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Stringfellow, CA

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Stringfellow site is an inactive hazardous waste disposal facility in Riverside County, California, approximately 50 miles east of Los Angeles. The site is divided into four zones: the onsite/upper mid-canyon area, which includes a 17-acre, inactive industrial disposal area in the southern portion of the Jurupa Mountains (Zone 1); the mid-canyon area (Zone 2); the lower canyon area (Zone 3); and the community of Glen Avon (Zone 4). From 1956 to 1972, approximately 34 million gallons of industrial waste from metal finishing, electroplating, and DDT production were disposed of in unlined evaporation ponds located throughout Zone 1. Some of the wastes from these ponds migrated into the ground water system and were transported 2 miles downgradient (under Zones 2 and 3) to form a ground water plume beneath the Glen Avon community (Zone 4). Between 1975 and 1980, the State removed approximately 6.5 million gallons of unspecified liquid waste and DDT-contaminated material from the site. In 1980, EPA removed approximately 10 million gallons of contaminated water, reinforced containment barriers, and improved a truck loading area. Further removal actions included installing french drain system fences; removal of all remaining surface liquids; partially neutralizing and capping the wastes; installing a gravel drain network,

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Stringfellow, CA
Fourth Remedial Action
Contaminated Medium: gw
Key Contaminants: VOCs (TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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Abstract (continued)

monitoring wells, and surface channels; and constructing a surface barrier and leachate collection system downgradient from the original evaporation ponds. In 1983, the first Record of Decision (ROD) provided an interim remedial measure and addressed additional fencing of the site and implemented erosion control and offsite disposal of the extracted leachate. In 1984, a second ROD addressed construction of an onsite pretreatment plant for contaminated ground water, and the third ROD in 1987, specified installation of a ground water extraction system in the lower canyon area (Zone 3), as well as surface channels to direct surface water runoff. This fourth ROD addresses the contaminated ground water in Zone 1 (an interim measure) and in Zone 4, and proposes treatability studies to remediate the source material in Zone 1. A future ROD will specify the source treatment methods as well as a remedy for any remaining ground water contamination in Zone 1. The primary contaminants of concern affecting the ground water include VOCs such as TCE.

The selected remedial action for this site includes dewatering the bedrock in the original disposal area (Zone 1), followed by ground water treatment at the existing pretreatment plant, and offsite discharge to a publicly owned treatment works (POTW) facility; ground water pumping and treatment using air stripping or granular activated carbon, and reverse osmosis in Zone 4, followed by onsite reinjection or disposal in an industrial sewer; conducting field tests on reinjection of treated ground water into Zones 2 and 3; and performing treatability tests on soil vapor extraction at Zone 1. The estimated present worth cost of this remedial action is $115,000,000, which includes unspecified O&M costs.

PERFORMANCE STANDARDS OR GOALS: No remediation goals have been determined in this ROD for Zone 1 ground water contamination, because this is an interim measure. Chemical-specific goals for ground water in Zone 4 include TCE 5.0 ug/l (SDWA MCLs).

RECORD OF DECISION DECLARATION

SITE NAME AND LOCATION

Stringfellow Hazardous Waste Site
Riverside County, California

STATEMENT OF BASIS AND PURPOSE

This decision document for the Stringfellow site in Riverside County, California selects certain interim remedial actions, which have been chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9601 et. seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan, 40 C.F.R. Part 300. The decisions in this ROD are based upon the contents of the administrative record for the Stringfellow site.

The State of California, while given the opportunity to concur upon the remedy selected in this Record of Decision, remains silent.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare and the environment.

DESCRIPTION OF THE REMEDY

This is the fourth interim action ROD for the site. The first ROD involved initial abatement activities including fencing, erosion control, interim source control, and off-site hauling and disposal of contaminated liquids. The second ROD involved construction of an on-site pretreatment plant to treat contaminated groundwater. The third ROD involved installation of a groundwater barrier system in the lower canyon and installation of peripheral surface channels to direct upgradient surface water runoff. This fourth interim action ROD addresses the groundwater pathway in Zone 1 (the original disposal area) and Zone 4 (the Community) by selecting actions that mitigate further degradation of groundwater at the disposal source and downgradient. The major components of the selected remedies include:

-- Dewatering of the original disposal area, Zone 1, using a system of extraction wells, followed by treatment of the extracted water at the existing mid-canyon pretreatment plant and disposal to a POTW for further treatment; and

-- Installation of a groundwater extraction system in the community to extract and treat contaminated groundwater that

has migrated downgradient to Zone 4, followed by reinjectio of the treated water.

In addition, a field test of soil-vapor extraction will be performed to determine the technology's implementability, effectiveness, and costs for removal of volatile organic compounds (VOCs) from Zone 1 soils. Field studies on reinjection of treated groundwater into Zone 2 and 3 also will be pursued.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal or state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

John Wise for

DANIEL W. McGOVERN
Regional Administrator

9.30.90
Date

1990 RECORD OF DECISION
DECISION SUMMARY
STRINGFELLOW HAZARDOUS WASTE SITE

SITE LOCATION AND DESCRIPTION

The Stringfellow Hazardous Waste Site (also referred to as "site," "Stringfellow," or "Stringfellow site") is located in Riverside County, California, approximately 50 miles east of Los Angeles (Figure 1). The original disposal area is located at the head of Pyrite Canyon in the southern portion of the Jurupa Mountains. The plume of contaminated groundwater, extending approximately 2 miles south of U.S. Highway 60 into the community of Glen Avon, is located within the Glen Avon Basin aquifer, which in the past served as a source of drinking and agricultural water. At present, the Glen Avon Basin aquifer does not serve as a primary source of drinking water for local residents.

The remedial actions selected in this Record of Decision (ROD) address the pathway of primary concern to public health, exposure to contaminated groundwater. These measures offer an opportunity to reduce site-related risk and prevent further degradation of downgradient groundwater.

For purposes of organizing remedial investigation/feasiblity study (RI/FS) information, the site, including its contaminated plume of groundwater, has been divided into four geographic zones (Figure 2).

The term "on-site" used to describe Zone 1 is in reference to the zone as the orginal disposal area, and not to the definition of "on-site" in the National Contingency Plan (NCP). The NCP defines on-site as the "areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." 40 C.F.R. section 300.5; 55 Fed. Reg. 8817 (3/8/90). Using the NCP definition, the entire plume of contamination, and therefore all zones, is considered "on-site." Pursuant to CERCLA section 121(e), no federal, state or local permit is required for any remedial action conducted entirely on-site as long as the actions are taken within the zone and the substantive portions or the ARAR are addressed.

Zone 1: On-site/Upper Mid-Canyon Area

Zone 1 includes the original 17-acre disposal area in the northern part of Pyrite Canyon, southward to approximately 600 feet below the subsurface barrier. There is no residential or commercial population in this zone. Zone 1 groundwater is contaminated with a large number of organic and inorganic contaminants, including heavy metals.

Zone 2: Mid-Canyon Area

Zone 2 encompasses the portion of Pyrite Canyon that extends from the southern edge of Zone 1 to the existing mid-canyon extraction wells. Zone 2 has no residential population and limited commercial use as a rock quarry. Zone 2 groundwater is moderately to heavily contaminated. The contaminants of concern are primarily soluble, volatile organics, and soluble inorganics. Moving southward through Zone 2, the groundwater contains rapidly decreasing to neglible amounts of heavy metals.

Zone 3: Lower Canyon Area

Zone 3 extends from the mid-canyon extraction wells down to the lower canyon extraction system, north of U.S. Highway 60. There are no private residences in Zone 3, although two active businesses are located within the zone. Zone 3 groundwater is low to moderately contaminated. The contaminants of concern are soluble, volatile organics, and soluble inorganics.

Zone 4: Community of Glen Avon Area

Zone 4 includes the area south of Highway 60 to the leading edge of the plume of site-related contaminated groundwater, approximately 12,000 feet from Zone 1. The affected area is populated with a number of private residences. The contaminants of concern in the groundwater in this zone are relatively low levels of a small number of soluble, volatile organics, and soluble inorganics. At present, the Glen Avon Basin aquifer (within which the Stringfellow plume lies) does not serve as a primary source of drinking water for local residents.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The site was operated by the Stringfellow Quarry Company from August 21, 1956, to November 19, 1972, as a state authorized hazardous waste disposal facility. Approximately 34 million gallons of industrial wastes (primarily from metal finishing,

electroplating and DDT production) were placed in unlined evaporation ponds located throughout the 17-acre disposal area. Some of these wastes migrated downward, entered the groundwater, and moved various distances downgradient. The site was voluntarily closed in 1972.

Removal Activities

In 1975, after declaring the site a public nuisance, the California Regional Water Quality Control Board (RWQCB) began studies to evaluate alternatives for abatement of the risks posed by the site. Between 1975 and 1980, the RWQCB developed reports, conducted a controlled release of contaminants to Pyrite Creek after heavy rains, and removed approximately 6.5 million gallons of liquid wastes and DDT contaminated material.

In 1980, federal involvement was initiated at Stringfellow after an inspection by the U.S. Environmental Protection Agency (EPA) and the U.S. Coast Guard (USCG). The EPA Regional Response Team (RRT) and the USCG Strike Team, using EPA funds, assisted the RWQCB in mitigating the threat of a catastrophic discharge of contaminated water. This response resulted in the removal of approximately 10 million gallons of contaminated water, reinforcement of containment barriers, and improvements to the truck loading area. Other activities completed by the RRT and USCG after 1980 include installation of a french drain, spring box, sumps, and fencing, and improvements to surface drainage.

In 1980, the RWQCB adopted an Interim Abatement Program (IAP) to further address the site. The IAP was designed to contain the wastes and minimize the risk of further contaminant migration. The program included the removal of all surface liquids; partial neutralization and capping of the wastes; installation of a gravel drain network, interceptor wells, monitoring wells, and surface channels; and construction of a clay core subsurface barrier and leachate collection system downgradient of the original evaporation ponds.

