plant operating 24 hours per day, 7 days per week. Currently, the PTP is usually operated 8 hours per day, 5 days per week (Environ, 2000). Additional operating time is occasionally required due to precipitation and seasonal variations in flow. Solid residues from the metals removal treatment are transported by truck to a federally-approved hazardous waste disposal facility. A DTSC contractor (Earth Tech Corporation) currently operates the PTP and related treatment and disposal activities.

Pumping rates from the Zone 2 groundwater interceptor system (composed of seven extraction wells) range from 19 to 48 gallons per minute (gpm), depending on the season. Extracted groundwater is sent to the onsite Pretreatment Plant for GAC treatment and then is discharged to the SARI pipeline. If CSDOC or other regulatory agencies set new standards for perchlorate or n-nitrosodimethylamine in the PTP effluent, additional treatment may be required.

## 4.3 Zone 3 Remedial Actions

**Remedy Selection.** The third ROD, issued in June 1987, established the following RAOs for Zone 3: "(1) remove contaminated groundwater, and (2) stop additional contaminated groundwater from moving south into the community of Glen Avon." The remedy selected for Zone 3 specified the installation of a groundwater interception system in the Lower Canyon area and treatment of extracted groundwater, followed by discharge to a POTW.

**Remedy Implementation.** The PRPs designed and installed the Zone 3 extraction system in 1988-1989 to intercept and remove groundwater contaminated with VOCs. Five groundwater extraction wells, located near the downgradient boundary of Zone 3, have been operational since 1989. The components of the implemented groundwater remedial action in Zone 3 are summarized in Table 4.

**Table 4: Remedial Actions Implemented in Zone 3, Lower Canyon Area**

| ROD | Remedial Action / Components |
|---|---|
| ROD 3, June 1987 | Lower Canyon Interceptor Well System<br>• Five groundwater extraction wells and 57 monitoring wells<br>• Treatment at Lower Canyon Treatment System or PTP<br>• Effluent discharge to POTW |

**System Operations.** The groundwater management system in Zone 3 is operated and maintained according to the Stringfellow project Operations, Health and Safety, and Contingency Plans. The Zone 3 groundwater extraction system has been operated continuously since 1989, pumping at a combined rate of 10 to 24 gpm, depending on the season. Extracted groundwater is currently sent to the PTP for GAC treatment and then is discharged to the SARI pipeline.

## 4.4 Zone 4 Remedial Actions

**Remedy Selection.** The remedy selected for Zone 4 in the fourth ROD (issued September 1990) was the installation of the Community Extraction System for pumping and treatment of site-related groundwater contamination in the Glen Avon area. The overall objectives of the Zone 4 groundwater remedy were to prevent further migration of contaminated groundwater and restore groundwater to applicable or relevant and appropriate requirements (ARAR) or background. If background levels exceeded ARARs, the ARARs levels were used in the selection of a remediation goal. Restoration of groundwater quality in the area is intended to allow the unrestricted use of groundwater in this Zone, consistent with the RWQCB's Water Quality Control Plan for the Santa Ana River Basin, which designates the groundwater downgradient of the Stringfellow site as suitable for municipal supply.

ROD 4 identified the following contaminants that exceed Maximum Contaminant Level (MCLs) or ARARs in groundwater in Zone 4: TCE, chloroform, nitrate, and sulfate. The remediation goals established in ROD 4 were the groundwater MCL of 5 micrograms per liter (µg/L) for TCE and the health-based level of 6 µg/L for chloroform. ROD 4 discussed nitrates and sulfates in groundwater, but selection of final remediation goals for these inorganic contaminants in Zone 4 was deferred. The

presence of perchlorate at the site was unknown at the time of ROD 4 and, therefore, no perchlorate remediation goals were set.

**Remedy Implementation.** The components of the remedial actions installed and operating in Zone 4 are summarized in Table 5. ROD 4 directed installation of two extraction wells in the community area as the initial groundwater response action. The two extraction wells, designated as the north and south wells, were installed by the PRPs and have continued to operate for plume control in Zone 4 since 1992. Subsequently, two additional extraction wells, referred to as "tree farm wells," were installed at the downgradient limit of the groundwater plume in 1998 by the PRPs.

**Table 5: Remedial Actions Implemented in Zone 4, Glen Avon Community**

| ROD | Remedial Action / Components |
|---|---|
| ROD 4, September 1990 | Community Groundwater Pump and Treat<br>• Four groundwater extraction wells and 85 monitoring wells<br>• Groundwater treatment at Lower Canyon Treatment System<br>• Effluent discharge to POTW and/or irrigation reuse<br>Surface Water Management<br>• Discharge under NPDES permit and/or reuse |

**System Operations.** The groundwater management system in Zone 4 is operated and maintained according to the Stringfellow project Operations, Health and Safety, and Contingency Plans. The Zone 4 community extraction system was operated by contractors for the PRP group (Papadopulos & Associates, 1999a and 1999b) until May 2000. It is now being operated by DTSC. The groundwater extracted from the north and south wells is sent to the Lower Canyon Treatment System for GAC treatment and then is discharged to the SARI pipeline. Groundwater pumped from the two down-gradient extraction wells (tree farm wells) is treated by activated carbon and then reused for local irrigation. The effectiveness of the remedial action is evaluated by water level and groundwater sampling of the extraction and monitoring wells in the remediation area. Based on recent groundwater monitoring data, the Zone 4 extraction system is performing to meet the goals of ROD 4. The plume of TCE-contaminated groundwater is being remediated, and the treatment actions are meeting the remediation objectives (Papadopulos & Associates, 1999a and 1999b: Environ, 2000). However, additional remedial actions will likely be necessary to address the perchlorate contamination currently under investigation by DTSC.

## 5.0 5-Year Review Process

The Stringfellow site 5-year review was led by Bob Fitzgerald, EPA's Remedial Project Manager for the Stringfellow site, and Christina Hong, CH2M HILL's Project Manager for the RAC IX Multi-Site support contract. EPA's Work Assignment Manager (WAM) for this project is Tom Kremer. Technical review and input for this 5-year review was provided by Peter Lawson of CH2M HILL.

This 5-year review of the Stringfellow site involved the following activities:

- Review of relevant documents (see Attachment 1), including routine operations, monitoring, and remedial performance evaluations; and
- Review of federal and state ARARs cited in the RODs for this site.

This 5-year review report will be placed in the Stringfellow site information repositories, and a fact sheet will be prepared to inform the public of the results of this 5-year review.

## 6.0 5-Year Review Findings

The following section discusses the findings from this 5-year review. The focus of this review was the relevant documents, reports, and memoranda issued in the past 2 years, which describe current status, O&M, and performance evaluations of remedial actions implemented at the site. Additionally, a review of federal and state ARARs cited in the site RODs was conducted to determine if there have been changes or new ARARs since issuance of the RODs.

### 6.1 Interviews

Because this is a site that has an ongoing agency presence, no interviews of individuals involved with site O&M were conducted. All site systems and facilities in Zones 1 through 4 are operated by DTSC contractors with oversight by DTSC and EPA (through the U.S. Army Corps of Engineers [COE] personnel). EPA is updating its Stringfellow Community Relations Plan and has conducted and will offer interviews to the community and other stakeholders as part of this process.

### 6.2 Site Inspections

Because this is a site that has an ongoing agency presence, no additional inspections of site facilities and remedial systems were conducted. All site systems and facilities in Zones 1 through 4 are operated by DTSC contractors with oversight by DTSC and EPA (through COE personnel). Inspection logs prepared by the COE oversight engineer and dating back to March 1998 were reviewed during the 5-year review. Items of significance that were identified in the COE Daily Oversight Reports are as follows:

- Onsite maintenance has generally been considered adequate to good, with the exception of a period during early 2000. In February, a build up of trash, silt, and weeds was noted in several trash racks in stream channels. By March 2000, however, the maintenance items had been addressed.
- In early 2000, DDE, DDD, and DDT were detected in the sludge at levels too high to allow for land disposal. By the February inspection, the sludge was being sent to Aconite near Salt Lake City, Utah, for disposal, and the A-stream wells (Zone 1), which were presumed to have contained the contaminants, were shut down, reducing flow to the pre-treatment plant. By the March 2000 oversight inspection, the eight wells identified as producing the DDE, DDD, and DDT had been turned off. To date, these particular A-stream wells have remained shut down. Due to low water levels and pumping from other Zone 1 wells, there has been no adverse

impact to the containment remedial action from turning off these wells. In addition, DTSC is preparing a land disposal restriction variance application for EPA, which would allow the wells to be pumped again.

- From February through May 2000, the COE inspector observed groundwater seeping into the west channel at the north end, near the french drain. The oversight inspector believed it to be clean groundwater.

- By June 1999, total daily groundwater extraction from A, B, C, and F streams (which went online in the fall of 1999) had fallen below 100,000 gallons per day (gpd) and the system has not yet regained that output. Reasons for the lower volumes include construction in Zone 1 during the summer of 1999, which impacted the A stream; inability to operate some A-stream wells that may have contained DDE, DDD, and DDT; and inability to operate an F-stream well that has remained out of service. Typical daily production from the four combined streams since that time has ranged from approximately 43,000 to 69,000 gpd. There has been no adverse impact to containment remedial actions at the site from these lower extraction volumes.

### 6.3 Document Review

Attachment 1 provides a listing of the documents and reports which were reviewed and serves as the reference list for documents cited in this report. The documents reviewed include the four RODs issued for the Stringfellow site, DTSC's recent Draft Supplemental FS Report (April 2000), monthly progress reports during the past 2 years of O&M activities of the onsite pretreatment plant, and semiannual groundwater monitoring reports. Additionally, recent remedy performance evaluations on groundwater extraction systems in Zone 2 (CH2M HILL, 2000a), Zone 3 (CH2M HILL, 2000b), and Zone 4 (Papadopulos & Associates, 1999a and 1999b) were reviewed. Data from the DTSC perchlorate investigation were also reviewed.

Progress reports providing data and discussion of Pretreatment Plant O&M have been prepared monthly by DTSC's contractors and submitted to EPA. For this 5-year review, progress reports from the reporting periods of January 1999 through July 2000 were reviewed.

The progress reports describe unit equipment status, unscheduled maintenance and downtimes that occurred, and planned preventive maintenance activities. Typically, discussions of O&M activities were brief but clear, with discussion of corrective actions provided. The reports provide data on operations, including flow rates, on-hand chemical inventories, analytical results and mass discharge calculations from monitoring of effluent, hydrographs, and other well data. In addition, the reports confirmed compliance with discharge permit requirements. The progress reports on O&M of the Pretreatment Plant during 1999 (DTSC, 1999) addressed all key topics, except for discussion of plant security and worker health and safety. Security documentation logs apparently were submitted separately. The format for the monthly operations reports changed in March 2000 with the transition to a new PTP operations contractor (DTSC, 2000b). Again, the documentation and data provided were thorough and clear; however, the format still fails to mention plant security or worker safety issues.

