FIFTH FIVE-YEAR REVIEW REPORT FOR STRINGFELLOW SUPERFUND SITE RIVERSIDE COUNTY, CALIFORNIA

PREPARED BY

U.S. Army Corps of Engineers, Seattle District

FOR
U.S. Environmental Protection Agency
Region IX

Approved by: Date:

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Executive Summary

This is the fifth Five-Year Review (FYR) of the Stringfellow Superfund Site (Site). The purpose of this FYR is to review information to determine if the remedy is protective of human health and the environment.

The Site is located in the City of Jurupa Valley, (incorporating the community formerly known as Glen Avon), in Riverside County, California, approximately 50 miles east of Los Angeles. The original 17-acre Site is located in Pyrite Canyon in the Jurupa Mountains at the head of Pyrite Creek. From 1956 until 1972, the Stringfellow Quarry Company, Inc, operated a Class 1 hazardous waste disposal site at this location. During this period, more than 34 million gallons of liquid industrial waste, primarily from metal finishing, electroplating, and pesticide production, were deposited in approximately 20 unlined disposal ponds. As a result of these activities, the Site is contaminated with volatile organic compounds, semi-volatile organic compounds, pesticides, perchlorate, n-nitrosodimethylamine, 1,4-dioxane, para-chlorobenzene-sulfonic acid, salts, and heavy metals such as cadmium, nickel, chromium, copper, manganese, and zinc. Site contaminants of concern, as dictated by the Records of Decision (RODs), include TCE and chloroform. Groundwater contamination from the Site extends approximately 4.5 miles south towards the Santa Ana River.

Site remedial activities occur in four geographic zones, which include: Zone 1, On-Site/Upper Mid-Canyon Area; Zone 2, Mid-Canyon Area; Zone 3, Lower Canyon Area; and, Zone 4, Community of Glen Avon Area. Other more recently discovered source areas, denominated EPA Investigation Areas 1 and 2, are the subject of ongoing studies to be considered in future EPA remedial decisions.

Four interim RODs selected remedial actions for each of the four Zones. The remedial actions selected in the Zone 1 interim ROD, signed in July of 1983, included fencing, erosion control, interim source control, and off-site hauling and disposal of contaminated liquids. The remedial actions selected in the Zone 2 interim ROD, signed in July of 1984, included the construction of an on-site pretreatment plant to treat contaminated groundwater, the installation of an expanded groundwater extraction system in Zone 2. The remedial actions selected in the Zone 3 interim ROD, signed in June of 1987, included the installation of a groundwater barrier system and peripheral surface channels to direct upgradient, surface water runoff. The remedial actions selected in the Zone 4 interim ROD, signed in September of 1990, included the dewatering of the original disposal area (Zone 1), the installation of a groundwater extraction system in Zone 4, field-testing of soil vapor extraction, and field-testing of treated groundwater reinjection in the upper canyon area.

As of April 2016, all of the remedies selected in the four interim RODs are implemented and functioning as intended, although there are elements of the remedies, for example the groundwater extraction system in Zones 2 and 3, which require additional extraction wells and possible modification of pumping rates to ensure complete contaminant plume capture. Additionally, there are data gaps in the lateral and vertical extent of groundwater contamination within Zones 2 and 4 and EPA Investigation Areas 1 and 2 that require further investigation. Continuous optimization of the remedies is ongoing. The final Site-wide ROD completion date is currently 2021.

The selected interim remedies at the Stringfellow Superfund Site are protective of human health and the environment in the short-term because exposure pathways that could result in unacceptable risks are being controlled. However, to be protective in the long-term, the following actions should be completed:

1. Evaluate additional methods of dewatering and contaminant removal in Zone 1.
2. Evaluate the apparent hydraulic connection under the clay barrier between Zone A and Zone 1B.
3. Evaluate the possibility of further optimization and well placement in the areas with little to no capture or well coverage.
4. Collect soil gas samples from locations in Zone 4 that overlie TCE groundwater concentrations of 5 μg/L or greater and evaluate the risk of vapor intrusion within the two years.

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List of Abbreviations

µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
ARAR	applicable or relevant and appropriate requirement
Brine Line	Inland Empire Brine Line
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminants of concern
COPC	contaminants of potential concern
CWTS	Community Wellhead Treatment System
DGI	data gap investigation
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	feasibility study
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallon(s) per minute
HRA	health risk assessment
IC	institutional control
LCTF	Lower Canyon Treatment Facility
MCL	maximum contaminant level
MG	million gallons
mg/L	milligram(s) per liter
NDMA	n-nitrosodimethylamine
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OSWER	EPA, Office of Solid Waste and Emergency Response
PCB	polychlorinated biphenyl
pCBSA	para-chlorobenzene-sulfonic acid
PCTF	Pyrite Canyon Treatment Facility
POTW	publically owned treatment works
PTP	pretreatment plant
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RSL	regional screening levels
RWQCB	Regional Water Quality Control Board
SAP	sampling and analysis plan
SARI	Santa Ana Regional Interceptor
SAWPA	Santa Ana Watershed Project Authority
SLERA	screening level ecological risk assessment
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TCE	trichloroethylene
TTHM	total trihalomethanes
TVOC	total volatile organic compounds

USACE	U.S. Army Corps of Engineers
USC	United States Code
USGS	U.S. Geological Survey
VOC	volatile organic compound

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1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. FYR reports also include progress made in addressing previous FYR recommendations, outline planned and completed work, provide a technical summary of the remedy, review data related to the performance of the remedy, and provide an overall protectiveness statement about the remedy. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, 40 Code of Federal Regulation (CFR) Section 300.430(f)(4)(ii) of the National Contingency Plan and EPA policy.