In 1981, the California Department of Health Services (DHS) became the lead state agency for Stringfellow-related cleanup, although the RWQCB continued its involvement at the site. The Stringfellow site was placed on the Environmental Protection Agency's (EPA) National Priorities List in 1983.

Interim Remedial Measures

On July 22, 1983, EPA signed its first Record of Decision (ROD) selecting certain interim remedial measures (IRM) and allowing the state to be reimbursed for the earlier abatement actions taken by the RWQCB. Among other actions, the IRM included additional fencing of the site, erosion control, and hauling and off-site disposal of extracted leachate. The IRM were undertaken primarily by DHS using EPA funding under a cooperative agreement. DHS began receiving such funding in 1983.

Fast-Track Remedial Investigation/Feasibility Study

EPA conducted a fast-track remedial investigation/feasibility study (RI/FS) between September 1983 and May 1984. Based primarily upon the fast-track RI/FS, a second ROD was issued by EPA on July 18, 1984. The ROD selected, as an interim measure, the construction and operation and maintenance of a mid-canyon extraction well system and pretreatment plant to remove and treat contaminated groundwater.

The pretreatment system consists of lime precipitation for metals removal, followed by granular activated carbon treatment for removal of the organic contaminants. Under a discharge permit from the Santa Ana Watershed Project Authority (SAWPA), the treated effluent is currently trucked to a local industrial sewer line, the Santa Ana Regional Interceptor (SARI). The effluent then receives additional treatment at a publicly-owned treatment works (POTW) in Orange County. Sludge generated from the pretreatment process is dewatered and taken to an EPA-approved land disposal facility.

Although DHS holds the discharge permit from SAWPA, EPA has entered into an interagency agreement with the U.S. Army Corps of Engineers (the Corps) for field oversight of the pretreatment plant. The Corps, in turn, uses a contractor to operate and maintain the pretreatment plant.

The pretreatment plant's influent, treatment process, and effluent are monitored extensively to ensure quality performance. Since start-up operations, the plant has consistently met the stringent requirements of SAWPA's discharge permit. As of December, 1989, over 30 million gallons of contaminated groundwater have been treated at the plant, and approximately 15,000 pounds of metals and 135,000 pounds of organics have been removed. Pretreatment plant operations are ongoing.

Full-Scale Remedial Investigation/Feasibility Study (RI/FS)

With funding provided by EPA under the cooperative agreement, DHS procured a contractor to conduct a full-scale RI/FS for the Stringfellow site. The RI/FS was initiated in 1984 to characterize the site and to identify and evaluate alternatives for final site cleanup. The FS assessed 86 potentially applicable technologies. Certain of these technologies have been combined into five remedial alternatives (RAs). Detailed evaluation of the five alternatives was performed, as were a number of treatability studies. Although a majority of the work on the RI/FS has been completed, work is still ongoing, including additional soil treatability studies (see "Highlights of Community Participation").

The draft RI report was released to the public in June, 1987, followed by the draft FS report in June 1988. Public meetings on the draft FS report were held in September 1988.

Alternate Water Supply

Analysis of water samples taken during site investigations detected radiation. In response, DHS sampled private drinking water supply wells in the site area. Although the elevated levels of radioactivity were later determined to be naturally occuring and not related to the contamination at the site, in the summer of 1984, in response primarily to continued concern with drinking water quality, DHS initiated an interim program to provide bottled water to nearly 400 Glen Avon residences. Bottled water was supplied to give anyone in identified areas of elevated groundwater radioactivity an alternate supply of domestic water, and to eliminate any domestic dependence on groundwater near the potential influence of contamination from the Stringfellow site. In October 1985, California Senate Bill 1063 provided State funds to hook up residences, which had been receiving State supplied bottled water, to the Jurupa Community Services District. The connections began in June 1986, and were completed in 1989.

Early Implementation Actions

Based upon the ongoing remedial alternative (RA) evaluation in the full-scale RI/FS, additional interim remedial activities were selected in a third ROD issued by EPA on June 24, 1987. These additional actions included: 1) the installation of a groundwater extraction system in the lower canyon area (Zone 3) with treatment of the extracted groundwater at the existing

pretreatment plant; 2) the installation of surface channels around the north end of the original disposal area in Zone 1; 3) the southward extension of the existing eastern and western surface channels; and 4) the reconstruction of the Pyrite Creek channel.

Using cooperative agreement funding, DHS procured contractors to design these actions, and to construct the surface channels around the north end of the orginal disposal area and the southward extension of the existing surface channels. DHS' contractors completed the design in 1988 and the construction of the channels in 1990. A number of potentially responsible parties (PRPs), through an Administrative Order on Consent (AOC), installed the extraction system and reconstructed the Pyrite Creek channel (see "Federal Enforcement," below).

Federal Enforcement

In August and October 1982, EPA issued to over 200 potentially responsible parties (PRPs), General Notice and Demand letters, combined with information requests, under sections 104 and 113 of the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The governments' negotiators held an initial meeting with the PRPs in November 1982, followed by a number of settlement meetings. An acceptable settlement agreement was not reached.

On April 21, 1983, the United States and the State of California filed a civil suit in the United States District Court for the Central District of California (U.S. v. J.B. Stringfellow, Jr., et. al., Civil Number 83-2501 JMI (C.D. Cal.)). Eighteen generators, four transporters, and nine owner/operators were named as defendants in the lawsuit. On June 4, 1987, the District Court granted the government's motion for partial summary judgment against fifteen of the defendants on the issue of liability under section 107 of CERCLA. A sixteenth defendant recently has been added to the judgment. A case management order divides the litigation into three phases: 1) liability, 2) remedy/damages, and 3) cost allocation. Litigation is ongoing.

To facilitate legal discussions with the governments, following suit initiation, the defendants formed a steering committee. A technical subcommittee was also formed and meets with EPA and DHS technical staff approximately once every quarter to exchange technical information. The community's technical advisor is invited to these meetings. Local and other state government representatives are also invited depending on the

agenda covered by the technical discussions.

In May 1988, sixteen of the defendants agreed, in an Administrative Order on Consent (AOC), to construct certain of the interim actions that were selected in the third ROD issued by EPA on June 24, 1987. The AOC did not include the design and operation and maintenance of the groundwater extraction system, the installation of the northern channels or the southward extension of the existing channels. Rather, using cooperative agreement funding, DHS' contractors completed the design and constructed the channels. Operation and maintenance of the pretreatment plant resides with EPA.

Proposed Remediation Plans

Community Groundwater Proposed Plan

In June 1988, EPA and DHS released a Proposed Plan to address site-related groundwater contamination in the community of Glen Avon (Community Groundwater Proposed Plan). The Plan proposed to extract, treat (through air stripping and reverse osmosis), and reinject the treated groundwater. The public had an opportunity to comment on the Community Groundwater Proposed Plan from June to November 1988. Two public meetings addressing the Plan were held in September 1988.

Overall Proposed Plan

At one of the public meetings in September 1988, Riverside Representative George Brown held an open congressional hearing on the Stringfellow site. At the hearing, the Agencies' agreed to conduct additional soil treatability studies before making a decision on the final remedy for Zone 1. Testimony by members of the community and the U.S. Office of Technology Assessment reflected the belief that certain soil treatment technologies should be further evaluated because of possible technical developments since the issuance of the draft FS report.

In response to the hearing and to public input, EPA and DHS developed a new remedial alternative, RA6. Consequently in February 1989, the Agencies released for public comment a second plan (Overall Proposed Plan) proposing to implement RA6. EPA and DHS also released a fact sheet in April 1989 reflecting recalculated estimated groundwater flow in the community area (Zone 4). The April fact sheet described the revised estimated cost comparisons and cleanup times for the Community Groundwater Proposed Plan, and for the RAs considered in the draft FS report.

The proposed remedy, RA6, of the Overall Proposed Plan included, for Zones 2 - 4, the long-term continuation of downgradient plume management activities. For Zone 1, the Plan proposed to dewater the area, use soil-gas extraction (hereinafter referred to as "soil-vapor extraction," or "SVE") for removal of volatile organic compounds (VOCs) if tests proved favorable, complete additional soil treatability studies, and install an improved cap.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

The community of Glen Avon has been kept actively informed of the cleanup progress and actions taken at the Stringfellow site. One of the primary means of keeping the public informed has been through the DHS publication of the "Stringfellow Update." Updates have been published approximately every other month since late 1984, and are mailed to over 3,000 Glen Avon residents and interested parties. The Community Groundwater Proposed Plan was released through the June/July 1988 "Stringfellow Update," and the Overall Proposed Plan through the February/March 1989 "Stringfellow Update."

Public Comment Periods

EPA and DHS sought public comment on the draft RI/FS report and on the two proposed plans. The comment period for the draft RI report began in June and ended in October 1987. The public had an opportunity to comment on the draft FS report and Community Groundwater Proposed Plan from June through November 1988. The comment periods for the Overall Proposed Plan and the April fact sheet began in March 1989, and April 1989, respectively. The comment period for both documents closed in June 1989.

Public Meetings

Public meetings and workshops have been held in and near Glen Avon to present cleanup information and to receive input from the public. Public meetings on the draft FS report and Community Groundwater Proposed Plan were held in Riverside and Orange Counties in September 1988. A public meeting on the Overall Proposed Plan was held in Riverside County in March 1989.

In addition to public meetings, the Stringfellow Advisory Committee (SAC)---an amalgum of community, government, and private interests---meets once a month to discuss cleanup progress at the site, and the remedial activities being pursued by EPA and DHS. The SAC is comprised of a community leader,

elected representatives, local officials, and EPA and DHS staff and management. SAC meetings are open to the public.