Semiannual reports on groundwater monitoring activities were reviewed for fall 1998 through spring 2000. The reports, prepared by a DTSC contractor (Tetra Tech, 1999a, 1999b, 1999c,

2000), are detailed data reports which summarize the monitoring activities for reporting period, present the field and laboratory results, and provide discussion and evaluation of the monitoring results and data trends.

## 6.4 ARARs Review

This section provides a review of the federal and state ARARs and other criteria used to assess the implemented remedial actions at the Stringfellow site. The ARARs presented in the four RODs were reviewed for any changes, additions, or deletions.

### ROD 1, July 22, 1983

No ARARs were identified in this ROD. This ROD consisted of institutional and access controls for which there are no ARARs and documentation of removal actions, which complied with ARARs identified as part of the removal actions to the extent practicable. Removal of DDT-contaminated soils and leachate treatment/ disposal had ARARs identified. Because these activities are complete, no ARARs are identified here. Zone 1 ARARs will be fully identified and analyzed in the next site ROD.

### ROD 2, July 18, 1984

Action-specific ARARs relevant to this ROD are presented in Table 6. The Clean Water Act (CWA) and Clean Air Act (CAA) were identified as ARARs in the ROD. However, the CAA does not appear to be an ARAR based on the selected alternative. Resource Conservation and Recovery Act (RCRA) should be an ARAR because the sludge generated is either a solid waste or a hazardous waste. RCRA will be evaluated as an ARAR in the Final Supplemental FS and in the subsequent ROD. The generated sludge is being managed in a manner that complies with waste management regulations, and is transported under manifest to a permitted facility for disposal. No location-specific or chemical-specific ARARs were identified.

Site operations data indicated that requirements under CWA and RCRA were met for this 5-year review period.

### ROD 3, June 25, 1987

Action-specific ARARs relevant to this ROD are presented in Table 7. CWA, CAA, and RCRA were identified in the ROD. Under the CWA, pretreatment requirements must be met for discharge to the SARI sewer line. However, the CAA requirements are not applicable to the recommended alternatives. RCRA is applicable to the recommended alternatives since the sludge generated is either a solid waste or a hazardous waste. No location-specific or chemical-specific ARARs were identified.

## Table 6: Action-Specific ARARs for ROD 2
## Stringfellow Hazardous Waste Site; Glen Avon, California

| Action-Specific ARARs | | | | |
|---|---|---|---|---|
| **ROD Requirement** | **5-Year Review Requirement** | **Citation** | **ARAR Determination** | **Comments** |
| **Clean Water Act** | | | | |
| No specific sections; however, proposed pretreatment objectives were listed | National Pretreatment Standards for Discharges to Publicly Owned Treatment Works | 40 CFR 403 | Applicable | Substantive requirements of the Federal Clean Water Pretreatment Standards (40 CFR Part 403) are ARARs for discharges of treated groundwater to POTWs. Requirements are administered through discharge permits issued by the Santa Ana Watershed Project Authority. |
| **Clean Air Act** | | | | |
| No specific sections | None identified | | | |
| Resource Conservation and Recovery Act | | | | |
| None | Identification and Listing of Hazardous Wastes | 40 CFR Part 261 | Applicable | Applicable to the classification of remediation wastes for onsite/offsite disposal |
| | Land Disposal Restrictions | 40 CFR Part 268 | Applicable | Potentially applicable to the treatment/ disposal of remediation wastes that are hazardous |

## Table 7: Action-Specific ARARs for ROD 3
## Stringfellow Hazardous Waste Site, Glen Avon, California

| Action-Specific ARAR | | | | |
|---|---|---|---|---|
| **ROD Requirement** | **5-Year Review Requirement** | **Citation** | **ARAR Determination** | **Comments** |
| **Clean Water Act** | | | | |
| No specific sections; however, proposed pretreatment objectives were listed | National Pretreatment Standards for Discharges to Publicly Owned Treatment Works | 40 CFR 403 | Applicable | Substantive requirements of the Federal Clean Water Pretreatment Standards (40 CFR Part 403) are ARARs for discharges of treated groundwater to POTWs. Requirements are administered through discharge permits issued by the Santa Ana Watershed Project Authority. |
| **Clean Air Act** | | | | |
| No specific sections | None identified | | | |
| **Resource Conserva-tion and Recovery Act** | | | | |
| None | Identification and Listing of Hazardous Wastes | 40 CFR Part 261 | Applicable | Applicable to the classification of remedia-tion wastes for onsite/offsite disposal |
| | Land Disposal Restrictions | 40 CFR Part 268 | Applicable | Potentially applicable to the treatment/ disposal of remediation wastes that are hazardous |

Site operations data indicated that requirements under CWA and RCRA were met for this 5-year review period.

**ROD 4, September 30, 1990**

**Zone 1 (Original Disposal Area).** Action-specific ARARs for Zone 1 remedial actions are presented in Table 8. The CWA, CAA, and RCRA were identified in the ROD. Under the CWA, pretreatment requirements must be met for discharge to the SARI sewer line. The ROD calls for a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of water to the SARI sewer line. This discharge requires a pretreatment permit, not an NPDES permit. Under RCRA, the Land Disposal Restrictions, including treatment standards for the third scheduled wastes, are applicable, because the sludge generated at the pretreatment plant may be considered hazardous. No location-specific or chemical-specific ARARs were identified.

**Zone 4 (Glen Avon Community).** Action-specific ARARs for Zone 4 remedial actions are presented in Table 8. Action-specific ARARs identified in the ROD were the CWA and CAA. The ROD calls for an NPDES permit. In addition, under the CAA, the South Coast Air Quality Management District's Regulation XIII is applicable. Chemical-specific ARARs identified in the ROD include the Safe Drinking Water Act (SDWA). Under the SDWA, MCLs must be met. For the action of reinjection, the Underground Injection Control program requires that the SDWA and the State of California MCLs be met. Guidelines included in the ROD stated that ARARs need to be considered for the primary chemicals of concern for Zone 4, namely, TCE, chloroform, sulfate, and nitrate. The 5 µg/L state and federal MCL for TCE has not changed as the ARAR since issuance of ROD 4. Similarly, the federal ambient water quality health-based standard of 6 µg/L for chloroform is unchanged from the remediation goal used in the ROD. Secondary MCLs have been added to the ARARs as part of the "To Be Considered" (TBC) criteria. No location-specific ARARs were identified.

Site operations data indicated that requirements under the CWA, SDWA, CAA, and RCRA were met for this 5-year review period. Recently, DTSC determined that the filter cake from the PTP should be assigned a different RCRA waste code. DTSC also determined that filter cakes exceeding the Universal Treatment Standards (UTS) must be incinerated. As a result, some filter cakes were sent offsite for incineration (April 2000).

## 7.0 Assessment

This section assesses the performance and effectiveness of the implemented remedial actions at the Stringfellow site in satisfying ROD requirements and protecting human health and the environment. This assessment is based on the evaluation of site data presented and evaluated in the following documents: the Draft Supplemental Feasibility Study (Environ, 2000, with supplemental information provided by Environ in January 2001), Zone 2 and Zone 3 groundwater extraction system effectiveness evaluations (CH2M HILL, 2000a and 2000b), monthly progress reports during the past 2 years of O&M activities of the onsite pretreatment plant and semi-annual groundwater monitoring reports, the Zone 4 Community Extraction System operations evaluation reports (Papadopulos & Associates, 1999a and 1999b), and perchlorate investigation data.

## Table 8: Action-Specific and Chemical-Specific ARARs for ROD 4 Stringfellow Hazardous Waste Site, Glen Avon, California

| Action-Specific ARARs | | | |
|---|---|---|---|
| **ROD Requirement** | **Citation** | **ARAR Determination** | **Comments** |
| Clean Water Act | | | |
| National Pretreatment Standards for Discharges to Publicly Owned Treatment Works | 40 CFR 403 | Applicable | Substantive requirements of the Federal Clean Water Pretreatment Standards (40 CFR Part 403) are ARARs for discharges of treated groundwater to POTWs. Requirements are administered through discharge permits issued by the Santa Ana Watershed Project Authority. |
| Resource Conservation and Recovery Act as amended by the 1984 Hazardous and Solid Waste Amendments | | | |
| Land Disposal Restrictions | 42 USC Section 6924(m); 40 CFR part 268 (55 Federal Regulations 22520-720 [June 1, 1990]) | Applicable | May be applicable to the disposal of the treatment sludge from the pre-treatment plant. |
| Identification and listing of hazardous wastes | 40 CFR part 261 | Applicable | Applicable to the classification of remediation wastes for onsite/offsite disposal |
| **Chemical-Specific ARARs** | | | |
| Safe Drinking Water Act | | | |
| Maximum Contaminant Levels | 40 CFR 141, Subparts B, G & I | Relevant and appropriate | The concentration of contaminants in public drinking water supply systems must not exceed national primary drinking water MCLs. Because MCLs are applied at the tap, they are not applicable; however, they are considered to be relevant and appropriate for groundwater zones that are potential sources of drinking water supply. |

## Table 8: Action-Specific and Chemical-Specific ARARs for ROD 4 Stringfellow Hazardous Waste Site, Glen Avon, California

| Action-Specific ARARs | | | |
|---|---|---|---|
| **ROD Requirement** | **Citation** | **ARAR Determination** | **Comments** |
| Maximum Contaminant Level Goals | 40 CFR 141, Subpart F | Relevant and appropriate | Non-zero Maximum Contaminant Level Goals (MCLG) are non-enforceable, maximum levels of contaminants in drinking water at which no known or anticipated adverse effect would occur. Non-zero MCLGs may be relevant and appropriate for groundwater determined to be a current or potential source of drinking water and where multiple contaminants or pathways of exposure exist. |
| **Action-Specific ARARs** | | | |
| ROD Requirement | Citation | ARAR Determination | Comments |
| **Safe Drinking Water Act** | | | |
| Secondary Drinking Water Regulations | 40 CFR Part 143 | To be considered | These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. The regulations are not federally enforceable but are intended as guidelines for the states. |
| Underground Injection Control | 40 CFR 144 | Potentially applicable | Regulations governing underground injection are applicable if treated groundwater is reinjected. The Federal Safe Drinking Water Act requires an Underground Injection Control (UIC) permit which, in California, is administered by the EPA for wells not related to oil and gas activities. The UIC regulations allow injection of groundwater that has been treated and is being reinjected into the same formation from which it was withdrawn, subject to EPA approval of the reinjection as a CERCLA remedial action (40 CFR 144.12[c]). |
| **California Porter Cologne Water Quality Control Act** | | | |
| Water Quality Protection Standard | 23CCR § 2550.2 through 2550.5 | Applicable or relevant and appropriate | The RWQCB establishes a water quality protection standard for waste management units, specifying the constituents of concern and the concentration limits for each constituent. The concentration limits are set at background unless it is technically or economically infeasible to achieve background for that constituent. |