This is the fifth FYR for the Stringfellow Superfund Site (Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

Daewon Rojas-Mickelson of EPA, Region IX, led the Site FYR. Participants included David Clark, Michael Kulbersh, Aaron King, and Miriam Gilmer of the U.S. Army Corps of Engineers, Seattle District, as well as Cynthia Wetmore and Viola Cooper of EPA, Region IX. The review began on October 28, 2015.

Table 1. Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Stringfellow Superfund Site		
EPA ID: CAT080012826		
Region: 9	**State:** CA	**City/County:** Jurupa Valley, Riverside County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Daewon Rojas-Mickelson		
Author affiliation: EPA, Region IX		
Review period: 10/28/2015 - 9/28/2016		
Date of site inspection: 1/21/2016		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/28/2011		
Due date *(five years after triggering action date)*: 9/28/2016		

1.1. Background

From 1956 until 1972, the Stringfellow Quarry Company, Inc., operated a Class 1 hazardous waste disposal site (EPA, 1983) and accepted more than 34 million gallons (MG) of liquid industrial wastes generated by businesses conducting metal finishing, electroplating, and pesticide operations. Liquid wastes were deposited into approximately 20 unlined disposal ponds, which collectively covered an area of land approximately 3.5 acres in size. Spray evaporation procedures decreased the amount of liquid wastes remaining in the ponds, but generated incidental dispersion of liquid wastes creating an additional 5.6-acre area of contaminated land. (EPA, 1983).

In 1969, excessive rainfall caused the disposal ponds to overflow and discharge liquid wastes into Pyrite Creek. In response, the Regional Water Quality Control Board (RWQCB) directed the property owner to implement several measures (e.g., earthen berms, collection sump, waste liquid return system) to help prevent additional liquid waste discharges to surface water. In 1972, analytical sampling results reported

detections of Stringfellow related chemicals in an off-site downgradient monitoring well. The Stringfellow Quarry Company, Inc., voluntarily closed in November 1972 (ENVIRON, 2009).

Between 1975 and 1981, the RWQCB, Santa Ana Region, initiated the removal of contaminated soil from areas downgradient of the Stringfellow property, the construction of three downgradient containment berms, a controlled release of liquid wastes from the disposal ponds to Pyrite Creek after heavy rains, and the removal of approximately 6.5 MG of liquid wastes. The RWQCB directed the removal of all remaining surface liquids followed by partial neutralization and capping of the source area soil contamination. Starting in 1981, the RWQCB also directed the installation of a clay barrier dam improvements to the surface drainage system, and the installation of interceptor wells and monitoring wells (ENVIRON, 2009).

The Stringfellow property (hereinafter the "Site") was added to the NPL in 1983. Since that time a number of parties have conducted work at the Site. EPA was involved in the construction and operation of remedial systems between 1983 and 1996. From 1983 to 1988 EPA and Department of Toxic Substances Control (DTSC) conducted site studies through a cooperative agreement. The Pyrite Canyon Group, a working group of Potential Responsible Parties (PRP), performed activities between 1988 and 1996. In 1996 DTSC began implementing work on behalf of the State of California as a liable party at the Site, as determined in litigation among the State of California and parties that arranged for the disposal of hazardous substances at the Site. EPA continues to be the lead oversight agency.

1.2. Physical Characteristics

The Site is located in the City of Jurupa Valley, (incorporating the community formerly known as Glen Avon), in Riverside County, California, approximately 50 miles east of Los Angeles. The original 17-acre Site property is located in Pyrite Canyon in the Jurupa Mountains at the head of Pyrite Creek. Historical activities at the Site included discharge of liquid industrial water in unlined disposal ponds with subsequent migration of contaminants to groundwater. Groundwater contamination extends from the original Site property to approximately 4.5 miles south to the Santa Ana River. The Site's four geographic zones (Figure 2, Zone Map of the Stringfellow Superfund Site) include:

- **Zone 1: On-Site/Upper Mid-Canyon Area** – the original 17-acre disposal facility in the northern part of Pyrite Canyon (Zone 1A) to an area 600 feet south of the clay core barrier dam (Zone 1B); a dam constructed downgradient of the disposal ponds to mitigate the migration of subsurface leachate.

- **Zone 2: Mid-Canyon Area** –the portion of Pyrite Canyon extending from the southern edge of Zone 1 approximately 800 feet to the mid canyon extraction wells.

- **Zone 3: Lower Canyon Area** – the area from the mid-canyon extraction system to the lower canyon extraction system located just north of State Highway 60 (approximately 2,400 feet).

- **Zone 4: Glen Avon Community** –the area to the south-southwest of the lower-canyon extraction system to the leading edge of the known groundwater plume at the Santa Ana River (approximately 20,000 feet southwest of Zone 1).