Community Input: ROD

Public comment, in various forums, indicated the community's strong belief that the final remedial decision for Zone 1 should be deferred until after the completion of additional soil treatability studies. Nevertheless, pending the studies, the community supported the issuance of a separate ROD to address the cleanup of the groundwater underlying the Glen Avon area (Zone 4), and the dewatering and soil-vapor extraction actions in Zone 1.

The Agencies agreed with the suggestions provided by the community, and have adopted its strategy as reflected in this ROD (see "Scope and Role of Response Actions of This ROD"). The final remedial decisions on the long-term plume management, and the final response actions for Zone 1, will be addressed in a subsequent ROD, following completion of the RI/FS, including the additional soil treatability studies.

Community Input: Significant/Episodic Storm and Seismic Events

In response to community concerns regarding flooding and possible exposure to contaminants via the surface water pathway, EPA and DHS are evaluating the potential effect significant/episodic storm or seismic events may have on the site's engineered structures and downgradient community. After a conceptual plan for the analysis was presented to the public for comment in March 1990, the Agencies' proposed a detailed analytical approach and again sought public comment. EPA and DHS will share their written analyses for discussion with the SAC.

Community Input: Additional Soil Treatability Studies

Following the Agencies' agreement to conduct additional soil treatability studies for Zone 1, EPA and DHS prepared discussion papers on the purpose and objectives of the studies. EPA's Office of Research and Development (ORD) is providing technical expertise and analysis to assist the Agencies in determining the implementability, costs, long-term and short-term effectiveness, and reduction in contaminant toxicity, mobility, and volume (TMV) of the soil technologies being considered. The information gained from these treatability studies, along with the alternatives currently in the draft FS report, will be evaluated by EPA and DHS (using the nine superfund criteria described under

"Summary of Comparative Analysis") in making the final remedial decision for the Zone 1 area. The treatability studies process is currently under discussion between EPA, DHS, and the community.

Information Repositories

Documents issued for public comment, such as the draft RI/FS reports, proposed plans, and other information relevant to the Stringfellow site remediation and decision-making process are routinely transmitted to and made available for inspection at a number of information repositories located in Riverside and Orange Counties. The Administrative Record for this ROD will be located at EPA's offices in San Francisco, DHS' offices in Sacramento, and the Glen Avon Branch Library.

Responsiveness Summary

During public comment periods and associated public meetings, residents, elected officials, community organizations, the community technical advisor, and the PRPs submitted comments on the draft RI report, draft FS report, and two proposed plans. The attached responsiveness summary responds to those comments relevant to the remedial decisions selected in this ROD.

SCOPE AND ROLE OF RESPONSE ACTIONS IN THIS ROD

The primary pathway of concern for the response actions selected in this ROD is groundwater. As described in the Community Groundwater Proposed Plan, the ROD incorporates the decision to remediate the site-related contaminated plume of groundwater in the community area (Zone 4). In addition, the ROD selects two source control measures for Zone 1 identified in the Overall Proposed Plan: 1) dewatering, and 2) field testing of soil-vapor extraction (SVE). These interim response actions are limited in scope, and after the RI/FS and additional soil treatability studies are completed, will be followed by selection of the final site remedy. Accordingly, while the Agencies have identified certain contaminant-specific remediation goals in this ROD, cleanup levels for the site as a whole cannot be finalized until the long-term plume management of the zones is decided. The response actions selected for Zone 4 in this ROD are, therefore, interim decisions, although the Agencies do not envision any additional selection of cleanup technologies for this zone.

SUMMARY OF SITE CHARACTERISTICS

This section summarizes information in the draft RI report that is relevant to the remedial actions considered in this ROD.

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.

Groundwater contamination extends from Zone 1 into the community of Glen Avon, Zone 4, as shown in Figure 3. The leading edge of the contaminant plume is defined by the presence of trichloroethylene (TCE) in groundwater, and is approximately 11,000 to 12,000 feet south-southwest of Zone 1 at the intersection of Agate Street and Jurupa Road in Glen Avon. The plume width in the Glen Avon area is up to 900 feet.

Zone 1

The soil/fill material in Zone 1 is contaminated with a variety of chemicals, including chlorinated solvents, pesticides, PCBs, heavy metals, acidic materials, and volatile and semi-volatile organic pollutants. The predominant organic contaminant identified in Zone 1 soils is para-chlorobenzene sulfonic acid (p-CBSA), a by-product of DDT manufacturing. Volatile organics (e.g., TCE and chloroform) constitute less than 1 percent of the soil contaminant mass. Metals such as nickel, chromium, and cadmium are present. Sulfates are also found in high concentrations.

The inorganic and organic contaminants which have migrated from the soils into the groundwater in this zone, and which constitute the greatest percentage of the contamination, are the sulfates and p-CBSA, respectively. Based on available information and studies, p-CBSA is not considered to be toxic to human health. Sulfates can be harmful in high concentrations. Metals, such as cadmium, chromium, and nickel, and VOCs, such as chlorobenzene, chloroform, and trichloroethylene are also found in the Zone 1 groundwater. The VOCs constitute less than 1 percent of the dissolved organic carbon in the groundwater, but many individual components exceed federal/state drinking water levels. Mean concentrations of at least eight inorganic constituents and nine organic constituents exceed federal maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs),

maximum contaminant level goals (MCLGs), or adjusted ambient water quality criteria (AWQC): cadmium, chromium, copper, fluoride, iron, manganese, nitrate, zinc, chlorobenzene, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethylene, 1,1,2,2-trichloroethane, tetrachloroethylene, trichloroethylene, and xylene.

Groundwater contamination is prevalent in all three groundwater strata (alluvium, decomposed granite, and bedrock) in Zone 1.

Zone 4

The draft RI report found that in Zone 4, the only site-related organic groundwater contaminant that exceeds federal maximum contaminant levels (MCLs) for drinking water is TCE. The federal MCL is 5 ug/l. TCE, as measured in 1985 and 1986 and reported in the draft RI report, reached as high as 436 ug/l in this zone. At the plume's leading edge (Agate and Jurupa Streets) TCE was detected at less than the MCL.

Chloroform is also found in excess of health-based levels. In the absence of a federal MCL specific to chloroform, the Agencies are looking to the concentration, 6.0 ug/l, associated with an excess cancer risk of 10^{-6} as the level that is protective of human health. This concentration coincides with the State of California's Action Level. Chloroform concentrations as measured in 1985 and 1986 and reported in the draft RI report, reached as high as 32 ug/l in the Zone 4 plume.

Other dissolved organic contaminants measured above background in Zone 4 include chlorobenzene, 1,2-dichlorobenzene, and p-CBSA. With respect to the first two contaminants, the levels found in the groundwater are lower than proposed federal MCLs (the proposed MCL for chlorobenzene is .1 mg/l and for 1,2 dichlorobenze is .6 mg/l). There are no standards or guidelines for p-CBSA, but as discussed earlier, p-CBSA has not been determined to be toxic to human health.

With respect to inorganic compounds, the findings of the RI indicate that there is no heavy metal contamination in Zone 4 groundwater. As pH increases, heavy metals in the groundwater precipitate from solution or react with aquifer materials approximately 1,000 feet downgradient of the subsurface barrier in Zone 1. The inorganic contaminants found in the downgradient zones are sulfates and nitrates. Within the plume of contaminated groundwater, concentrations of these contaminants are

as much as 4 to 5 times higher than within the surrounding aquifer. Plume concentrations of nitrates and sulfates exceed the federal MCL and proposed MCL, respectively. With respect to nitrates, currently available data indicate that anthropogenic background levels in the community area also are elevated and exceed the federal MCL.

The contaminants in Zone 4 are predominantly confined to the alluvium (uppermost) groundwater stratum. Groundwater contamination underlying the community can be described three dimensionally as a relatively narrow plume, increasing from approximately 300 to as much as 900 feet wide, and extending to as deep as 100 feet below the surface. TCE contamination has migrated 11,000 to 12,000 feet southwest of Zone 1, and is migrating at an approximate effective rate of 250 feet per year (assuming that groundwater and its dissolved TCE are moving at the same rate).

Zone 4 is highly populated, and contains private residences with operable water wells. Few private wells have been found to be contaminated, and none are presently used for drinking water.

SUMMARY OF SITE RISKS

The baseline risk assessment conducted as part of the RI examined human ingestion of contaminated groundwater and surface water, ingestion of contaminated soil, and inhalation of airborne contaminated soil particles and volatile compounds. Because this ROD focuses on remedial actions affecting the groundwater pathway, the risk assessment findings for this pathway alone are summarized.

Groundwater Pathway

The findings of the RI risk assessment indicate that the exposure pathway of primary concern is the potential human exposure to contaminated groundwater. As discussed earlier, the groundwater beneath Zone 1 is contaminated with a large number of soluble organic and inorganic contaminants, including heavy metals. Moving southward along the plume to Zone 2, the groundwater is moderately to heavily contaminated with soluble, volatile organics and soluble inorganics. In this zone, the heavy metals begin to rapidly decrease and become neglible before entering Zone 3. The Zone 3 groundwater is minimally to moderately contaminated with soluble, volatile organics, principally TCE and chloroform, and soluble, inorganics, principally nitrates and sulfates. At the downgradient end of the plume in Zone 4, the

concentrations of the carcinogenic compounds (principally TCE and chloroform), and of the inorganic compounds (principally nitrates and sulfates) have significantly decreased from Zone 1.

Contaminants of Concern

TCE and chloroform were selected as the basis for the public health evaluation of the groundwater exposure pathway because they are the only carcinogenic chemicals found above federal MCLs or health-based levels in the community plume, and thus presented the greatest human exposure risk.