## Table 8: Action-Specific and Chemical-Specific ARARs for ROD 4 Stringfellow Hazardous Waste Site, Glen Avon, California

| Action-Specific ARARs | | | |
|---|---|---|---|
| **ROD Requirement** | **Citation** | **ARAR Determination** | **Comments** |
| **Clean Air Act** | | | |
| South Coast Air Quality Management District (SCAQMD) Regulation XIII | Section 110; 42 USC Section 7410 | Potentially applicable | Emissions of VOCs from new sources. |
| SCAQMD's Rule 1167 | No specific sections | To be considered | All air stripping facilities treating contaminated groundwater that emit more than one pound per day of total VOC emissions must install controls capable of reducing air emissions by 90 percent. |

## 7.1 Zone 1 Remedial Actions

***Question A: Is the remedy functioning as intended by the decision documents?***

Administrative measures, including project Health and Safety Plan, Contingency Plan, and institutional controls, are in place, properly implemented, and sufficient to restrict access and control risks in Zone 1.

The existing cover system in Zone 1 has been effective in isolating waste and contaminants and preventing direct exposure to site-related contaminants. As described in the Draft Supplemental FS Report, more comprehensive remedial measures will be implemented for the final cover system in the original disposal area to ensure long-term effectiveness and permanence.

The existing groundwater extraction system in Zone 1, including improvements and expansion completed in 1999, is operating as intended in ROD 4. However, the performance and maintenance of optimum dewatering in the source area has not been fully successful with the current extraction system. As proposed in the Draft Supplemental Feasibility Study, upgradient control remedial measures will be implemented for further dewatering in Zone 1 to mitigate future releases from the source area to groundwater.

***Question B: Are the assumptions used at the time of remedy selection still valid?***

Based on the results of ongoing site characterization and treatability studies, the assumptions on hydrogeology, groundwater flow/recharge, and source area conditions in Zone 1 were not well understood and are considered more complex than assumed when the interim remedial actions for Zone 1 were selected in ROD 4. The Draft Supplemental FS has provided in-depth review and evaluation of the physical and contaminant conditions in the original disposal area that will be used to refine the technical basis for selecting the next remedial action in Zone 1.

***Question C: Has any other information come to light that could call into question the protectiveness of the remedy?***

No additional information has been identified that would call into question the protectiveness of the existing remedial actions in Zone 1. However, the current state of knowledge on source conditions and performance of the dewatering system indicates the need for more comprehensive remedial measures to ensure long-term effectiveness and permanence of the next remedy.

## 7.2 Zone 2 Remedial Actions

***Question A: Is the remedy functioning as intended by the decision documents?***

Located in Zone 2, the onsite PTP, including recent facility upgrades, is functioning as intended and is effective in the treatment and containment of contaminated water. However, construction of a new treatment plant or expansion of the existing PTP will be needed to handle increased flows associated with the next remedy implementation. Furthermore, additional treatment may be needed if perchlorate or n-nitrosodimethylamine standards are set for the PTP effluent.

The Mid-Canyon groundwater extraction system has been effective in the interception and reduction of contaminant migration in the upper groundwater flow system (fill and alluvium). Although recent studies and evaluations indicate that some of the existing extraction wells may not be optimally located to intercept contaminated groundwater in the deeper flow channels and weathered bedrock units, the effectiveness of the Zone 2 extraction system is demonstrated by the decline of contaminant concentrations downgradient of it (Environ, 2000). Figures 5 and 6 illustrate a significant decline in TCE contamination in the affected zone, and Figures 7 and 8 illustrate a similar decline in Zone 2 sulfate contamination. Furthermore, during recent years, the Zone 2 extraction system has extracted groundwater at higher rates than the average flow rate down the canyon of 40 gpm, as estimated in ROD 2 (Environ, 2000). In summary, the Zone 2 groundwater extraction system is functioning as intended by the decision document, and progress is being made in achieving the ROD 2 objectives and RAOs.

***Question B: Are the assumptions used at the time of remedy selection still valid?***

Overall, the remedial design assumptions for the PTP and Mid-Canyon groundwater extraction system developed during ROD 2 remain valid. However, the improved understanding of groundwater flow conditions in Zone 2 may necessitate augmenting the existing extraction system to improve contaminant capture and achievement of the RAOs for the groundwater remedy in Zone 2. If PTP effluent requirements are revised, perchlorate treatment may also be necessary.

***Question C: Has any other information come to light that could call into question the protectiveness of the remedy?***

The data from recent investigations of subsurface conditions in Zone 2 (geophysical survey, soil gas, groundwater modeling) indicate that a more detailed review of site conditions may be needed and that modifications to the existing system may be warranted to accelerate compliance with the RAOs. In particular, verification of the characteristics of old erosional surfaces and deeply weathered bedrock should be conducted to determine the need for and the optimal placement of additional monitoring or extraction wells.

### 7.3 Zone 3 Remedial Actions

***Question A: Is the remedy functioning as intended by the decision documents?***

Water quality monitoring upgradient and downgradient of the Zone 3 extraction system shows measurable reduction of VOCs in groundwater within the upper alluvial saturated interval underlying Zone 3. Data from 35 groundwater wells which have been monitored since before the extraction system began operations indicate that VOC concentrations have significantly declined in 19 wells. An additional 13 wells indicated a moderate, although sometimes mixed, decline in VOC concentrations (Environ, 2000). Furthermore, maximum detected contaminant concentrations have also been reduced. The decrease in TCE concentrations in the downgradient Zone 4 groundwater monitoring wells is shown in Figures 9 and 10, and the decrease in sulfate concentrations in this zone is shown in Figures 11 and 12. (Please note that the outer boundary contour line in Figure 9 represents a 5-µg/L detection of TCE, and the outer boundary contour line in Figure 10 represents a 1-µg/L detection of TCE. Please be aware that the MCL for TCE is 5 µg/L and that this additional outer boundary contour line in

Figure 10 may give the false appearance of an increase in the overall size of the contaminated groundwater plume.) These Zone 4 contour maps illustrate the effectiveness of the Zone 3 containment system.

In summary, the existing groundwater extraction system has shown an ability to reduce contaminants in the groundwater. Progress is being made toward achieving the ROD 3 objectives and RAOs, as shown by the reduction in contaminant concentrations. Although recent studies and evaluations indicate that some of the existing extraction wells may not be optimally located to intercept contaminated groundwater in the deeper flow channels and weathered bedrock units, the effectiveness of the Zone 3 extraction system is demonstrated by the decline of contaminant concentrations downgradient of it (Environ, 2000).

***Question B: Are the assumptions used at the time of remedy selection still valid?***

The assumptions used to select the groundwater remedial action in Zone 3 are basically still valid. However, the site information available at the time the ROD 3 groundwater remedy was selected and designed (1987-1988) may not be sufficient to identify the optimum layout for the Zone 3 extraction system.

***Question C: Has any other information come to light that could call into question the protectiveness of the remedy?***

The data from recent investigations of subsurface conditions in Zone 3 (geophysical survey, soil gas, groundwater modeling) indicate that a more detailed review of site conditions may be needed and that modifications to the existing system may be warranted to accelerate compliance with the RAOs. In particular, verification of the characteristics of old erosional surfaces and deeply weathered bedrock should be conducted to determine the need for and the optimal placement of additional monitoring or extraction wells.

### 7.4 Zone 4 Remedial Actions

***Question A: Is the remedy functioning as intended by the decision documents?***

The Zone 4 groundwater extraction system has been effective in preventing further TCE and sulfate migration and in remediating this site-related groundwater contamination in the Glen Avon community. The Zone 4 remedy is functioning as intended by the decision documents, and is meeting the RAOs defined in ROD 4.

***Question B: Are the assumptions used at the time of remedy selection still valid?***

The assumptions initially used to select the groundwater remedial action in Zone 4 are only partly valid. The rate of decrease of TCE and sulfate contaminant levels in the groundwater plume in the community is consistent with expectations for the groundwater remedy established in ROD 4 (see Figures 9 through 12). The presence and extent of perchlorate contamination in Zone 4 groundwater was unknown at the time of remedy selection and is currently under investigation by DTSC.

***Question C: Has any other information come to light that could call into question the protectiveness of the remedy?***

DTSC detected perchlorate, a salt used in solid rocket fuels, in groundwater throughout the site and began an investigation in May 2001. DTSC has recently identified 15 households in the Zone 4 area which still rely on private drinking water wells contaminated with perchlorate. DTSC expects these households will be provided with bottled drinking water by the end of September 2001 and plans to connect them to water from a public utility in nine months. In addition, DTSC anticipates that perhaps another 10 households currently relying on private drinking water wells in areas of perchlorate contamination may be identified during its investigation.

### 7.5 Deficiencies in Existing Remedial Actions

Based on the assessment of the performance and effectiveness of the existing remedial measures described in this review, the following deficiencies have been identified:

**Zone 1.** There is an identified need for more comprehensive remedial measures to ensure long-term effectiveness and permanence of the remedy in this zone. The Draft Supplemental Feasibility Study (Environ, 2000) has described the deficiencies, technical issues, and RAOs associated with source containment, source control, and dewatering issues. Remedial measures to optimize dewatering and other source control in Zone 1 have been identified in the Draft Supplemental Feasibility Study and will be included in the next site ROD.

**Zone 2.** The existing groundwater extraction system in Zone 2 may not fully intercept and capture site-related contaminants in deeper groundwater in this area of the site.

**Zone 3.** The existing groundwater extraction system in Zone 3 may not fully intercept and capture site-related contaminants in deeper groundwater in this area of the site.

**Zone 4.** The existing groundwater extraction and treatment system in Zone 4 is functioning adequately to meet the RAOs of ROD 4. However, institutional controls in Zone 4 are incomplete in preventing exposure to perchlorate contamination. Although the characterization of perchlorate contamination in groundwater has begun, the investigation is still ongoing. Identification and implementation of further remedial actions is pending completion of the perchlorate investigation.