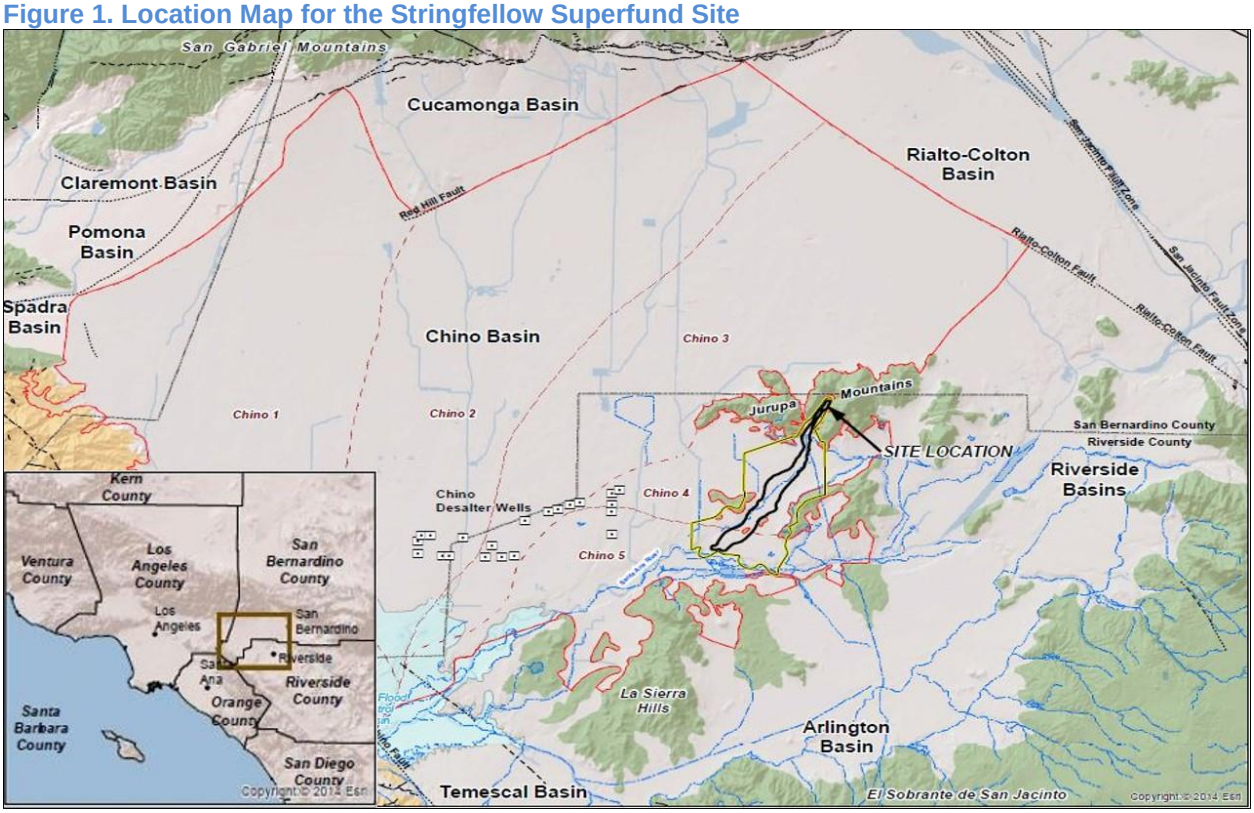
The Site is located within a semiarid climate zone, and intermittent stream flow in Pyrite Creek occurs from infrequent, intense rainfall events. The Pyrite Creek watershed covers approximately 270 acres

(EPA, 1983). Construction of the former disposal ponds and surface water channels altered the natural surface water flow in the canyon. Surface water flows from the canyon walls upstream of the Site and Zone 1 into a drainage channel bordering the original Site property. Surface water either infiltrates unlined portions of the channel or discharges from the channel into Pyrite Creek.

Pyrite Canyon has undeveloped steep canyon walls, which reach a height of 1,000 feet above the canyon floor in Zone 1. The floor of the canyon drops approximately 100 feet in elevation from the northernmost boundary of the Site to the clay barrier dam (Zone 1A/Zone 1B transition) and an additional 840 feet in elevation to the mouth of the canyon near U.S. Highway 60 (ENVIRON, 2009).