Exposure Assessment

The Stringfellow plume of contaminated groundwater lies within the Glen Avon Basin aquifer. The aquifer is not currently used as a drinking water supply for local residents. However, it is considered to a be a potential source of drinking water and is located within a groundwater subbasin (Chino III) with Class I characteristics.

Toxicity Assessment and Health Effects

TCE has a relatively low acute toxicity, but exposure to high doses can cause central nervous system depression, long-ter neurological effects, dermatitis, and peripheral neuropathy. TCE is a probable human carcinogen and a proven animal carcinogen. Chloroform can cause nausea, dizziness, and acute central nervous system depression, as well as chronic liver and kidney damage. This substance has been listed as a probable human carcinogen by EPA.

Cancer potency factors have been developed by EPA's Carcinogenic Assessment Group for estimating the excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. The cancer potency factor, expressed in units of $(mg/kg/day)^{-1}$, is multiplied by the average intake of a potential carcinogen to provide an estimate of the upper bound lifetime excess cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative nature of the risks calculated from the cancer potency factor, which are unlikely to underestimate the actual cancer risk. The cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which uncertainty factors have been added. The cancer potency factor for TCE is 1.1×10^{-2} $(mg/kg/day)^{-1}$. The cancer potency factor for chloroform is 8.1×10^{-2} $(mg/kg/day)^{-1}$.

The toxicity of nitrate in humans is due to the body's reduction of nitrate to nitrite. This reaction takes place in saliva of humans at all ages and in the gastrointestinal tract of infants during the first three months of life. The toxicity of nitrite is demonstrated by vasodilatory/cardiovascular effects at high dose levels and methemoglobinemia at lower dose levels. Methemoglobinemia is an effect in which hemoglobin is oxidized to methemoglobin resulting in asphyxia. Infants up to 3 months of age are the most susceptible subpopulation with regard to nitrate. 50 Fed. Reg. 46973 (November 13, 1985).

There is no evidence of adverse chronic health effects in animals or humans from exposure to sulfate in drinking water, 50 Fed. Reg. 46979 (November 13, 1985). The only adverse effects noted from exposure to high levels of sulfate are diarrhea and dehydration. Infants appear to be more sensitive to sulfate than adults. There are limited data on the acute effects of sulfate. Information compiled from questionnaires indicated that at concentrations of sulfate above 1,000 mg/l, the majority of respondents noted a laxative effect. Animal studies suggest that sulfate is not mutagenic, carcinogenic or teratogenic in mammals. 55 Fed. Reg. 30382 (July 25, 1990).

Risk Characterization

The risk characterization quantifies potential risks to human health in the event that the contaminated plume of groundwater is used as a residential source of drinking water. The site-specific risk values are estimated by incorporating information from the exposure assessment and the toxicity assessment for the identified contaminants of concern. Excess lifetime cancer risks are determined by multiplying the intake or exposure level by the cancer potency factor.

Although no one is currently using the contaminated plume of groundwater as a domestic water supply, ingestion of the groundwater currently underlying the community zone (Zone 4) is associated with an excess cancer risk of approximately 10^{-4}. This risk increases by two orders of magnitude to approximately 10^{-2} moving upgradient from Zone 4 to Zone 1.

The exposure assumptions of the risk assessment---that an individual weighing 70 kilograms will drink 2 liters of water per day for 70 years---were used to calculate the risks associated with use of this water in the community by current and future residents. In addition, the risk calculation incorporated a range of concentrations representing the maximum and minimum

measured levels for TCE and chloroform.

Another indication of risks associated with human use of the contaminated plume of groundwater is comparison to health-based ARARs, such as MCLs, MCL goals, and State action levels. Plume concentrations are greater than ARARs for TCE, chloroform, nitrates, and sulfates.

Zone 1 Risk Reduction

The principal threat from Zone 1 derives from the presence of a large mass of water-soluble contaminants that can migrate and contaminate downgradient groundwater. Water-soluble contaminants above health-based levels which have migrated the farthest are the volatile organic compounds (VOCs), principally TCE and chloroform, and two inorganic compounds, nitrates and sulfates. Although VOCs represent less than one per cent of the mass of contaminants present in Zone 1, they are significant because of their relative mobililty, and because they are the major toxic organic contaminants found in the downgradient groundwater plume.

Zone 4 Risk Reduction

Response action in the community area is necessary to reduc the human health risk from contaminants in the plume of groundwater to levels that are protective of human health. Response action is also expected to prevent the further migration of the contaminated groundwater plume. Without remediation, continued plume migration could further contaminate the Glen Avon aquifer, as well as parts of the larger Chino III subbasin. Additional risks exist from exposure to contaminated groundwater through ingestion and, to a lesser extent, through dermal contact and inhalation of volatilized chemicals.

DESCRIPTION OF ALTERNATIVES

The following sections discuss the alternatives considered for response actions in Zones 1 and 4. The description of the alternatives, as well as the summaries of the comparative analysis, reflect the interim and limited nature of the Agencies' response action decisions in this ROD.

Zone 1

Dewatering

Active dewatering of the Zone 1 area is expected to reduce the threat of further contamination of groundwater, and to remove substantial amounts of VOCs and other water-soluble, mobile contaminants currently in the groundwater. Lowering the water table in Zone 1 is also expected to reduce the long-term health risks by decreasing the volume and mobility of VOCs and other soluble contaminants. Dewatering will serve to prepare the subsurface for soil-vapor extraction (SVE) and/or other treatment technologies that may, as a result of currently ongoing treatability studies, be selected in the final ROD.

Dewatering: No Action Alternative

The "no action" alternative involves no further effort to control the source or the migration of site-related groundwater contamination underlying Zone 1. Inaction with respect to Zone 1 groundwater will lengthen the time to achieve cleanup in all downgradient zones.

Dewatering: Gallery Drainage Tunnel (Adit) System

As described in the draft FS report, one way to dewater Zone 1 is through a gallery drainage tunnel, or adit. The oval-shaped tunnel would be routed around Zone 1 and be constructed in competent bedrock. The gallery would include two sets of drain holes drilled laterally, one set to drain contaminated groundwater from beneath the site, and one set to redirect uncontaminated groundwater away from the site. The drained water would be piped to the existing mid-canyon pretreatment plant for removal of metals and organic compounds. The treated effluent would then be transported to the Santa Ana Regional Interceptor (SARI) where it would be piped to a POTW for further treatment.

Using the gallery system, initial dewatering to bedrock is anticipated to take one year, and to remove over 50% of the soluble organics and inorganics estimated to be present in the Zone 1 groundwater. Depending upon the Agencies' final remedial decision for Zone 1, maintaining the lowered water table level could be required in perpetuity. The estimated costs from Appendix A to the draft FS report, are presented, below.

Capital cost:	$ 27,000,000
Operations/Maintenance (first year):	500,000

Dewatering Surface Extraction Wells

Another way to dewater Zone 1 is through a series of groundwater extraction wells. Depending upon the cumulative extraction rates of these wells and drawdown characteristics, wells would iteratively be added to the dewatering matrix. Installation, followed by a review of effectiveness, would guide the location and placement of subsequent wells. Based upon the estimates of well yields and spacings required by the rock structure and the continuity of the fracture system, the draft FS report conceptualized a total of 18 to 36 wells. The actual number of wells, however, may not be confirmed until most or all of the wells have been installed and the system has been tested. The extracted groundwater would be treated at the existing mid-canyon pretreatment plant, transported to the SARI line, and, ultimately, to a POTW for further treatment.

As with the gallery system, initial dewatering to bedrock is anticipated to take one year, and to remove over 50% of the soluble organics and inorganics estimated to be present in the Zone 1 groundwater. Depending on the outcome of the Agencies' final remedial decision for Zone 1, maintaining the lowered water table level could be required in perpetuity. The revised estimated costs, including costs associated with maintaining the dewatering system in perpetuity, are presented, below.

Capital cost:	$ 4,000,000
Present Worth (7% discount rate):	47,000,000

Zone 4

Cleanup of the site-related contaminated groundwater in the community area (Zone 4) is a component of all remedial alternatives (RAs) evaluated in the FS report, except for the "no action" alternative.

Zone 4 Groundwater Cleanup: No action

This alternative involves no further action to clean up the site-related contaminated groundwater in the community area, or to prevent the further migration of the contaminant plume.

Zone 4 Groundwater Cleanup: Extraction, No Treatment, Disposal to SARI

This alternative involves extracting contaminated water from wells placed in the Zone 4 plume. As the contaminated water is extracted, uncontaminated groundwater from the surrounding aquifer will naturally flush the plume clean over time. The extracted groundwater would be discharged to the SARI industrial sewer line via an anticipated 15-mile pipeline, extending from Zone 4 to the sewer drop point. The chemical quality of the extracted water would be expected to be within the present quality limits of the industrial sewer discharge permit for the mid-canyon pretreatment plant, and therefore should not require further treatment. If the extracted water exceeds the water quality limits of the discharge permit, or if discharge to the industrial sewer is not permitted without treating the VOCs, the VOCs would be removed prior to disposal. For purposes of estimating costs, air stripping was assumed to be the treatment technology for removing VOCs.

Currently, under the SAWPA permit a maximum volume of 187,000 gallons per day can be discharged to the SARI line. The discharge permit would likely have to be modified to allow for the much larger volume expected to be generated by implementing this alternative.

Based upon a revised flow rate of 160 gpm, this alternative is estimated to reduce TCE to the federal MCL of 5 ug/l in approximately 75 years. The estimated costs are shown, below.