## 8.0 Recommendations and Follow-up Actions

The recommendations and follow-up actions necessary to address the performance issues and deficiencies noted in Section 7.5 are presented below and summarized in Table 9.

**Zone 1.** The final version of the Draft Supplemental Feasibility Study (Environ, 2000) will be used to support the development and selection of source containment, control, and dewatering remedial alternatives for Zone 1, which will be documented in the next site ROD. DTSC is finalizing the Draft Supplemental FS, and EPA will issue the next site ROD.

**Zone 2.** It is anticipated that modifications and improvements to the existing extraction system, including installation of additional groundwater monitoring or extraction wells, may be successful in

accelerating the achievement of the RAOs for the groundwater remedy in Zone 2. Implementation of these recommendations will be pursued as part of the current remedial operations.

**Table 9: Recommendations and Required Actions**

| Recommendations and Required Actions | Responsible Party | Oversight Agency | Milestone Date | Does Action Affect Protectiveness? |
|---|---|---|---|---|
| Zone 1 | | | | |
| Finalize Supplemental Feasibility Study | DTSC | EPA | December 2001 | No |
| Issue Next Site ROD | EPA | EPA | September 2002 | No |
| Perform Next ROD Remedial Actions | DTSC | EPA | TBD | No |
| Zone 2 | | | | |
| Install borings and monitoring wells to confirm the 3-D seismic reflection survey and model | DTSC | EPA | December 2001 | No |
| Monitor water quality and confirm model | DTSC | EPA | March 2002 | No |
| Interim operation of new extraction wells, if indicated | DTSC | EPA | June 2002 | No |
| Install permanent extraction wells, if indicated | DTSC | EPA | September 2005 | No |
| Zone 3 | | | | |
| Install borings and monitoring wells to confirm the 3-D seismic reflection survey and model | DTSC | EPA | December 2001 | No |
| Monitor water quality and confirm model | DTSC | EPA | March 2002 | No |
| Interim operation of new extraction wells, if indicated | DTSC | EPA | June 2002 | No |
| Install permanent extraction wells, if indicated | DTSC | EPA | September 2005 | No |
| Zone 4 | | | | |
| Enhance institutional controls - provision of bottled water | DTSC | EPA | September 2001 | Yes |
| Enhance institutional controls - connection to public water utility | DTSC | EPA | June 2002 | Yes |
| Enhance institutional controls - review and revision of Riverside County well restrictions | DTSC | EPA | September 2002 | Yes |
| Complete perchlorate investigation | DTSC | EPA | June 2002 | No |
| Identify and implement perchlorate remedies | DTSC | EPA | TBD | No |

**Zone 3.** It is anticipated that modifications and improvements to the existing extraction system, including installation of additional groundwater monitoring or extraction wells, may be successful in accelerating the achievement of the RAOs for the groundwater remedy in Zone 3. Implementation of these recommendations will be pursued as part of the current remedial operations.

**Zone 4.** Institutional controls will be enhanced to ensure that no households are exposed to perchlorate contamination. The perchlorate investigation will be completed and appropriate remedies will be selected and implemented. Optimization of existing system operations should be pursued as part of the current remedial operations.

## 9.0 Protectiveness Statements

The results of the 5-year review indicate the following:

Regarding the original disposal/source area (Zone 1), institutional and access controls are in place and effective in preventing exposure. With respect to source control, additional long-term remedial actions will be selected and implemented in this area of the site as part of the next ROD. These measures will be designed and operated to meet the RAOs as defined in the final version of the Draft Supplemental Feasibility Study and the next ROD. The remedial actions in place in Zone 1 are meeting the RAOs. The remedy is protective of human health and the environment.

With respect to Zone 2, institutional and access controls are in place and effective in preventing exposure. The existing groundwater control/interception system in this area is being operated to its full extent. Although future investigations of the Zone 2 system have been proposed in the Draft Supplemental FS, site monitoring and remediation data clearly indicate that this remedy is protective of human health and the environment.

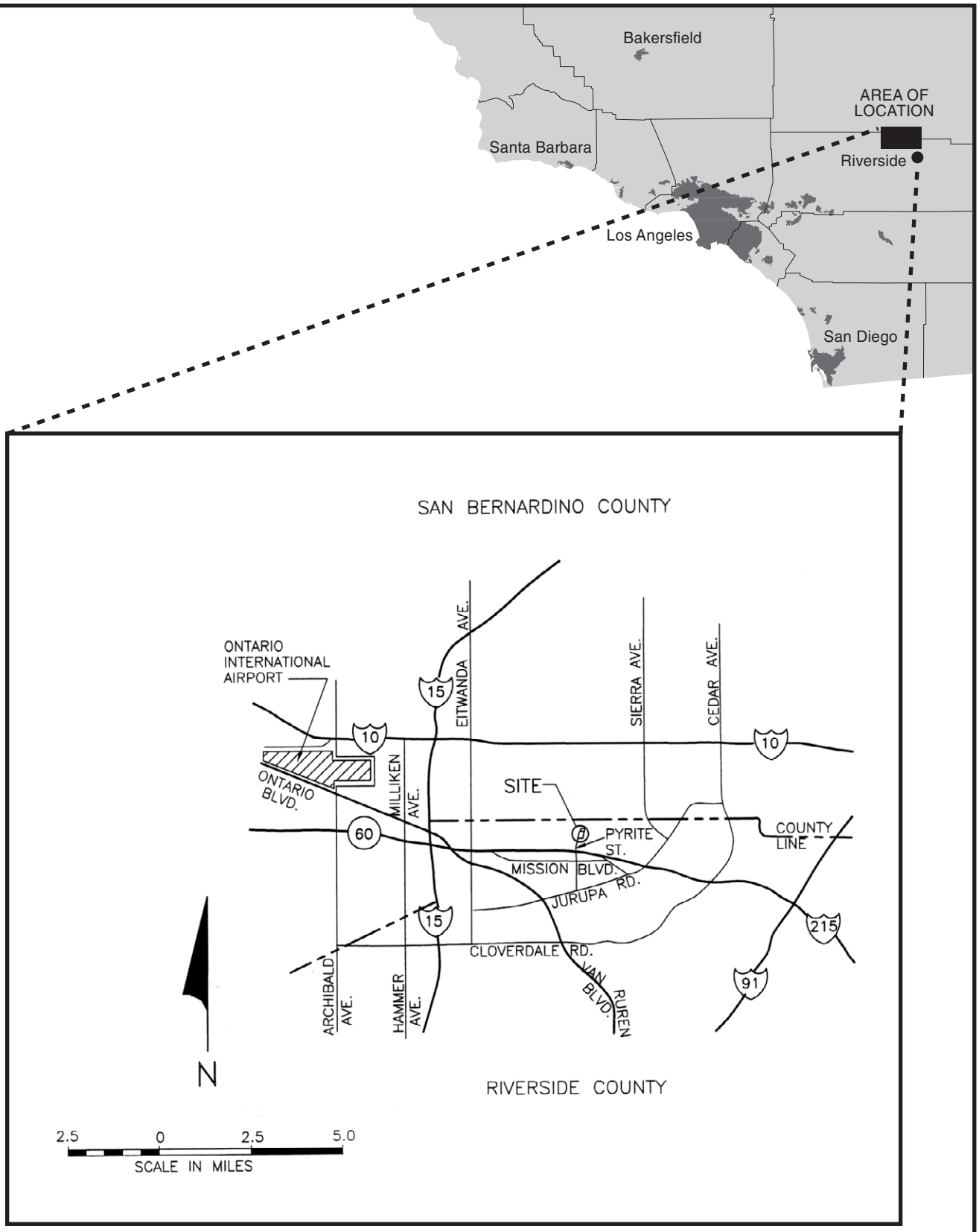
With respect to Zone 3, institutional and access controls are in place and effective in preventing exposure. The existing groundwater control/interception system in this area is being operated to its fullest extent. Although future investigations of the Zone 3 system have been proposed in the Draft Supplemental FS, site monitoring and remediation data clearly indicate that this remedy is protective of human health and the environment.

Regarding groundwater plume management in Zone 4, the implemented groundwater extraction system is operating and functioning as intended in the ROD. However, institutional controls in Zone 4 are incomplete in preventing exposure to perchlorate contamination. A protectiveness determination of the remedy at Zone 4 cannot be made at this time until further information is obtained. DTSC will provide sampling data from 15 Zone 4 households with private drinking water wells and data will be compared to the California Department of Health Services perchlorate drinking water action level of 18 parts per billion. DTSC will complete its investigation of Zone 4 households with private drinking water wells, sample well water from those households identified, and provide sampling data. It is expected that these actions will be completed by March 2002, at which time a protectiveness determination will be made.

## 10.0 Next Review

This is a site that requires ongoing statutory 5-year reviews to assure that implemented remedies are protective of human health and the environment. The next review will be conducted within 5 years of the completion of this 5-year Review Report.