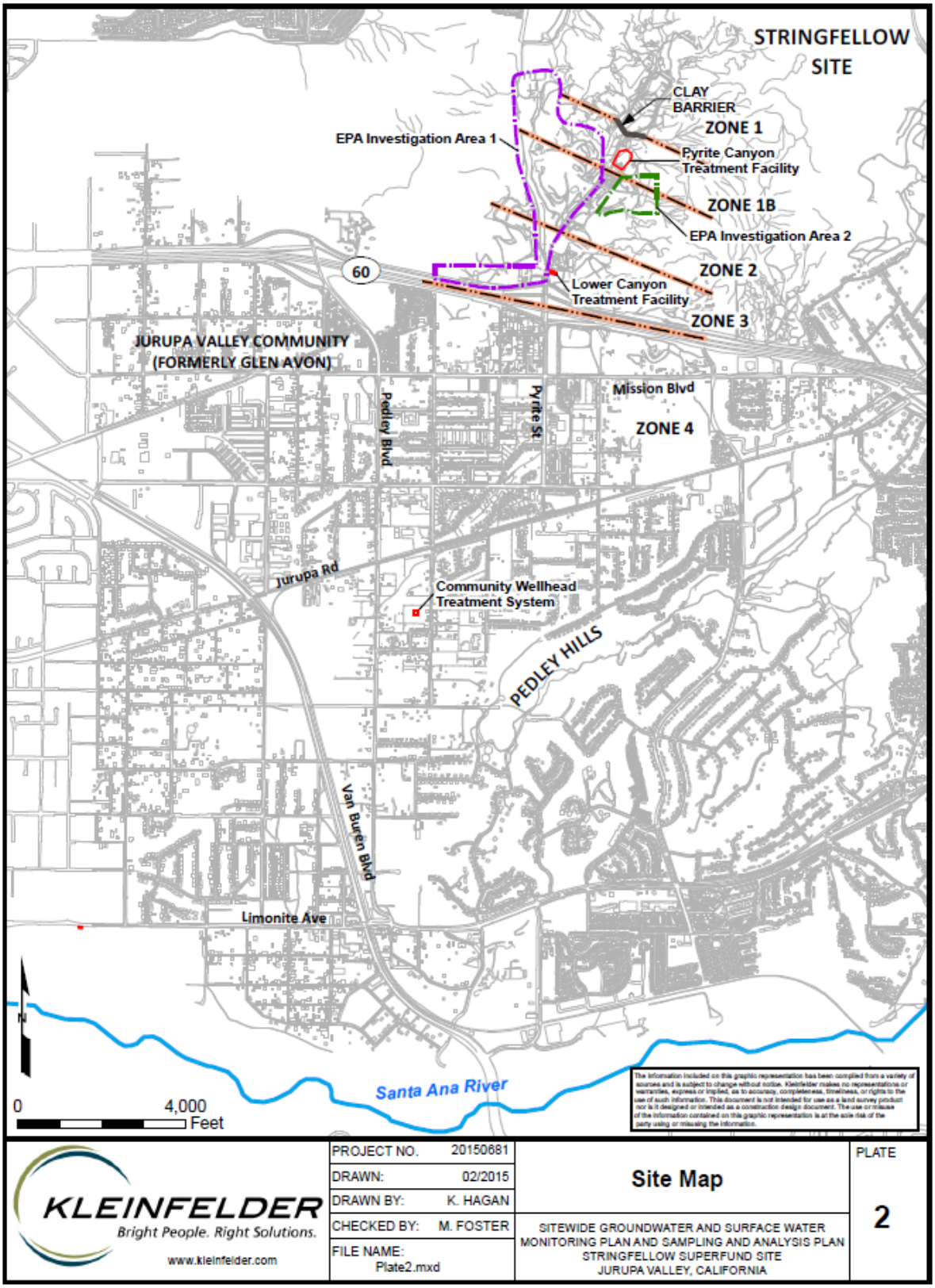
The original Site property remains largely undeveloped except for areas used to support remedy treatment, and operation, and maintenance (O&M) activities. Properties adjacent to the original Site property include commercial developments south of the Site, an active rock quarry to the west, and an automobile recycling facility to the east. EPA is currently investigating the quarry and automobile recycling facility as potential sources of perchlorate contamination to surface water and groundwater. The canyon slopes east and west of the original disposal facility are undeveloped. Land north of the Site (on the other side of the Jurupa Mountain Range) is residential.

Figure 1. Location Map for the Stringfellow Superfund Site



Kleinfelder. 2016. *Final Sitewide Groundwater and Surface Water Monitoring Plan and Sampling and Analysis Report*. Jurupa Valley, CA, July 19, 2016.

Figure 2. Zone Map of the Stringfellow Superfund Site



1.3. Hydrology

The following geologic units underlie Pyrite Canyon:

- **Fill/Alluvium**. In general, fill and alluvium materials are found at the surface and extend across all four Zones. The fill materials adjacent to the disposal area consist of unconsolidated sediments mixed with the native soil, this material was used to create berms, roads, and soil caps. The alluvium materials consist mainly of silts and sands with interbedded layers of clayey sand. The alluvium is thickest (over 100 feet in Zone 2) along the thalweg of the paleo channel incised into the underlying bedrock. Hydraulic conductivity values from pumping tests and slug tests ranged from 0.72 to 39.7 feet/day (ft/d). The thickness of the saturated alluvium in Zone 1 ranges from zero to about 30 feet. The horizontal hydraulic gradient ranges from 0.054 to 0.093 feet per foot (ft/ft) in Zones 1 through 3, and decreases across Zone 4 to about 0.0066 ft/ft near the Santa Ana River.

- **Weathered Bedrock**. Beneath the alluvium and across the Site is weathered granitic and metamorphic bedrock, varying in depth from two feet below ground surface (bgs) near the hills in Zone 4, to over 150 feet bgs near the paleo channel in Zone 2. These weathered bedrock fragments range in both size (coarse-grained, sand-sized particles to cobbles) and relative competency (friable to hard). Hydraulic conductivity values, derived from pumping tests and slug tests, range from 0.001 to 1.68 ft/d. The horizontal hydraulic gradient ranges from 0.26 to 0.11 feet per foot in Zones 1 through 3, to 0.0076 ft/ft in Zone 4.

- **Unweathered, Fractured Bedrock**. A variety of bedrock types (granodiorite, quartz diorite, granite and gneiss) are present at the Site. The upper watershed above the Site consists of older metamorphosed sedimentary rocks that were intruded by younger granitic rocks. The surface of the unweathered bedrock can exceed 150 feet bgs in the paleo channel in Zone 2. Hydraulic conductivity values from pumping tests and slug tests ranged from 0.00065 to 1.58 ft/d.