Capital costs (pipeline extension, no treatment):	$ 11,000,000
Present Worth (7% discount rate):	48,000,000
Capital costs (pipeline extension, air stripping):	$ 12,000,000
Present Worth (7% discount rate):	52,000,000

Zone 4 Groundwater Cleanup: Extraction, Treatment, Reinjection

As with the previous alternative, this alternative involves extracting contaminated groundwater along the Zone 4 plume. Unlike the previous alternative, this alternative involves replacement of the extracted and treated groundwater by reinjection along the periphery of the contaminant plume. The extraction and reinjection wells would be located and operated in a way to keep the existing contaminated groundwater plume hydraulically contained. A closed system would be sought in which contaminated

groundwater flow is from less contaminated toward more contaminated groundwater.

Pending confirmation by design studies, this alternative is envisioned to involve the following processes:

- Extraction of contaminated groundwater.
- Treatment to remove volatile organic contaminants (air stripping).
- Treatment to remove inorganic contaminants prior to reinjection (reverse osmosis (RO)).
- Reinjection of treated water along the periphery of the plume.
- Disposal of RO concentrate to the SARI line.

Reinjection of the treated water is expected to hasten clean up of the Zone 4 plume by a factor of three. The SAWPA permit may need to be modified to allow for an increased volume that could be generated by implementing this alternative. Based on a revised flow rate of 430 gpm, the estimated costs of this alternative are provided, below.

Capital costs (air stripping, RO, pipeline extension):	$ 19,000,000
Present Worth (7% discount rate):	$ 68,000,000

DESCRIPTION OF ALTERNATIVES: COMPLIANCE WITH OTHER LAWS AND ARARs

Under Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. section 121(d), remedial actions must attain a degree of cleanup that assures protection of human health and the environment. Additionally, remedial actions that leave any hazardous substance, pollutant, or contaminant on-site must meet a cleanup level or standard of control that at least attains federal and more stringent state standards, requirements, criteria, or limitations that are "applicable or relevant and appropriate" under the circumstances of the release. These requirements, known as "ARARs", may be waived in certain instances. CERCLA section 121(d)(4). To be considered as ARAR, a requirement must be promulgated, 40 C.F.R.section 300.400(g)(4); be sub-

stantive rather than administrative, 55 Fed. Reg. 8756-57 (March 8, 1990); and be a requirement of an "environmental" law as provided in CERCLA section 121(d)(2)(A)(i).

"Applicable" or "relevant and appropriate" requirements are defined fully in the revised National Contingency Plan (NCP), 55 Fed. Reg. 8666-8865 (March 8, 1990), 40 C.F.R. Part 300. In sum, "applicable" requirements are those standards, criteria, or limitations promulgated under federal or state environmental law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Where a promulgated standard, criteria, or limitation is not directly applicable, it may be "relevant and appropriate" if, in the exercise of the Agencies' discretion, it addresses problems or situations sufficiently similar to those encountered to be well-suited to the particular site.

ARARs may be (a) "chemical-specific," which are generally health- or risk-based numerical values or methodologies that set limits upon concentrations of specific contaminants in the environment; (b) "location-specific," which are generally restrictions upon certain types of activities because of existing site characteristics (e.g. wetland, floodplain, historic site); or (c) "action-specific", which are technology or activity based restrictions triggered by the type of remedial action under consideration. In addition to ARARs, EPA or the State may, as appropriate, identify other advisories, criteria, or guidance, whether or not promulgated, to be considered for a particular site. While not mandatory, the Agencies may identify and rely upon TBCs, as they are known, to assist in determining what cleanup level is protective or to otherwise assist the design of Superfund remedies.

The response actions considered and selected in this ROD are interim measures designed to mitigate site-related risks to human health and the environment and prevent further groundwater degradation. Accordingly, the ARARs discussion below focuses primarily upon compliance with those ARARs and environmental requirements specific to the interim actions selected. At the time the Agencies finalize remedial action decisions for the site, compliance with ARARs and final selection of cleanup levels will be fully addressed.

Zone 1: Compliance With Other Laws and ARARs

ARARs

For the action of dewatering, the federal Clean Water Act's pretreatment standards, authorized under section 307(b), 33 U.S.C. section 1317(b), and 40 C.F.R. Part 403; and the National Pollutant Discharge Elimination System (NPDES) standards, under section 311, 33 U.S.C. section 1317, are applicable to the off-site discharge of treated water to the SARI sewer line. Those standards applicable are currently set forth in the SAWPA permit governing effluent discharges from the existing mid-canyon pretreatment plant. Disposal of the extracted water from the dewatering system will be in compliance with the existing permit standards and any relevant modifications. There are no location-specific applicable or relevant and appropriate requirements pertinent to the interim actions considered for Zone 1 because it is not within 200 feet of a fault nor within a 100-year floodplain.

Recently EPA promulgated land disposal restrictions, including treatment standards for the Third Third scheduled wastes under the Resource Conservation and Recovery Act, 42 U.S.C. sectic 6924 (m) and 40 C.F.R. Part 148 (55 Fed. Reg. 22520-720 (June 1, 1990)). The Agencies are currently evaluating these standards and are aware that they may be applicable to the disposal of the treatment sludge at the pretreatment plant. While compliance with the Third Third, if necessary, may increase the costs of disposal associated with the dewatering alternative, the Agencies' preliminary analysis indicates there will be no effect upon the decision to dewater Zone 1.

Identification and selection of final cleanup levels for the chemical contaminants in the soil and groundwater in Zone 1 will be made at the time final remedial actions are selected for the Zone. Dewatering Zone 1 neither precludes achieving, nor is inconsistent with meeting, any chemical-specific cleanup levels that may be chosen for site-related contaminants in Zone 1.

Zone 4: Compliance With Other Laws and ARARs

ARARs

No location-specific ARARs have been identified for the action alternatives considered for Zone 4 groundwater cleanup.

For the first alternative (extraction, no treatment, disposal to the SARI), the Clean Water Act pretreatment and NPDES standards, as discussed above under the dewatering alternative, are applicable to the disposal of the extracted water to the SARI. These standards, as currently set forth in the existing SAWPA permit, are likely to require modification because of the expected increase in discharge volume associated with this alternative. This alternative, if implemented, will comply with applicable permit standards, including any necessary modifications.

For the second alternative (extraction, treatment, reinjection), the Agencies have identified potential ARARs for both treatment and reinjection. With respect to air stripping, the extracted water will be treated at the mid-canyon pretreatment plant to meet the federal drinking water MCL for TCE (5.0 ug/l) and the 10^{-6} risk level for chloroform (6.0 ug/l). In addition, the South Coast Air Quality Management District's (SCAQMD) Regulation XIII, federally enforceable under the Clean Air Act section 110, 42 U.S.C. section 7410, is applicable to emissions of VOCs from new sources. The SCAQMD recently promulgated a more stringent version of Regulation XIII that is applicable. Regulation XIII requires best available control technology (BACT) when incremental emissions of various air pollutants, including volatile organic compounds, exceed a certain threshold.

An additional guideline to be considered (TBC) for air is the SCAQMD's Rule 1167. Because a recent court ruling stayed enforcement of the Rule, it is not considered ARAR. Nevertheless, the purpose of the Rule is to control emissions of VOCs as precursors to ozone formation in the South Coast Basin, where the Stringfellow site lies. The Rule requires that all air stripping facilities treating contaminated groundwater that emit more than one pound per day of total VOC emissions install controls capable of reducing air emissions by 90 percent. Consideration of Rule 1167 in addition to the SCAQMD's Regulation XIII VOC emissions standards is warranted by, and consistent with, EPA OSWER Directive 9355.0-28, "Control of Air Emissions From Superfund Air Stripers at Superfund Groundwater Sites." In nonattainment areas like the South Coast Air Basin, which is acknowledged to have the worst ambient air quality in the nation, the Directive seeks to incorporate the use of controls for air strippers. Consequently, the air stripping treatment system will employ activated carbon adsorption at the air-stripper off-gas to meet ARARS and control VOC air emissions.

For the action of reinjection, the Underground Injection Control (UIC) program with respect to Class V Wells, pursuant to the Safe Drinking Water Act and 40 C.F.R. Part 144, Subpart B, and the California Regional Water Quality Control Board's "Water Quality Control Plan, Santa Ana River Basin" (Basin Plan) provide the interim action ARARs for TCE, nitrates, and sulfates. The UIC program requires that reinjection into Class V Wells, such as those at the site, may not cause a violation of an existing drinking water standard (MCL) under the SDWA, in this case 5 ug/l for TCE and 10 mg/l as N for nitrates. With respect to nitrates, the California Basin Plan's water quality objective of 11 mg/l as N is the State standard directly applicable to the reinjection of nitrates. Nitrate concentrations in the receiving formation are believed to exceed the drinking water standard, and thus reinjection of treated water should not cause a violation of the SDWA requirements under the UIC program. Nevertheless, the UIC standards are relevant to potential underground sources of drinking water and appropriate action ARARs under the circumstances where the effectiveness of the technology considered for removal of nitrates is anticipated to produce injectate that meets or exceeds either the UIC level of 10 mg/l, or the applicable Basin Plan objective of 11 mg/l. Consequently, both TCE and nitrates will be reinjected at the UIC program levels (5 ug/l and 10 mg/l as N, respectively).

In the absence of a federal standard for sulfates the California Basin Plan's water quality objective of 110 mg/l is directly applicable to the action of reinjection. Treated water from the Zone 4 extraction system will be reinjected at the Basin Plan objective.

Remediation Goals

The Zone 4 response action decisions made in this ROD are considered interim for the reasons noted below. Nevertheless, the Agencies do not expect to select further Zone 4 response actions beyond those chosen in this ROD. The Agencies are, therefore, identifying remediation goals for the contaminants found in the Zone 4 groundwater. The remediation goals, although being set here for Zone 4 plume cleanup, will not be finalized until the decision for long-term management of the contaminated groundwater in all downgradient zones is made.