# FIGURES

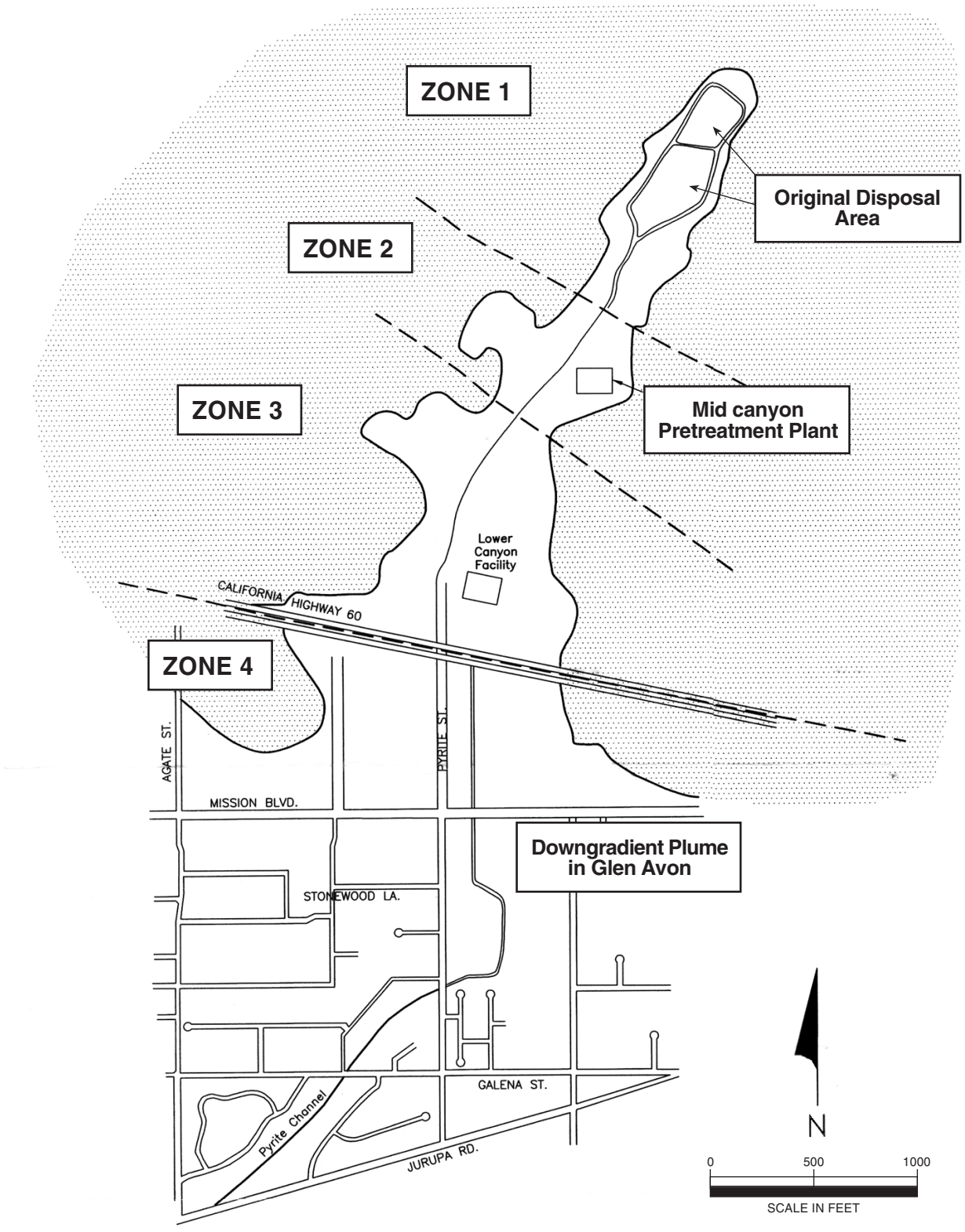



*Source: Modified from Environ, 2000*

Figure 1
**Site Location Map**
**Stringfellow Hazardous Waste Site**
**Glen Avon, CA**



CH2MHILL




Bedrock Outcropping

*Source: Modified from Environ, 2000*

Figure 2
**Stringfellow Site Map by Zone**
**Stringfellow Hazardous Waste Site**
**Glen Avon, CA**

CH2MHILL

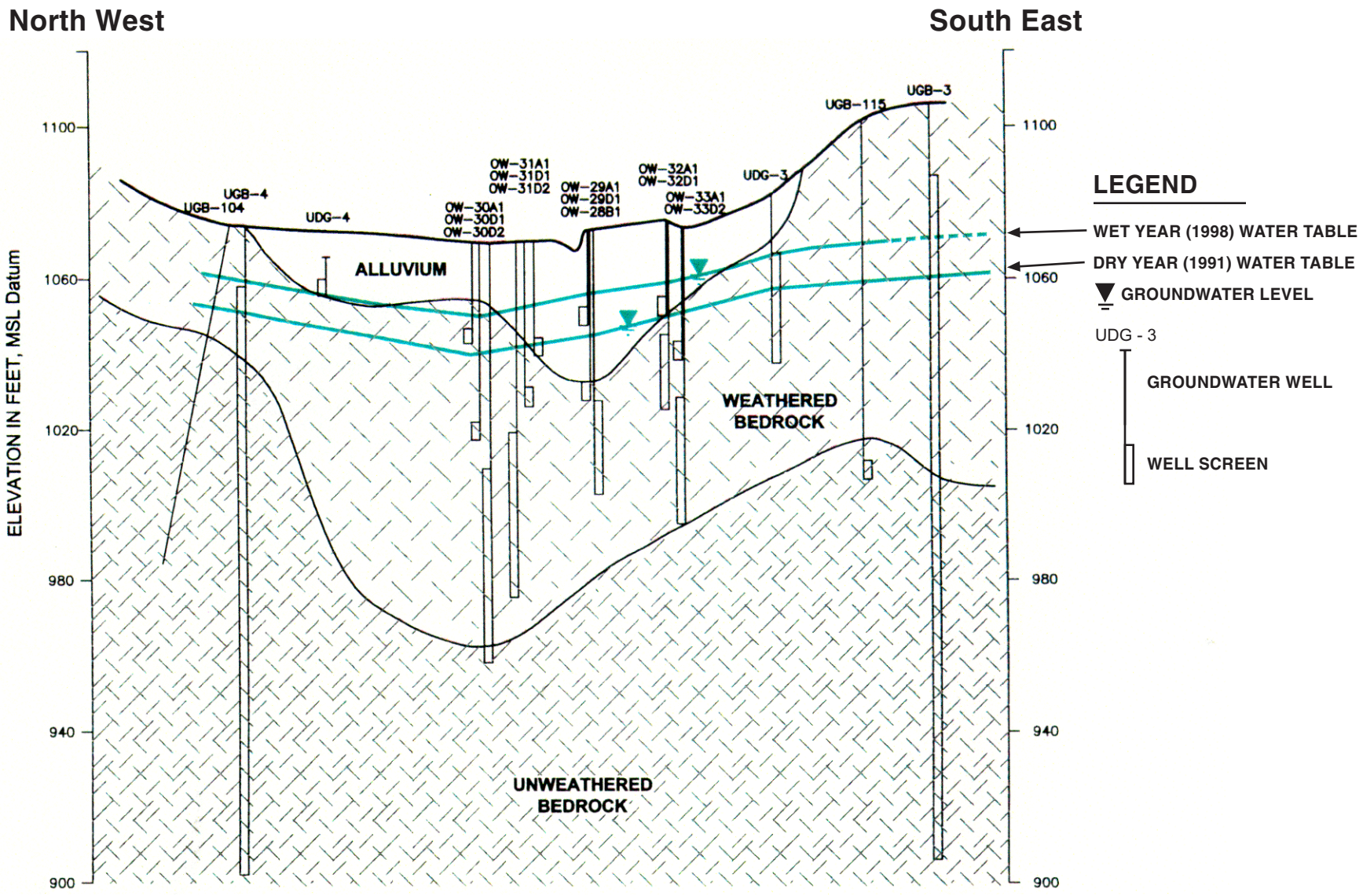
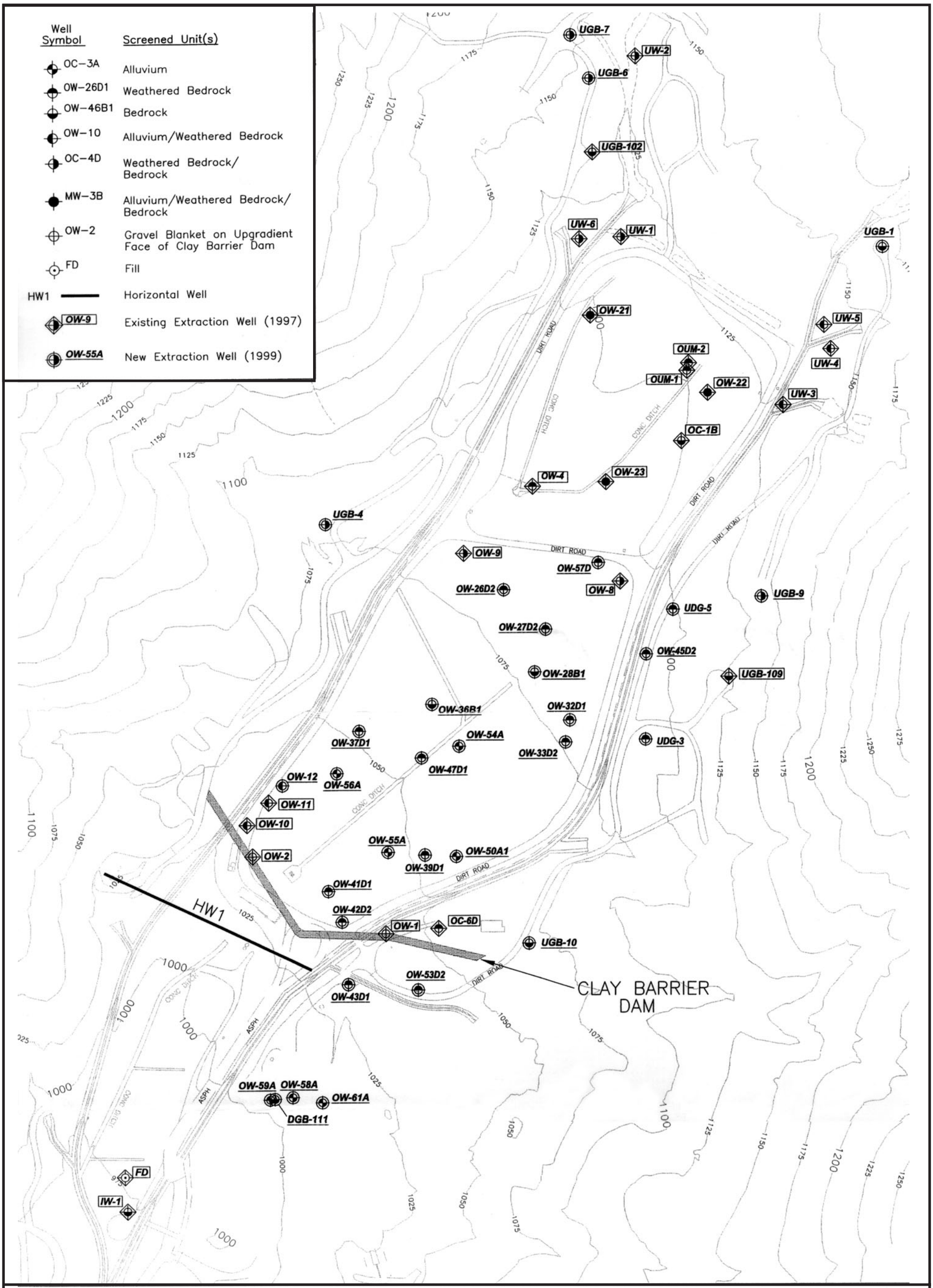



Figure 3
**Typical Subsurface Cross-Section, Pyrite Canyon (Zone 1)**
**Stringfellow Hazardous Waste Site**