Groundwater originates from upstream of the Site and canyon sidewalls. Depth to groundwater varies within the canyon, and groundwater is found in all three underlying geologic units (alluvium, weathered bedrock, and unweathered bedrock). The groundwater flow direction across Zones 1 through 3 mimics the surface topography and generally flows to the south. Across Zone 4, the flow direction shifts from nearly due south to southwest and then finally west, just north of the Santa Ana River.

2. Remedial Actions Summary

2.1. Basis for Taking Action

Based on an evaluation of all contaminated media analytical sampling data at the time of the RODs, the exposure pathway identified with the greatest risk to human health was from the consumption of contaminated groundwater. Groundwater at the Site was found to be contaminated with high concentrations of soluble organic and inorganic contaminants, including, but not limited to, acids, minerals, and heavy metals. Groundwater contamination from the Site extends from Zone 1 to the Santa Ana River in Zone 4. The vertical extent of contaminated groundwater in Zones 1, 2, 3 was found in the

alluvium, weathered bedrock, and the fractures in the unweathered bedrock to depths over 150 feet bgs. Contamination in Zone 4 has been observed in the alluvium and weathered bedrock and could potentially migrate to the unweathered bedrock.

Of the other exposure pathways, the exposure to contaminated soils (without a cap) was of potential concern only in Zone 1. On the basis of these findings, remedial action was determined to be warranted to mitigate risks to human health and the environment.

2.2. Remedy Selection

The Site cleanup includes four zones within the area of contamination, described as Zone 1 to Zone 4, with an interim Record of Decision (ROD) and selected remedy for each zone (Figure 2: Zone Map of the Stringfellow Superfund Site). Described briefly below is a summary of Site remedial actions (Table 2, Remedial Action/Components by ROD), which address the hazards and risks created by the original waste disposal area (Zone 1). The RODs remedial measures include fencing, erosion control, surface water management, and controlling the sources of contamination (e.g., waste removal, capping/containment, groundwater barrier, and groundwater extraction).

The first interim ROD, for Zone 1, issued on July 22, 1983, included the completion of several initial abatement activities such as fencing, erosion control, interim source control, and off-Site hauling and disposal of contaminated liquids (EPA, 1983). The ROD remedial action objectives (RAOs) for Zone 1 are 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 on-Site pretreatment systems.

The second interim ROD, for Zone 2, issued on July 18, 1984, included the construction of an on-Site pretreatment plant to treat contaminated groundwater, and the installation of an expanded groundwater extraction system in Zone 2 (EPA, 1984). The ROD groundwater RAO is to prevent further downgradient migration of contaminated groundwater from Zone 2 to Zone 3. In 1998, EPA issued an ESD for Zone 2 that changed the effluent discharge from the publicly owned treatment works (POTW) to the Santa Ana Regional Interceptor (SARI) pipeline, later renamed the Inland Empire Brine Line (Brine Line). The ROD also included treated water “pretreatment objectives” prior to discharge into either the POTW or Brine Line (Table 7, Inland Empire Brine Line Discharge Pretreatment Standards, SAWPA Permit #D1079-2).

The third interim ROD, for Zone 3, issued on June 25, 1987, included the installation of a peripheral channel (upgradient of the original disposal facility) and a groundwater interception system (in the Lower Canyon area) to intercept surface water runoff, and treatment of extracted groundwater along with treated water discharge to a POTW. The ROD RAOs for Zone 3 are: (1) remove contaminated groundwater, and (2) stop additional contaminated groundwater from moving south into the Glen Avon area within the city of Jurupa Valley.

The fourth interim ROD, for Zone 4, issued on September 30, 1990, included dewatering (Zone 1), installation of a community extraction system for the removal and treatment of Site-related groundwater contamination in Zone 4, field testing of soil vapor extraction (SVE), and field testing reinjection of treated groundwater in the upper canyon area (EPA, 1990). The ROD RAOs for Zone 4 are: (1) to prevent

further migration of contaminated groundwater; and, (2) to restore groundwater to applicable or relevant and appropriate requirements (ARAR) or background levels.

Restoration of groundwater quality in Zone 4 will allow, to the extent possible, unrestricted use of groundwater, part of the Chino Basin (East), in an effort to be consistent with the beneficial uses as an existing and potential municipal supply described in the Santa Ana Regional Water Qualtiy Control Board *Water Quality Control Plan for the Santa Ana River Basin* (RWQCB, 2011).

The Zone 4 groundwater contaminants above maximum contaminant levels (MCLs) or ARARs include trichloroethylene (TCE), chloroform, nitrate, and sulfate[1]. The Zone 4 ROD remediation goals[2] include the federal groundwater TCE MCL of 5 micrograms per liter (µg/L) and the chloroform health-based level of 6 µg/L.

2.3. Remedy Implementation

2.3.1. Zone 1

In 1981, RWQCB installed a clay cap and vegetative cover to retard rainfall infiltration and prevent erosion in Zone 1. RWQCB and DTSC installed: an upgradient groundwater and surface water interception systems consisting of groundwater drainage trenches, surface drainage channels, interception wells; a hydraulic control and dewatering system; and a hydraulic control system consisting of eight extraction wells and a French drain at the subsurface clay barrier dam downgradient of the source area (Zone 1A). These abatement activities are part of the Zone 1 ROD selected remedy.