Identification of remediation goals in this ROD for the community area (Zone 4) is based upon CERCLA's objective of restoring and protecting usable groundwater to the extent possible. The Stringfellow plume is located within the Chino III subbasin,

which is a Class I aquifer having the potential for, and designated use as, a potential source of drinking water. Under these circumstances, the NCP indicates that the Agencies should look to the maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) under the Safe Drinking Water Act (SDWA), 42 U.S.C. section 300f, as potential cleanup levels. While these standards are not directly applicable because the community residents are not currently relying upon the groundwater as a drinking water source, they are relevant and appropriate health-based standards. In the absence of a federal standard, the Agencies looked to more stringent state standards or, if unavailable, a concentration based upon a 10^{-6} carcinogenic risk level.

The only site related organic contaminants in Zone 4 that were found in excess of health-based levels are TCE and chloroform. For TCE, the federal MCL and state promulgated standard are the same, at 5.0 ug/l. Although the MCLG for TCE is zero, EPA has determined that a zero-based MCLG is not appropriate as a remediation goal. Therefore, the Agencies have identified the remediation goal for TCE in Zone 4 as 5.0 ug/l.

While there is neither an MCL nor an MCLG specific to chloroform, there is a federal MCL of 100 ug/l for total trihalomethanes, which includes chloroform. The standard, however, is based on an analysis evaluating the health benefits of chlorinating public drinking water supplies against the detrimental effects of the production of trihalomethanes as a result of chlorinating those supplies. The Agencies, therefore, determined that the MCL for trihalomethane is not an ARAR for a nonchlorinated source such as the Stringfellow contaminant plume. Since no other ARAR was available, the concentration, 6.0 ug/l, associated with an excess cancer risk of 10^{-6} was identified as the cleanup goal for chloroform. This concentration coincides with the State of California Action Level. In identifying the goal, the Agencies have concluded that a chloroform concentration in the plume of 6.0 ug/l is appropriate for the circumstances of the Stringfellow site, and will be protective of human health.

Based on available data, the Agencies believe that the remediation goals for TCE and chloroform can be achieved. The Agencies do recognize, however, that recent studies by EPA suggest that groundwater extraction and treatment are not, in all cases, completely successful in reducing contaminants to health-based levels. If it becomes apparent during operation of the system, that contaminant levels have ceased to decline or are declining at a much slower rate than anticipated, and are remaining at levels higher than the remediation goal, such goal and/or

the selected remedy may be reevaluated at the discretion of the Agencies.

Both nitrates and sulfates are present in the Zone 4 contaminant plume. The federal MCL (10 mg/l as N) for nitrates has been identified as a potentially "relevant and appropriate" Zone 4 remediation goal. In the course of reviewing and evaluating the public comments on the Community Groundwater Proposed Plan and draft FS report, the Agencies have determined that setting such a cleanup goal presents a problem. While existing data indicate that nitrate levels within the plume exceed the federal MCL, the data also suggest that, in many locations, the background concentration of nitrates also exceed this standard. The situation raises questions as to the technical practicability of achieving a cleanup goal which is lower than background conditions. Based upon present knowledge, the Agencies are considering invoking an ARAR waiver to allow the remediation goal for nitrates to be set at background concentrations rather than at the federal MCL. Because the issue has not been the subject of focused discussion and public comment, the Agencies will defer finalizing the remediation goal for nitrates until after an opportunity for public input.

With respect to sulfates, the EPA has recently issued a proposed rule under SDWA which now identifies sulfate drinking water concentrations that pose a threat to human health. Prior to this proposal, sulfate concentrations were set as a non-enforceable secondary MCL for the aesthetic value of drinking water. The proposed rule is a potential ARAR, which will be considered in setting the final remediation goal for sulfates in the contaminant plume.

SUMMARY OF COMPARATIVE ANALYSIS

As noted previously, the remedial actions described in this ROD are interim measures. Accordingly, the comparative analysis between the interim measures considered here is limited to ensuring that the chosen alternatives are consistent with any potential final remedy and the Superfund criteria relevant to the interim measure being considered. The draft FS report provides additional detailed analysis of remedial aiternatives. To facilitate the interim analysis here, the nine criteria are identified, below.

Nine Superfund Criteria

1. Overall protection of human health and the environment.
2. Compliance with ARARs.
3. Long-term effectiveness.
4. Reduction of toxicity, mobility, and volume (TMV).
5. Short-term effectiveness.
6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

Zone 1

Dewatering: No Action

The "no action" alternative fails to meet criteria 1, 2, 3, 4, 5, 8, or 9. This alternative can be implemented, by inaction, at no cost.

Dewatering: Gallery versus Surface Extraction Wells

Both alternatives would meet ARARs, and the relevant technical criteria---reduction of TMV, short-term effectiveness, long-term effectiveness, and implementability. While the standards in the SAWPA permit must be met for dewatering, such standards are being consistently met by treatment of extracted water at the mid-canyon pretreatment plant. Continued compliance should not be affected by dewatering. Both alternatives would result in the removal of a significant volume of the soluble, mobile contaminants from the plume, including those of primary concern, VOCs. Dewatering will physically isolate remaining contaminants by eliminating the potential for groundwater transport. The extracted water would be treated at the existing pretreatment plant to remove metals and organics. Both dewatering alternatives can be implemented. Any necessary precautions to ensure short-term protectiveness would be taken during construction and implementation.

The capital costs associated with the gallery system are higher than those for the surface extraction wells. The community and State of California favor selection of dewatering through use of surface extraction wells.

Zone 4

Community Groundwater Cleanup: No Action

The "no action" alternative fails to meet Superfund criteria 1, 2, 3, 4, 5, 8, or 9. This alternative can be implemented, by inaction, at no cost.

Community Groundwater Cleanup:
1. Extraction, No Treatment, Disposal to SARI
2. Extraction, Treatment, Reinjection

Both alternatives meet the first six superfund criteria. Through continous extraction and treatment of contaminated groundwater from Zone 4, reductions in contaminant concentrations to the cleanup levels identified by the Agencies will be sufficiently protective of human health and the environment. Implementation of each alternative will meet action-specific ARARs and TBCs regarding use of air strippers. Contaminant volumes under either alternative will decrease without further degrading the surrounding aquifer.

Contaminant removal combined with treatment will provide long-term effectiveness and ensure short-term protection from ai adverse impacts on human health and the environment during construction and implementation. Consideration of implementability and cost shift the balance in favor of the second alternative. If a major modification of the SAWPA permit is not granted to increase allowable discharge of treated water, it may not be possible to implement the first alternative. With respect to costs, the first alternative appears to be less costly. If modeling indications of cleanup time are correct, the first alternative could take three times as long as the second alternative to achieve the remediation goals identified for Zone 4. Selection of the second alternative is favored by the State and the community.

THE SELECTED REMEDY

Zone 1

As an interim response action in Zone 1, the Agencies have selected dewatering using a matrix of surface extraction wells that would be iteratively installed throughout the Zone 1 area.

Initial dewatering to bedrock is anticipated to take one

year, and to remove over 50% of the soluble organics and inorganics estimated to be present in the Zone 1 groundwater. Depending on the outcome of the Agencies' final remedial decision for Zone 1, maintaining the lowered water table level could be required in perpetuity.

At this time, there are no remediation goals being set through this ROD for Zone 1. Implementation of this alternative would include compliance with all identified ARARs.

Zone 4

The Agencies also have selected as an interim response measure cleanup of the community groundwater through extraction, treatment, and reinjection.

Under the selected alternative, a number of wells would be installed along the centerline of the plume south of U.S. Highway 60 to extract contaminated groundwater. Additonal wells installed at the sides of the plume would reinject treated water to accelerate plume cleanup. An estimated extraction rate between 200 and 600 gallons per minute is expected. This rate and the feasibility of reinjection will be confirmed by field studies prior to final design and implementation.

If reinjection is feasible, the extracted water would be temporarily stored and piped to an air stripping unit, where TCE and chloroform in the water would be removed to meet concentrations of 5.0 ug/l and 6.0 ug/l, respectively. The treated water would then be put through reverse osmosis to reduce the nitrates and sulfates to acceptable levels (10 mg/l as N and 110 mg/l, respectively) prior to being reinjected.

The decision whether to use air stripping, as opposed to granular activated carbon, to remove VOCs is considered a design decision that will be confirmed through design studies. Similarly, use of reverse osmosis as opposed to another technology is subject to design studies. In lieu of reverse osmosis, the Agencies are also considering an offset through use of a Chino III subbasin desalter to remove nitrates and sulfates.

If reinjection is not feasible, the Agencies may pursue disposing of the extracted water (after treatment to reduce VOCs, and nitrates and sulfates, if necessary) through a sanitary or industrial sewer.

Field Tests and Studies

Soil-Vapor Extraction in Zone 1

This ROD includes a commitment to conduct a field test of soil-vapor extraction (SVE). Full-scale implementation of the technology will be pursued if the following conditions are met: 1) the results of the field test indicate that the technology can be successfully implemented at the site in a cost-effective manner; and 2) implementation of the technology will not be inconsistent with nor preclude the final response action taken in Zone 1. These determinations cannot be made at this time, but will be made by the Agencies during the development and implementation of the field test, and upon completion of the additional soil treatability studies. The decision whether to implement a full-scale SVE system will be documented at a later date.

If successful, soil-vapor extraction could further reduce the future migration of VOCs into the groundwater by removing them from the unsaturated soil above the water table. Such removal is anticipated to reduce the long-term health risks by decreasing the volume of VOCs in the soil, and thus the future volume of VOCs that could potentially migrate into the groundwater and be transported towards the downgradient community. SVE is anticipated to reduce the short-term health risk from emissions of VOCs during implementation of ex-situ soil treatment technologies, if chosen as part of the final remedy, and to hasten the remediation of Zone 1. Although VOCs represent less than one per cent of the mass of contaminants present in Zone 1, they are significant contaminants because of their relative mobililty and toxicity, and because they are the major organic contaminants found in the downgradient groundwater plume.