*Source: Environ, 2000*

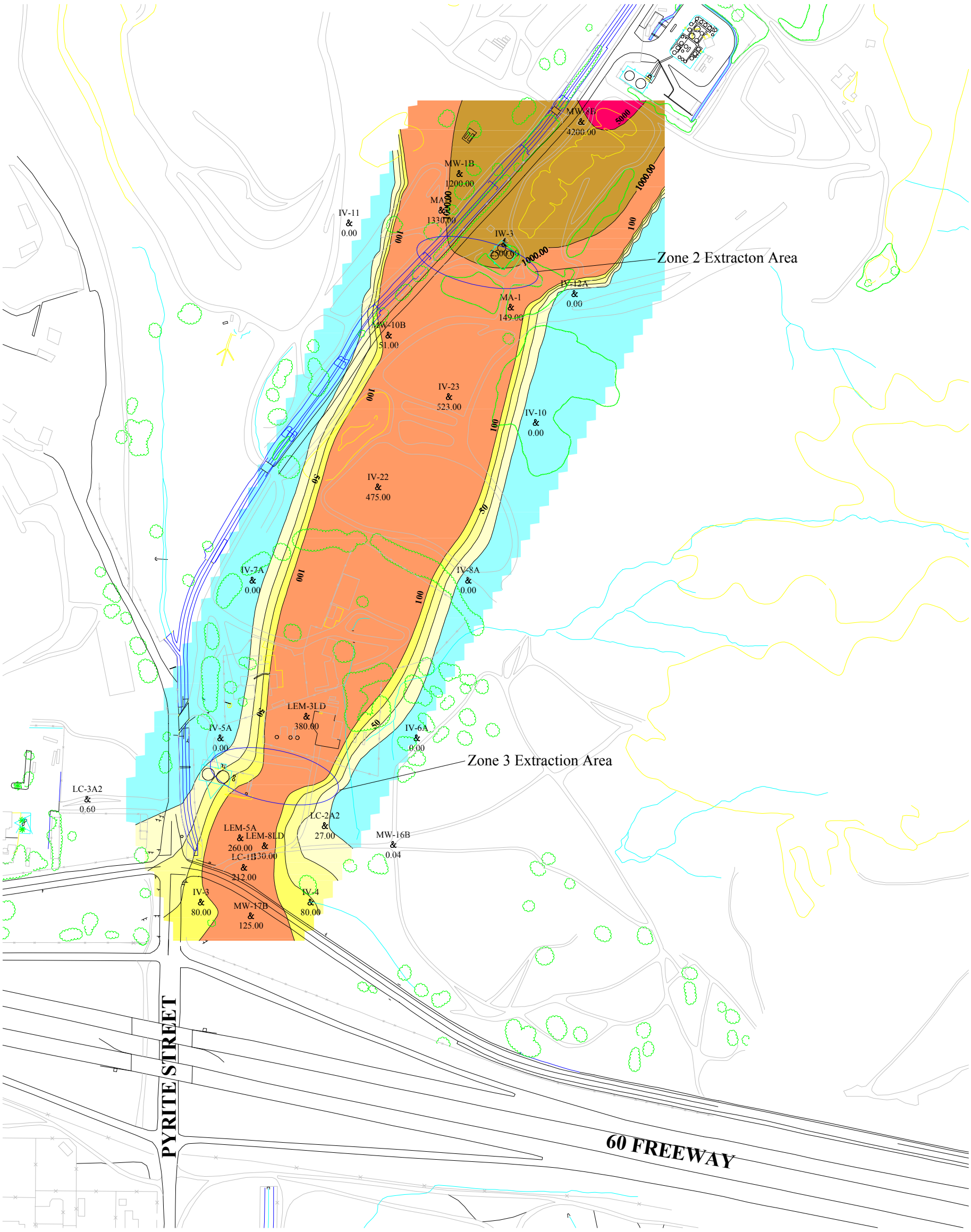
| Well Symbol | Screened Unit(s) |
|---|---|
| OC–3A | Alluvium |
| OW–26D1 | Weathered Bedrock |
| OW–46B1 | Bedrock |
| OW–10 | Alluvium/Weathered Bedrock |
| OC–4D | Weathered Bedrock/ Bedrock |
| MW–3B | Alluvium/Weathered Bedrock/ Bedrock |
| OW–2 | Gravel Blanket on Upgradient Face of Clay Barrier Dam |
| FD | Fill |
| HW1 | Horizontal Well |
| OW-9 | Existing Extraction Well (1997) |
| OW-55A | New Extraction Well (1999) |




*Source: Environ, 2000*

Figure 4

**Expanded Zone 1 Groundwater Extraction Network, October 1999**
**Five-Year Review Report**
**Stringfellow Hazardous Waste Site, Glen Avon, California**




IV-5A
&
0.0

Interpreted Data Point

Interpreted concentration, in micrograms per liter (ug/l), of TCE in ground water.

LEM-8LD
&
130

Identification of sampled location

Concentration, in micrograms per liter (ug/l), of TCE in ground water.

50

Line represents equal concentration, in micrograms per liter (ug/l), of TCE in ground water.

Approximate Scale
(feet)

0 320

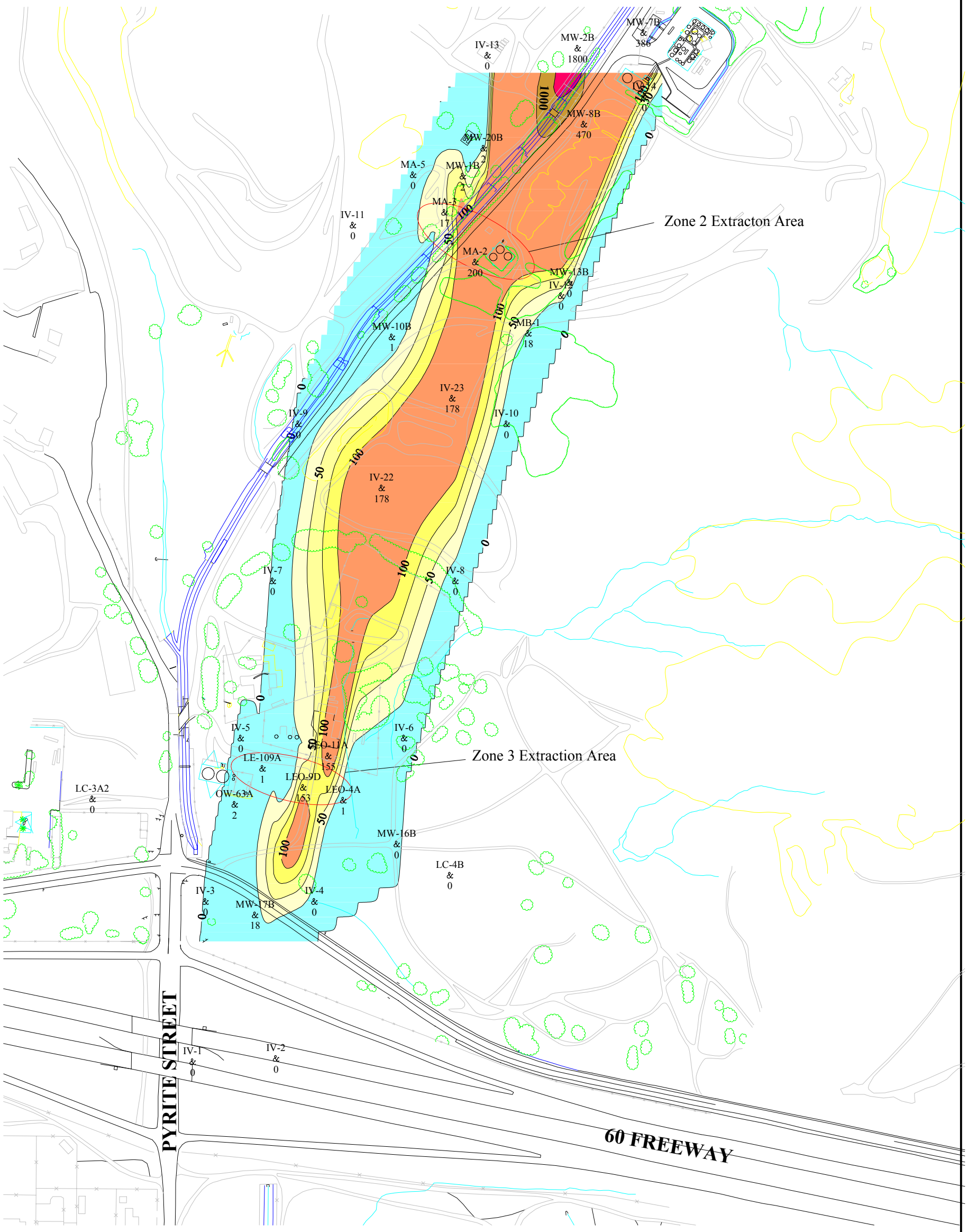
Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of TCE are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 5**

**Contour Map of TCE Concentrations in 1988**
**Stringfellow Zones 2 and 3**




IV-42
&
5.0

Interpreted Data Point

Interpreted concentration, in micrograms per liter (ug/l), of TCE in ground water.

CTP-TW1
&
2.8

Identification of sampled location

Concentration, in micrograms per liter (ug/l), of TCE in ground water.

50

Line represents equal concentration, in micrograms per liter (ug/l), of TCE in ground water.