In accordance with the second and third interim RODs improvements and expansion to erosion control and upgradient interceptor well systems were completed in 1989. The fourth interim ROD, issued in 1990, directed groundwater dewatering down to bedrock in Zone 1, to reduce the potential for further release of Site contaminants, and initiated SVE field-testing to evaluate the feasibility of removing VOCs from the vadose zone in the source area. The pilot tests for SVE and 2-Phase™ extraction were determined to have only limited effectiveness and were ruled out as viable remedial alternatives in 2000.

2.3.2. Zone 2

The Mid-Canyon Pretreatment Plant (PTP), in operation since 1985, is located on the northern portion of Zone 2. The PTP utilizes lime precipitation treatment for metals removal, and granular activated carbon (GAC) treatment for removal of organic contaminants. The PTP treats contaminated groundwater generated from the Zone 1 and 2 extraction systems. Water from the A-Stream (one of five waste streams described in Appendix C) runs through the pesticide removal system prior to metals treatment. Pesticides

[1] Nitrate and sulfate are Site related COCs resulting from the on-site disposal of nitric and sulfuric acids.

[2] EPA deferred setting a remediation goal for nitrate because, in many locations, the detected background concentration exceeded the nitrate MCL (10 mg/l as N) and there was not an "opportunity for public input." Additionally, a proposed SDWA rule change for sulfate from a non-enforceable secondary MCL to a primary MCL was underway at the time of the ROD; however, sulfate remains a drinking water secondary MCL (250mg/L) for taste and odor at the time of this FYR.

removal prevents pesticide exceedances in the metals treatment system filter cake that would preclude disposal and incineration of the filter cake in a hazardous waste landfill. Prior to 1998, treated effluent from the PTP was transported by truck to a pipeline collection point and discharged to the local POTW, the SARI industrial wastewater treatment plant. In October 1998, in conformance with the 1998 ESD, construction of a new PTP pipeline allowed effluent discharges directly from the PTP to the SARI (now Brine Line) pipeline, (EPA, 1998).

A new pretreatment plant, currently undergoing a commissioning process, will replace the PTP. While the existing PTP meets Brine Line discharge limits, the new treatment facility will replace the aging infrastructure and provide long-term, reliable groundwater treatment capability. The new pretreatment plant, the Pyrite Canyon Treatment Facility (PCTF) is located adjacent to the existing PTP. The PCTF's design is expandable in size, and designed to accommodate possible future treatment requirements for new COCs, (e.g., perchlorate, 1,4-dioxane, hexavalent chromium, and/or NDMA) not specified in interim RODs or Brine Line discharge limits. Pilot-scale tests for expansion and conceptual process evaluation reports (Shaw, 2008; Shaw, 2009) have been completed for the PCTF and are available should treatment for new COCs be needed. As of June 2016, construction of the PCTF was complete and the commissioning stages have begun; DTSC expects the final stage of the commissioning process to begin in late 2016 and continue for one year.

2.3.3. Zone 3

DTSC designed and installed the extraction system in Zone 3 between 1987 and 1990 to intercept and remove groundwater contaminated with VOCs. Since 1989, the Lower Canyon Treatment Facility (LCTF) has treated groundwater from Zones 3 and 4 (waste streams designated as the C- and D-Streams) for VOCs. The treatment system at the LCTF uses GAC vessels to remove VOCs from the extracted groundwater. The extracted groundwater is pumped through two GAC vessels connected in series. The first vessel generally removes the contaminants and the second contactor serves as a backup when the carbon in the first vessel becomes spent. After treatment, the effluent is routed to the PTP effluent holding tanks and is discharged to the Brine Line pipeline.

Five groundwater extraction wells screened in the alluvium and located near the downgradient boundary of Zone 3 have been operational since 1989. DTSC conducted upgrades and replacements to Zone 3 extraction wells, electrical panels, power system and collector pipelines in 2003.

2.3.4. Zone 4

In Zone 4, two extraction wells were installed in the community area as an initial groundwater response action. Since 1992, these two extraction wells, designated as the "North Well" (CTN-TW1) and "South Well" (CTS-TW1) have continued to operate for plume control and eventual restoration in Zone 4. The LCTF treats groundwater extracted from these two wells (designated the D-Stream). Two additional extraction wells (CTP-TW1 and CTP-TW2), referred to as the "Tree Farm" wells, were installed in 1998 (with waste water designated as the E-Stream). The Community Wellhead Treatment System (CWTS), which has been in place since 1998, treats groundwater extracted by Tree Farm wells.