In-situ SVE involves a patented process whereby a vaccuum is placed upon wells in the ground above the lowered water table, forcing air to flow through the pore spaces of unsaturated contaminated soil. The above-ground support equipment would include blowers, water/gas separators, and vapor-phase activated carbon adsorption equipment. The extracted air would contain both volatile organics and moisture (water vapor), so a water/gas separator would be required to separate the moisture from the air. The small volume of water separated out of the water/gas separator would be conveyed to the existing mid-canyon pretreatment plant. The volatile contaminants in the vapor phase would be adsorbed onto the activated carbon, which would be regenerated.

The costs of a full-scale SVE system based on revised FS estimates are presented, below.

Capital costs:	$ 15,000,000
Present Worth (7% discount rate):	24,000,000

In pursuing a field test of SVE, ARARs will be met. For the SVE field test, the existing SAWPA permit, embodying the applicable standards under the Clean Water Act's federal pretreatment regulations, 40 C.F.R. Part 403, and its NPDES requirements, 33 U.S.C. section 1311, govern the off-site discharge of treated water to the SARI. The manifest requirements under the Resource Conservation and Recovery Act, 40 C.F.R. Part 262, are applicable to the off-site disposal of spent carbon to an approved regeneration facility. Finally, the VOC emissions standards under Regulation XIII, as federally enforceable under the Clean Air Act, and as enforceable by the State of California under it revised regulation, are applicable to the SVE field tests. Regulation XIII requires best available control technology (BACT) when incremental emissions of various air pollutants, including volatile organic compounds, exceed a certain threshold. Rule 1167 of the SCAQMD and EPA's OSWER Directive 9355.0-28 relating to the control of air emissions at Superfund groundwater sites will be considered to the extent they are suitable to VOC air emissions from the SVE process.

Reinjection of Treated Groundwater in Zones 2 and 3

Also included in this ROD is a commitment to conduct field studies on the reinjection of treated groundwater into Zones 2 and 3. The type of information expected to be gained from such studies include estimated costs, implementability, long-term effectiveness, short-term effectiveness, and reduction in contaminant toxicity, mobility, and volume (TMV). This information, along with information on community and state acceptance, protection of public health and the environment, and compliance with ARARs will be used by the Agencies in determining whether to implement reinjection in Zones 2 and 3. The decision to implement a reinjection system will be documented at a later date.

STATUTORY DETERMINATIONS

Zone 1

Dewatering

Dewatering of Zone 1 is an interim measure that offers an opportunity to reduce risk and prevent further degradation of downgradient groundwater. It does not preclude nor is it inconsistent with potential future remedial actions. During initial dewatering, all action-specific ARARs will be met. No location-specific ARARs have been identified. Remediation goals for Zone 1 are not being addressed by this ROD.

The dewatering process includes treatment at the existing pretreatment plant of the water-soluble contaminants in Zone 1, such as VOCs, other organics, and metals. Dewatering will reduce the risk of human exposure to contaminated groundwater in Zone 1 by extracting and treating most of the contaminated groundwater beneath the zone. Minimizing contact between the source contaminants and uncontaminated groundwater infiltrating into the area will greatly reduce the quantity of contaminants that could migrate downgradient from Zone 1. This is an important aspect of any final remedial decision for the site.

During construction and implementation of the dewatering system, there may be short-term potential for minimal increase of VOC air emissions from well vents, relief valves in force mains, or interim storage tank vents. Based on an analysis of potential air contamination health risks associated with the implementation duration, the excess lifetime carcinogenic risk from inhalation exposure in the community is approximately 2×10^{-8}, and in Pyrite Canyon approximately 2×10^{-6}. These are within the allowable range for excess cancer risk.

Dewatering using surface extraction wells is cost effective in that it provides substantive reduction in the volume and subsequent mobility of the soluble, mobile contaminants in Zone 1 at a cost reasonable to the level of protectiveness. The draft FS report estimates that over 50% of the aqueous-phase contaminant mass in Zone 1 will be removed during the initial period of dewatering.

There does not appear to be any threat to natural resources or any impact on the 100-year floodplain that would result from dewatering. According to a map included in the Riverside County Comprehensive General Plan, there are no unique plant communities

in the Glen Avon area. Nor are there endangered, rare, or threatened animal species near the Stringfellow site. Although several birds, mammals, reptiles, and amphibians have been seen in the vicinity of Pyrite Canyon, no significant, rare or unique permanent habitat in the vicinity of Highway 60 has been observed.

Zone 4

Community Groundwater Cleanup

During system operation, action-specific ARARs and TBCs will be met. There are no forseen unacceptable short-term risks or cross-media impacts that could be caused by its implementation.

The selected remedy is not estimated to be the least expensive alternative for cleaning up the community groundwater, but in light of the confidence levels associated with the cost estimates, the actual costs may not be significantly different than the alternative which involved extraction, no treatment, and disposal to the SARI. Because the Agencies anticipate the selected alternative will hasten the cleanup of Zone 4, the Agencies have determined that the selected response action is the more cost-effective of the alternatives considered.

The selected remedy will reduce the toxicity, mobility, and volume of Stringfellow-related contaminants in the affected community south of Highway 60. The remedy is the most appropriate solution as it also represents the maximum extent to which permanent solutions and treatment can be practically utilized in a cost-effective manner.

Under CERCLA's amended provisions, the statutory preference for treatment is satisfied by the selected remedy. The approaches taken for sidestream and residual management, to be confirmed by design studies prior to final design and implementation, will comply with all requirements.

During construction and implementation of the system, there may be short-term potential for minimal increase of VOC emissions into the air from well vents, relief valves in force mains, or interim storage tank vents. Based on an analysis of potential air contamination health risks associated with the implementation duration, the excess lifetime carcinogenic risk from inhalation exposure in the community is approximately 2×10^{-8}, and in Pyrite Canyon approximately 2×10^{-6}. These are within the acceptable range for excess cancer risk.

According to a map included in the Riverside County Comprehensive General Plan, there are no unique plant communities in the Glen Avon area. Nor are there endangered, rare, or threatened animal species near the Stringfellow site. Although several birds, mammals, reptiles, and amphibians have been seen in the vicinity of Pyrite Canyon, no significant, rare or unique permanent habitat in the vicinity of Highway 60 has been observed.

All of the actions in this ROD are supported by the State and the community.

CHANGES FROM AND CLARIFICATIONS TO THE PROPOSED PLANS

None of the changes and clarifications discussed below warrant public notice and comment, nor affect the remedies selected.

In response to comments on the draft FS report and the Community Groundwater Proposed Plan, estimated extraction rates in Zone 4 were recalculated and now appear to be significantly lower than previously believed. The lowered extraction rates affected the estimated cleanup times and costs for the alternatives being considered, and thus were recalculated. The revised estimates are reflected in the April 1989, "Stringfellow Update" newsletter and reference documents. Predicting the groundwater cleanup time is difficult and existing methods are inexact. Actual extraction rate and yield need to be confirmed through further collection and evaluation of field data.

The new estimated times for cleanup of the Zone 4 contaminant plume presented in this ROD are two to three times longer than those reflected in the Proposed Plan. However, the recalculations still show that the alternative chosen is anticipated to hasten cleanup in Zone 4. With respect to estimated costs, the new figures indicate that the alternative chosen is more costly. Cost figures were calculated using both 7 percent and 10 percent discount rates.

The Community Groundwater Proposed Plan did not mention the necessary first phase of the remedial design, which will involve collection and evaluation of field data in the contaminant plume. This task will enable a more accurate design of the remedial system. Installing prototype extraction wells in selected areas of the community plume, and performing short-term and long-term pumping tests, will provide valuable information on aquifer

characteristics and water quantity and quality to be extracted and treated. Based on this information, it may become necessary to make changes to the treatment and disposal process currently envisioned. The modifications will be made during detailed remedial design, and if warranted, will be documented at a later date.

The Community Groundwater Proposed Plan assumed that no treatment would be needed for the extracted water to be discharged to an industrial sewer, such as the SARI. This was based on the assumption that the chemical quality of the extracted water would be within the present quality limits of the SAWPA discharge permit. In case the extracted water is found to exceed the discharge permit water quality limit, or if discharge to the industrial sewer is not permitted without reducing VOC concentrations in the extracted water, the water would be treated for VOC removal prior to discharge. Thus the alternative with disposal to the SARI line has been evaluated in two different ways: (1) without using air stripping (no treatment), and (2) using air stripping before discharge to an industrial sewer. For both these subalternatives, cleanup time is still estimated to be approximately three times longer than the alternative selected. Therefore, addition of this subalternative did not alter the selection of the remedy.

The Community Groundwater Proposed Plan indicated that the State Action Level for chloroform (4.3 ug/l) would be set as the remediation goal. As discussed in this ROD, the remediation goal for chloroform has been identified as 6.0 ug/l. The concentration coincides with the new State Action Level, as well as EPA's 10^{-6} carcinogenic risk level.

With respect to nitrates and sulfates, the Community Groundwater Proposed Plan implied a number of things which subsequently have been clarified through this ROD. First, the response action in Zone 4 is on-site. Therefore, a permit from the Regional Water Quality Control Board is not required, although the substantive portions of the Basin Plan applicable to the response action will need to be met. Secondly, the Proposed Plan indicated that the cleanup (remediation) goal for nitrates would be the federal MCL. As discussed earlier, the Agencies are considering setting the goal at background by invoking a waiver based on the technical impractacability of meeting a cleanup standard which is lower than anthropogenic background conditions which currently are believed to exceed the federal MCL. Thirdly, with respect to sulfates, the Proposed Plan implied that the remediation goal would be set at the water quality objective

specified in the RWQCB's Basin Plan. Rather, in setting the remediation goal, the Agencies will consider the proposed EPA MCL for sulfates. If the rule is promulgated, the MCL will become ARAR.