Approximate Scale
(feet)

0 320

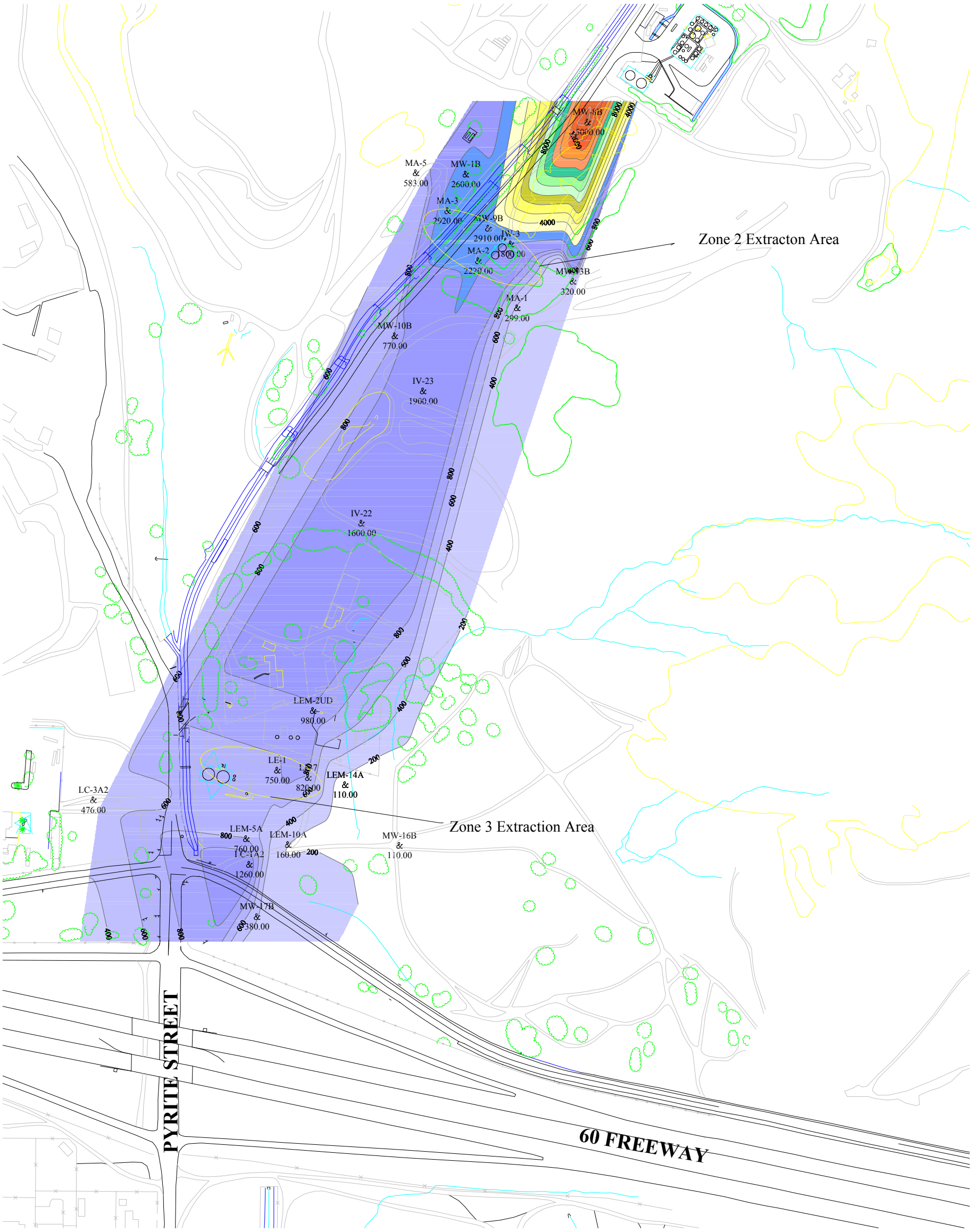
Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of TCE are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 6**

**Contour Map of TCE Concentrations in 1998/2000**
**Stringfellow Zones 2 and 3**




IV-22
&
1000
Interpreted Data Point

Interpreted concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

MW-17B
&
380
Identification of sampled location

Concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

200
Line represents equal concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

Approximate Scale
(feet)

0 320

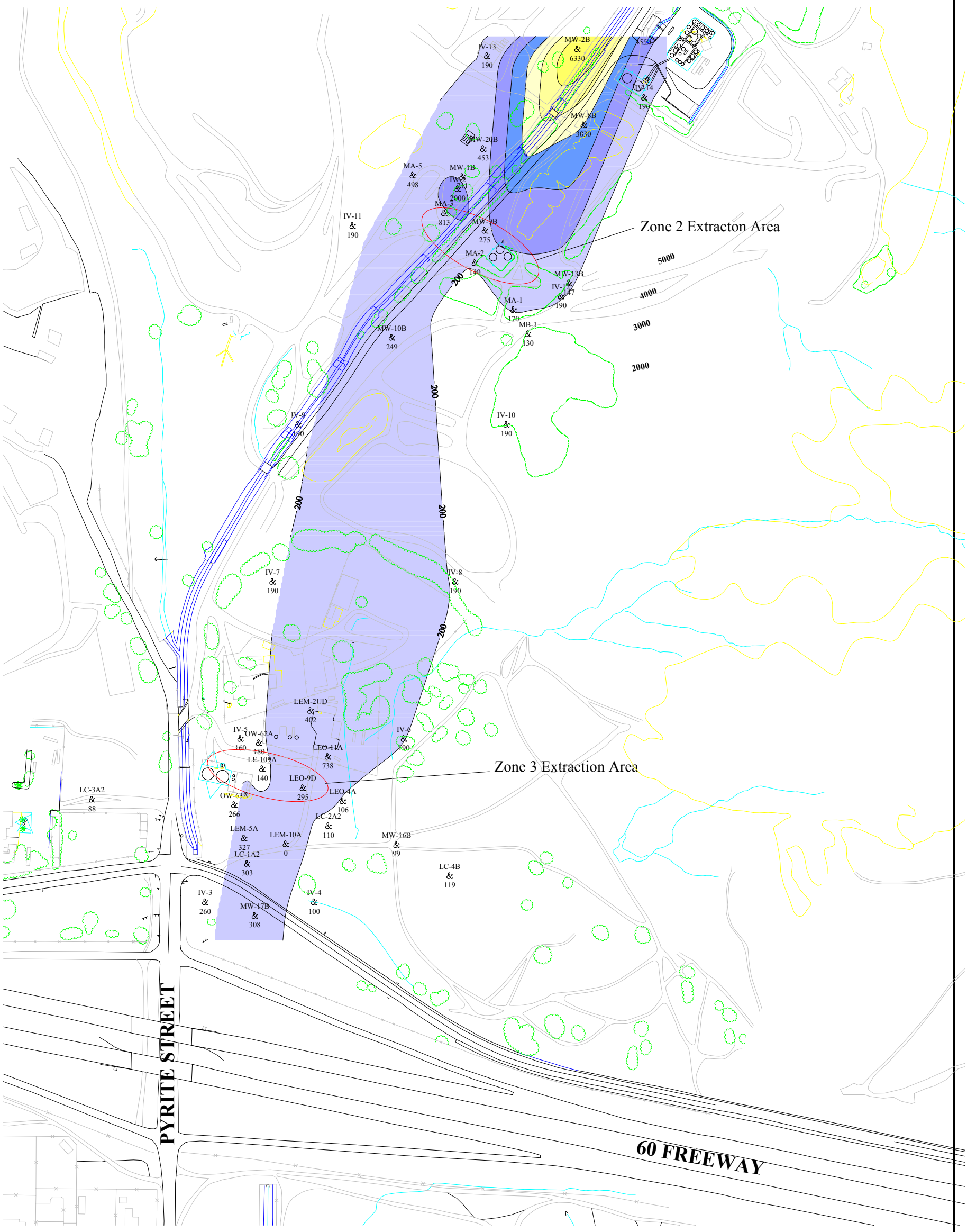
Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of Sulfate are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 7**

**Contour Map of Sulfate Concentrations in 1988**
**Stringfellow Zones 2 and 3**




IV-4
&
100
Interpreted Data Point

Interpreted concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

MW-17B
&
302
Identification of sampled location

Concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

200
Line represents equal concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

Approximate Scale
(feet)

0 320

Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of Sulfate are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 8**

**Contour Map of Sulfate Concentrations in 1998/2000**
**Stringfellow Zones 2 and 3**


IV-39 & 4.0 — Interpreted Data Point; Interpreted concentration, in micrograms per liter (ug/l), of TCE in ground water.

FC-936A2 & 8.12 — Identification of sampled location; Concentration, in micrograms per liter (ug/l), of TCE in ground water.

5 — Line represents equal concentration, in micrograms per liter (ug/l), of TCE in ground water.

Approximate Scale (feet)

0 650

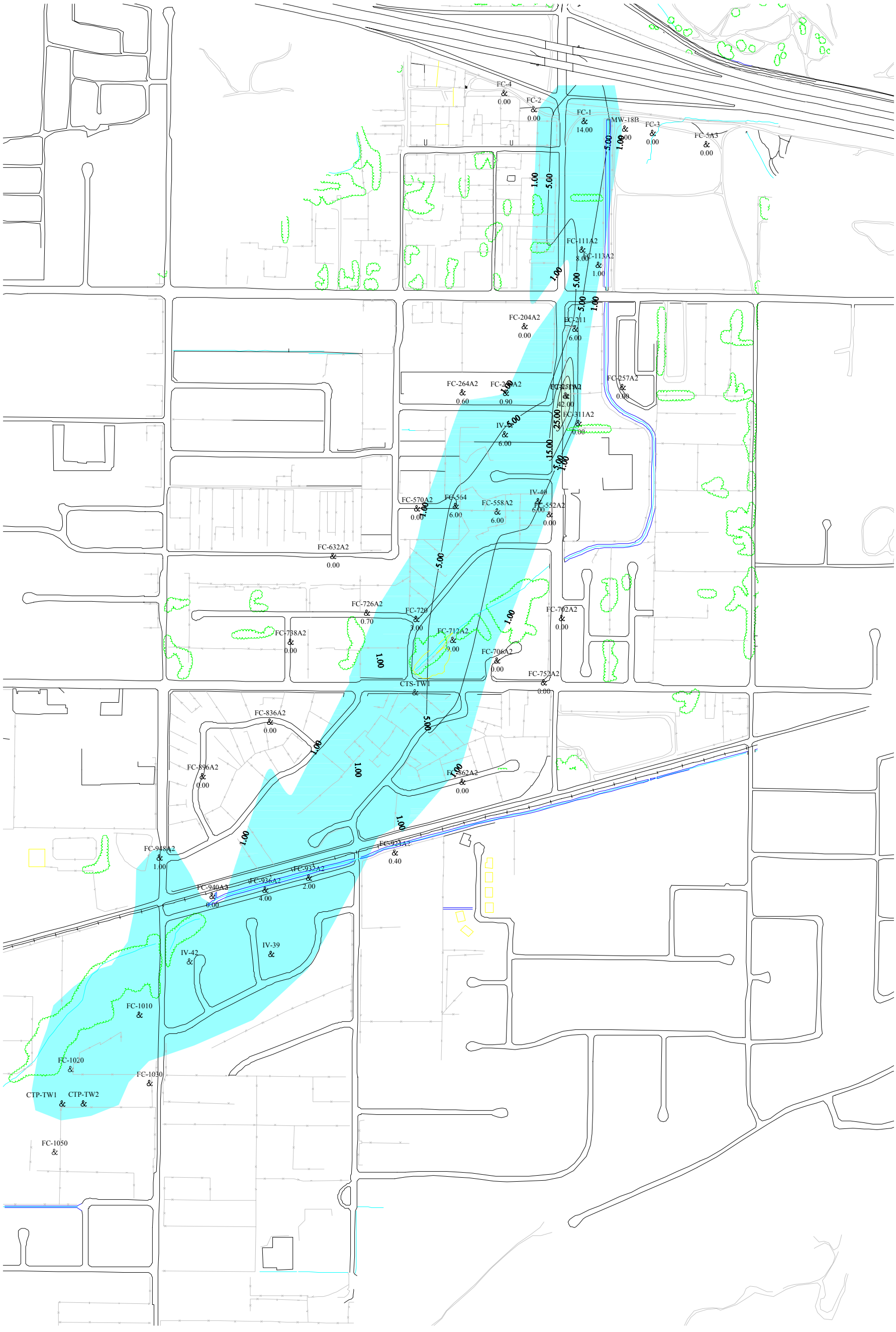
Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of TCE are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 9**

**Contour Map of TCE Concentrations in 1988**
**Stringfellow Zone 4**




IV-42
&
5.0

Interpreted Data Point

Interpreted concentration, in micrograms per liter (ug/l), of TCE in ground water.