Table 2. Remedial Action/Components, by ROD

Decision Document	Remedial Action/ Components			
	Zone 1	Zone 2	Zone 3	Zone 4
N/A (Interim Abatement Program) – Pre-RODS (see first ROD, Appendix 1B)	-Source control • Remove all surface liquids • Neutralize acid soils -Installation of clay barrier dam			
First ROD, July 1983	-Site-wide fencing -Erosion control • Maintenance of existing cap and surface drainage • Vegetative seeding to prevent erosion - Source control • Off-Site disposal of leachate -Groundwater extraction/monitoring wells			
Second ROD, July 1984	-On-Site pretreatment system (Mid-Canyon PTP) • Heavy metals and organics removal • Off-Site disposal of sludge • Effluent discharge to POTW	-On-Site pretreatment system (Mid-Canyon PTP) • Extracted groundwater (Zones 1 and 2) treatment • Effluent discharge to POTW • Pretreatment system O&M Mid canyon interceptor well system • Installation of additional extraction and monitoring wells		
Third ROD, June 1987	-Erosion control • Install peripheral drainage channel to direct upgradient surface water runoff • Extend existing concrete channels southward to discharge surface water to Pyrite Creek		-LCTF • Extraction Wells • Treatment at LCTF • Effluent discharge to POTW	
Fourth ROD, Sept 1990	-Source area dewatering -Treat Zone 1 extracted groundwater at PTP; discharge treated effluent to POTW -Feasibility evaluation of SVE to remove VOCs (pilot tests determined SVE was not a viable option)	-Feasibility evaluation of reinjection of treated groundwater from Zone 4 to enhance flushing of COCs (pilot tests determined ineffective)	-Feasibility evaluation of reinjection of treated groundwater from Zone 4 (pilot tests determined ineffective)	-Community groundwater pump and treat • Extraction and monitoring wells • Groundwater treatment at LCTF and CWTS • Effluent discharge to POTW and/or irrigation reuse -Surface water management • Discharge under National Pollutant Discharge Eliminating System (NPDES) permit and/or reuse
ESD, 1998		-Construction of effluent pipeline to convey effluent form the PTP to the SARI pipeline (now the Brine Line)		

2.4. Operations and Maintenance

Operations and maintenance (O&M) at the Site has not significantly changed over the last five years. The current monitoring program for groundwater is implemented in accordance with procedures contained in the *Groundwater Monitoring Program Work Plan* (Geo-Logic Associates, 2001) and the *Final Quality Assurance Project Plan: Routine Groundwater Monitoring and Zone 4 DGI Investigation* (Laboratory Data Consultants, 2015). DTSC collects groundwater samples quarterly from new wells for eight quarters and then the wells are incorporated into the annual sampling program. Existing monitoring wells are currently sampled annually. Optimization efforts, including the destruction of redundant wells, conversion of monitoring wells to extraction wells, and the installation of new wells in key locations have been ongoing; recommendations were presented in the *Groundwater Monitoring Optimization Report* (Kleinfelder, 2016). DTSC samples surface water after every qualifying rain event, according to the *Final Surface Water Sampling and Analysis Plan* (Geo-Logic Associates, 2014a) and the *Zone 4 Data Gap Investigation (DGI) Sampling and Analysis Plan* (Kleinfelder, 2015). DTSC issued an updated Site-wide groundwater and surface water sampling plan on July 19, 2016. This plan combines both sampling regimens into a single document. Once the new PCTF is completed, a revised O&M manual will be prepared.

DTSC operates and maintains the remedial groundwater treatment components in Zones 1-4 according to the *Influent Systems Operations, Monitoring, and Maintenance Manual* (Veolia, 2014). O&M presence is maintained at a continuous level, with two full-time DTSC employees and 15 full-time contractor (Veolia) personnel. Water extracted from Zone 1 is pumped to influent storage tanks, then treated using a GAC process with an air stripper to remove VOCs, followed by two precipitation processes to remove pesticides first and metals second. The treated Zone 1 water is filtered to remove solids, and then mixed with water extracted from Zone 2. A second GAC process then treats this combined stream. The process components require regular maintenance, as the liquid and vapor phase GAC must be switched as needed (typically yearly), and the pesticides and metals treatment systems generate filter cakes that must be removed and disposed of off-Site. The LCTF receives water extracted from all Zone 3 and select Zone 4 wells, this stream passes through a GAC system. The LCTF does not include treatment processes for metals or pesticides because they have historically not been found in Zone 3 groundwater. Treated water from the PTP and LCTF is stored in the PTP effluent holding tanks before being discharged to the Brine Line. PTP operators check the effluent line that discharges treated Site water to the Brine Line on an annual basis. There have been small changes to the Santa Ana Watershed Project Authority (SAWPA) discharge requirements, which govern the concentrations in treated water entering the Brine Line. The PTP currently operates two days a week due to limited aquifer recharge on the Site. The LCTF operates 24 hours a day.

The third treatment system, the CWTS, treats extracted Zone 4 groundwater. The CWTS features two GAC vessels for VOC treatment, as well as two resin beds to remove perchlorate from the groundwater. The GAC is changed as needed based on effluent concentrations, and the resin bed is replaced every five to six months. Once this water is treated, it is either discharged into Pyrite Creek, or is provided to the owners of the property on which the CTWS is located, for use as irrigation water. The CWTS operates 24 hours a day. One carbon vessel at the CWTS developed a leak in July of 2015; it was isolated and removed from service until it was repaired in March of 2016.

During a 2015 inspection of steel storage tanks, DTSC noticed the epoxy lining in seven tanks (four in Zone 2 and three in Zone 3) was failing prematurely. The cause of the premature failure seems to be attributable to inadequate and/or incomplete surface preparation. In 2016 DTSC decided to remove the existing lining and reline all seven steel tanks. This work is scheduled for completion in September of 2016. Additionally, prior to relining the tanks DTSC installed new manways to improve accessibility for future maintenance in the three tanks which did not previously have this feature. This work did not impact operations of the treatment systems.

In the last five years DTSC has completed an upgrade of extraction well communication systems in Zones 2, 3 and 4. The project involved replacing all well flowmeters, installing Ethernet cable between each extraction wellhead and the control panels in Zones 2 and 3, and repairing an existing communication cable between the Zone 4 extraction wells and the Zone 3 control panels. The resulting improved communication will allow the Site's automated control system to monitor the water level in the B-Stream storage tanks, LCTF influent storage tanks and Effluent storage tanks, and prevent their overtopping by automatically shutting down the pumps that discharge to these tanks. Service was coordinated to minimize any impacts to groundwater capture.