The Overall Proposed Plan stated that soil-vapor extraction (SVE) would be implemented if a field test proved favorable. The ROD offers further explanation by clarifying that the Agencies are committed to full-scale implementation of SVE if the field test indicates that SVE could be successfully used at the site in a cost-effective manner, and that implementation of SVE would not preclude nor be inconsistent with the final remedial decision for Zone 1. These determinations cannot be made at this time, but will be made by the Agencies during the development and implementation of the test and upon completion of the additional soil treatability studies. The decision whether to implement SVE will documented at a later date.

The Overall Proposed Plan also implied that a ROD covering RA6 in its entirety would be issued by the Agencies. In response to community comment, and through issuance of this ROD, the Agencies have agreed to first pursue the dewatering and SVE aspects of RA6, and to combine these with the decision to remediate the groundwater plume in the community area. Long-ter continuation of downgradient plume management activities will be addressed in the final ROD.

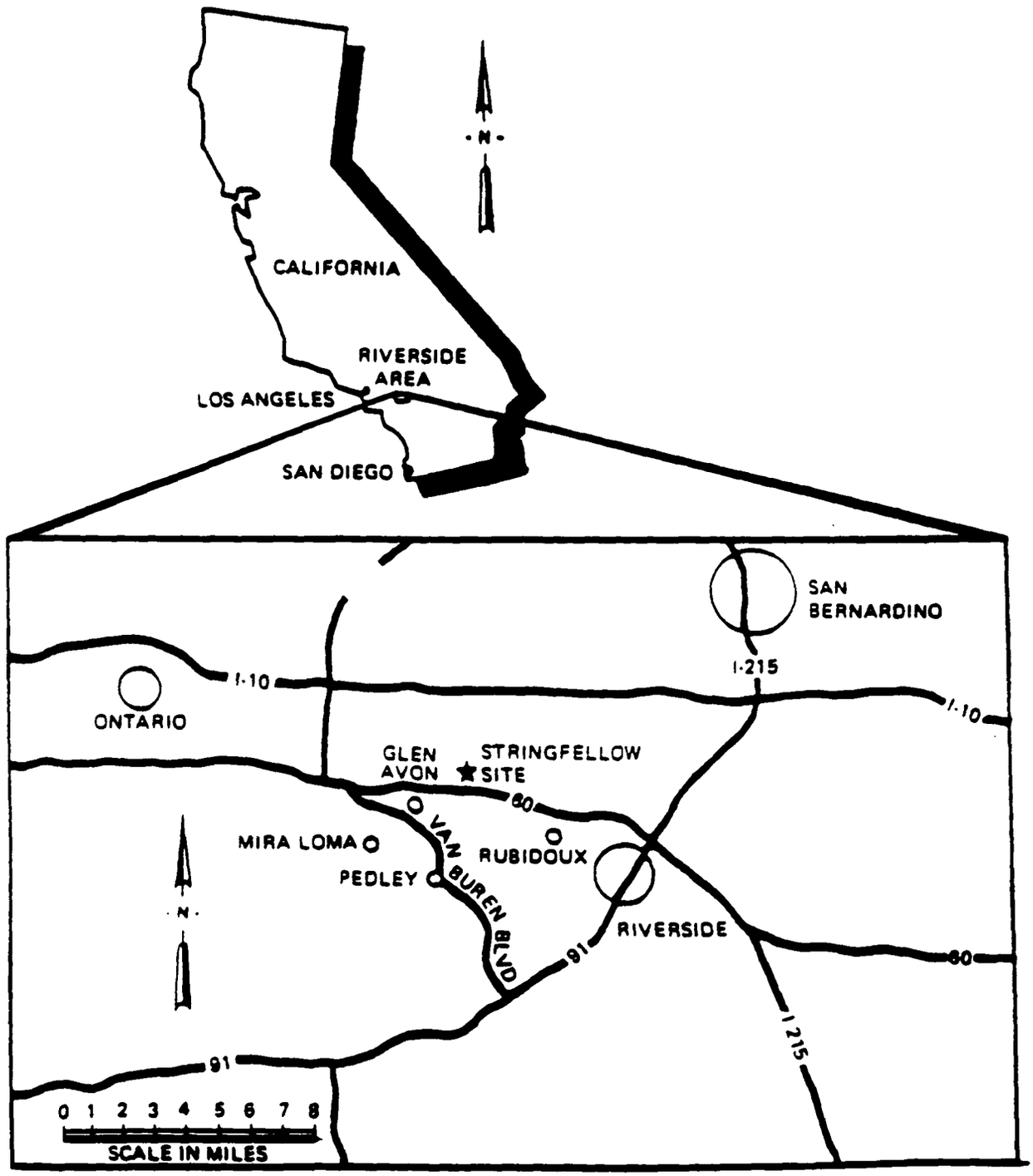
CALIFORNIA
RIVERSIDE AREA
LOS ANGELES
SAN DIEGO
N
SAN BERNARDINO
I-215
I-10
I-10
ONTARIO
GLEN AVON
STRINGFELLOW SITE
60
MIRA LOMA
VAN BUREN BLVD
RUBIDOUX
PEDLEY
RIVERSIDE
91
60
I 215
91
0 1 2 3 4 5 6 7 8
SCALE IN MILES

Figure 1

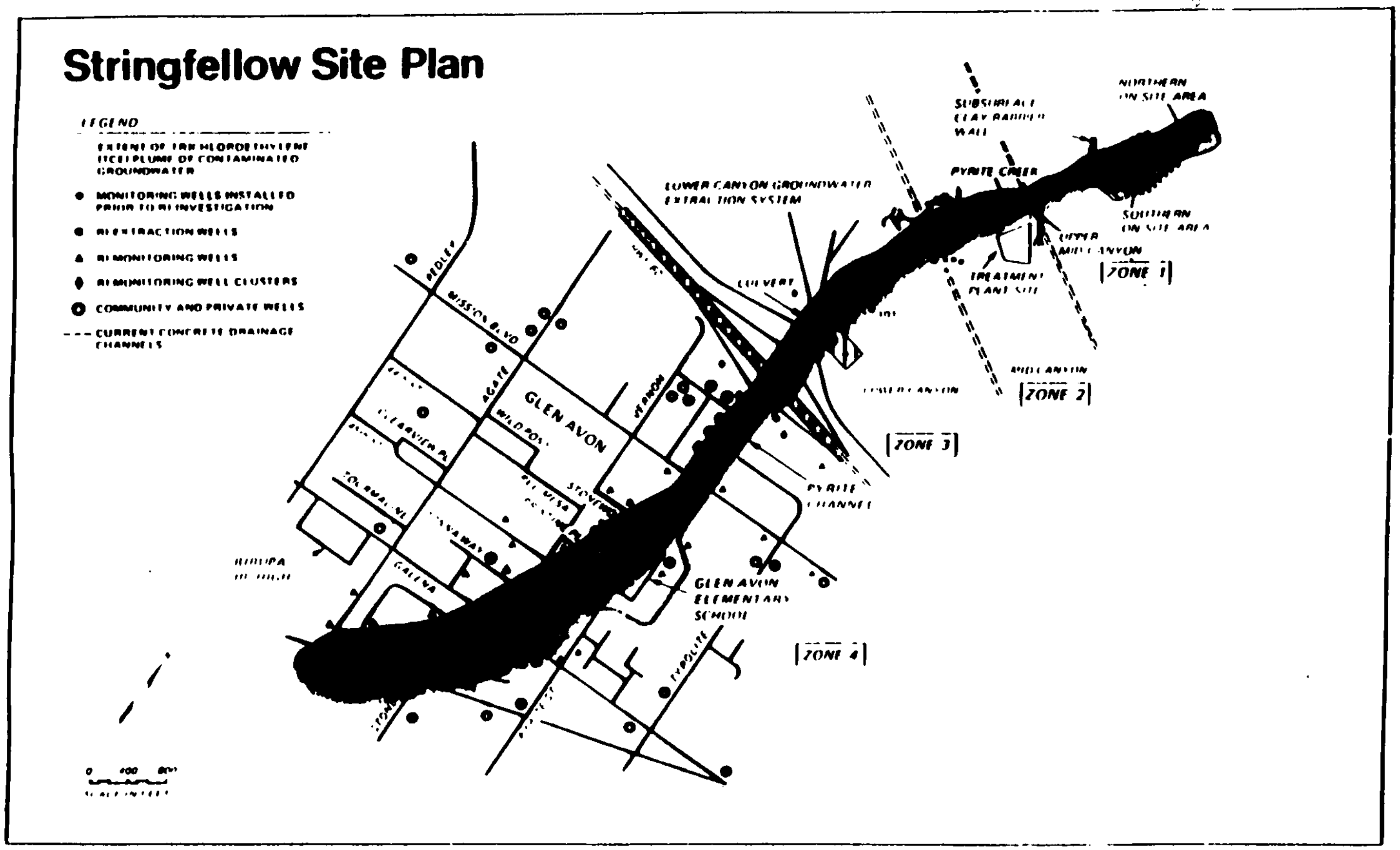
Stringfellow Site Plan
LEGEND
COMMUNITY AND PRIVATE WELLS
LOWER CANYON GROUNDWATER EXTRACTION SYSTEM
PYRITE CREEK
NORTHERN ON SITE AREA
SOUTHERN ON SITE AREA
CULVERT
GLEN AVON
MISSION BLVD
AGATE
VERNON
PYRITE CHANNEL
GLEN AVON ELEMENTARY SCHOOL
ZONE 1
ZONE 2
ZONE 3
ZONE 4

Figure 2