CTP-TW1
&
2.8

Identification of sampled location

Concentration, in micrograms per liter (ug/l), of TCE in ground water.

1.0

Line represents equal concentration, in micrograms per liter (ug/l), of TCE in ground water.

Approximate Scale
(feet)

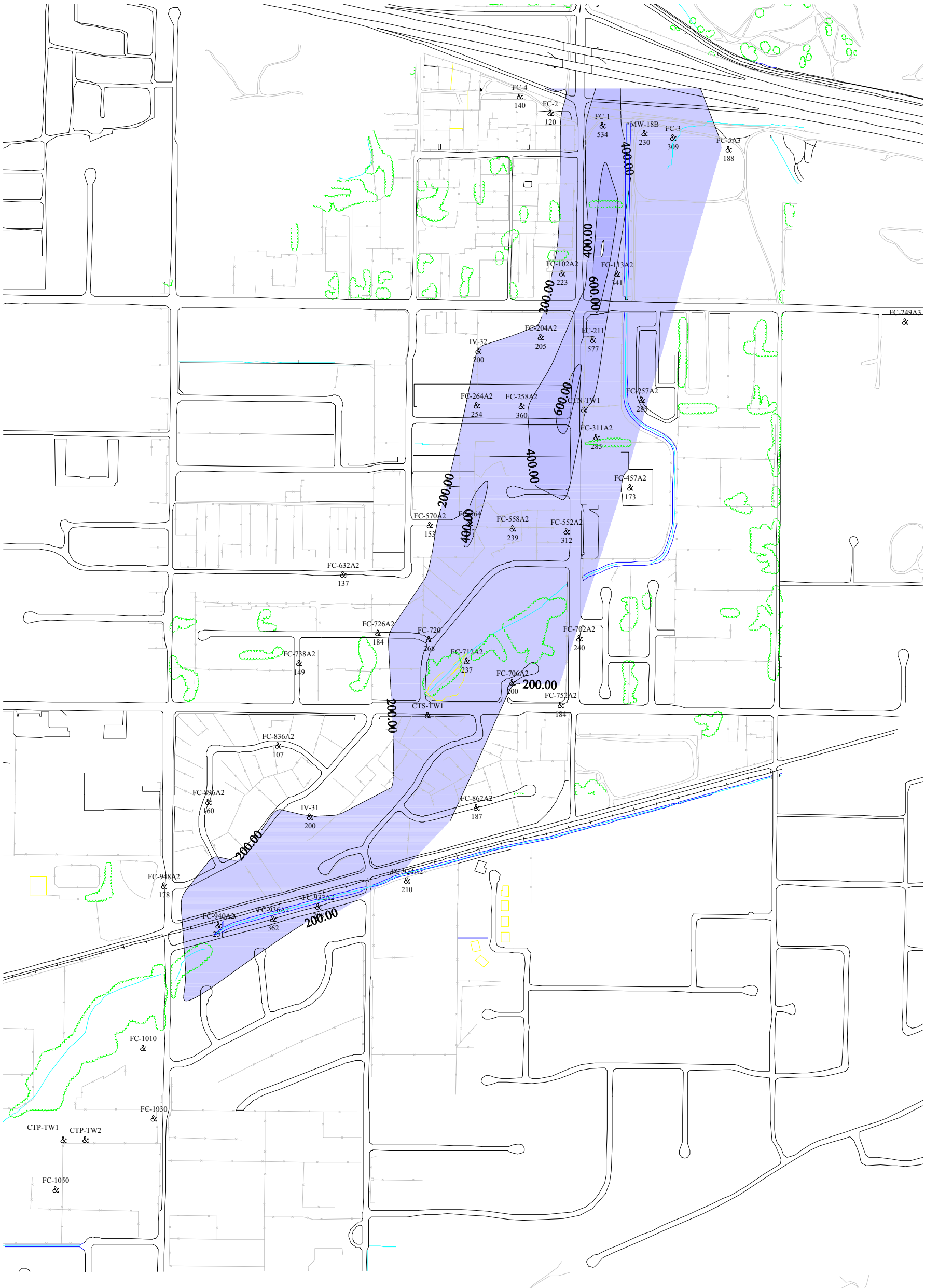
0 650

Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of TCE are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 10**
**Contour Map of TCE Concentrations in 1998/2000**
**Stringfellow Zone 4**




IV-31
&
200

Interpreted Data Point

Interpreted concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

FC-932A2
&
208

Identification of sampled location

Concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

200

Line represents equal concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

Approximate Scale (feet)

0 650

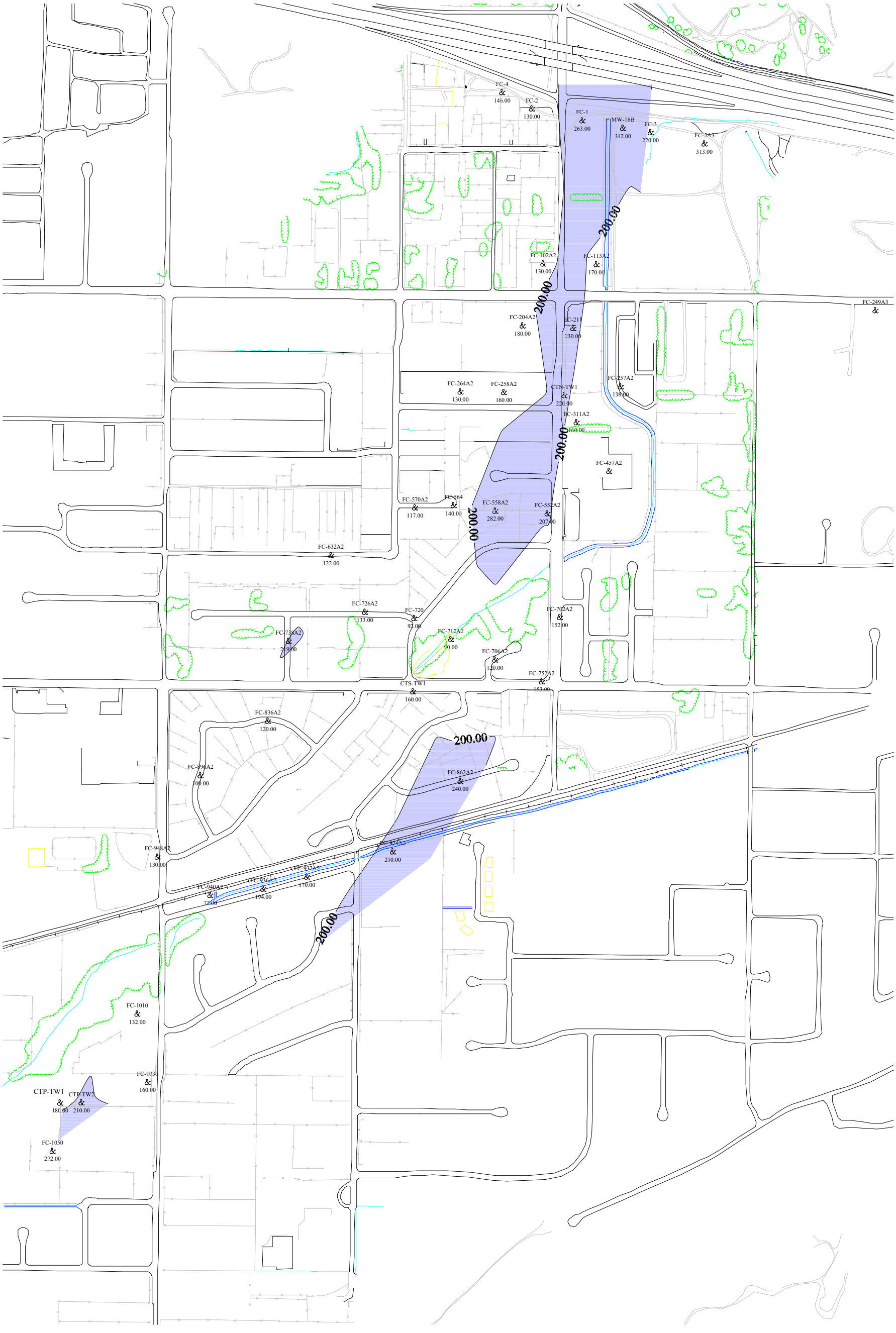
Note: Interpreted values were added to facilitate computer generation of contours. Interpreted values of Sulfate are background concentrations near the known perimeter of the plume and calculated averages between data points within the plume.

All wells are not shown due to space limitations.
This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 11**

**Contour Map of Sulfate Concentrations in 1988**
**Stringfellow Zone 4**




CTP-TW1 & 180 — Identification of sampled location; Concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

200 — Line represents equal concentration, in milligrams per liter (mg/l), of Sulfate in ground water.

Approximate Scale (feet)

0 650

Note: All wells are not shown due to space limitations. This map was developed by the California Department of Toxic Substances Control

Source: Department of Toxic Substances Control

**Figure 12**
**Contour Map of Sulfate Concentrations in 1998/2000**
**Stringfellow Zone 4**

# ATTACHMENT 1

**ATTACHMENT 1**

**DOCUMENTS REVIEWED**


CH2M HILL, 2000a. *Zone 2 Groundwater Extraction System Effectiveness Evaluation, Stringfellow Superfund Site, Glen Avon*. Prepared for EPA Region IX. July 14.

CH2M HILL, 2000b. *Zone 3 Groundwater Extraction System Effectiveness Evaluation, Stringfellow Superfund Site, Glen Avon.* Prepared for EPA Region IX. August 31.

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Tetra Tech, Inc., 2000. *Stringfellow Hazardous Waste Site Groundwater Monitoring Report, Spring 2000.* Prepared for DTSC. July.