Other O&M activities not related to the extraction and treatment systems also occur at the Site. Site operators conduct extensive grounds keeping activities on an ongoing basis in order to maintain access roads and the capped areas in Zone 1. Inspection of the cap after heavy rainfall events, and weeding is conducted on a regular basis. Areas in the cap where subsidence has occurred are typically filled in, although this has not been necessary in the last five years.

3. Progress Since the Last Five-Year Review

3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2011 FYR for the Stringfellow Superfund Site stated the following:

> *The interim remedies at the Stringfellow Superfund Site are currently protective because exposure pathways that could result in unacceptable risks are being controlled. However, to be protective in the long term the following action should be completed:*
>
> - *Optimize the existing monitoring and extraction well systems in Zones 1, 2 and 3 in order to determine if there are sufficient wells to assess containment and contaminant migration. Modify or augment the monitoring and extraction systems as necessary.*
> - *Evaluate the need for additional monitoring and/or extraction wells in Zone 1.*
> - *Complete additional investigations as necessary to verify the off-site perchlorate sources.*
>
> *The selected remedy for the Site is protective of human health and the environment in the short-term because exposure pathways that could result in unacceptable risks are being controlled.*

The 2011 FYR included three issues and recommendations. Each recommendation and the current status is shown in Table 3 and discussed in Section 3.2.

Table 3. Issues and Recommendations from the 2011 FYR

Zone	Issue	Recommendations	Current Status	Current Implementation Status Description
1, 2, and 3	The current monitoring network may be inadequate to monitor contaminants and assess extraction well capture zones in the weathered and unweathered bedrock.	Optimize the monitoring program so that there are sufficient wells to assess containment at extraction systems and migration in weathered/unweathered bedrock. Modify the extraction systems as necessary.	Ongoing	Ongoing, further optimization likely required.
1	Alluvium is not completely dewatered to bedrock and weathered and unweathered bedrock along the western portion of the clay barrier dam may not be completely sealed by the grout curtain.	Evaluate the need for additional monitoring and/or extraction wells or dewatering in Zones 1 and 1b.	Ongoing	Wells added, and evaluation being conducted. Additional measures likely required.
2, 3, and 4	There are potential off-Site sources of perchlorate in groundwater and surface water.	Complete additional investigations as necessary to verify off-Site perchlorate sources.	Completed	Investigations complete, reports in-progress.

3.2. Work Completed at the Site during this Five-Year Review Period

The 2011 FYR recommended the optimization of the monitoring program in order to increase the ability to assess contaminant containment and migration throughout the weathered and unweathered bedrock units. DTSC has initiated several optimization efforts in the last five years. In 2010 and 2011, DTSC conducted a bedrock aquifer testing investigation in Zones 1-3, to evaluate hydraulic conductivity in unweathered bedrock, recognizing the shortcomings of the current extraction system in containing contaminated groundwater in the bedrock layers and that data gaps needed to be closed before installing any additional wells. In 2012, DTSC decommissioned 42 dual phase monitoring wells in Zone 1. DTSC previously used these wells for a vapor recovery study, which was deemed unsuccessful. A Groundwater Monitoring Optimization Report prepared by DTSC provided several recommendations that have been

adopted into the Site-Wide Sampling and Analysis Plan for groundwater, thereby standardizing and coordinating optimization efforts across the Site. However these efforts are still ongoing and, pending the results, additional optimization of monitoring in the weathered and unweathered bedrock may be required.

The second recommendation made in the 2011 FYR was to evaluate the need for additional monitoring and/or extraction wells or dewatering in Zones 1A and 1B. From August to September 2011, two Zone 1 monitoring wells (OC-10D & OC-10B) were converted to extraction wells, and from February to April 2012, four new monitoring wells were installed in Zone 1B. Related to this, the weathered and unweathered bedrock along the western portion of the clay barrier dam may not be completely sealed by the grout curtain. To this end, in 2013 DTSC added three extraction wells around the barrier system in Zone 1, thus improving containment in weathered bedrock beneath the barrier dam. From 2012 to 2013, DTSC installed one extraction well, two piezometers, and five new monitoring wells as part of the blast fracturing pilot study (Tetra Tech, 2014). This study looked to assess the feasibility of blasting as a way to increase dewatering and contaminant removal in the weathered bedrock. Upon completion of the study, DTSC concluded that blasting did not increase permeability in weathered bedrock, and blasting was not considered further as a remedial approach.

In 2015, DTSC completed a phase I evaluation of the Zone 1 barrier system and hydraulic containment in Zone 1B (ENVIRON, 2015). This report concluded that the barrier system, which includes the barrier wall, grout curtain, and associated extraction wells, effectively prevents the downgradient migration of contaminants in the alluvium and shallow weathered bedrock. However, in the deeper weathered bedrock and unweathered bedrock, contaminant migration is slowed, but not prevented. The report makes a number of recommendations for additional monitoring wells and piezometers, as well as recommendations for enhancing groundwater containment. After the implementation of these modifications to the barrier system a phase II evaluation will be conducted to assess their effectiveness.

The final recommendation of the 2011 FYR was the further investigation of several potential off-Site sources of perchlorate, including contamination from operations of the adjacent quarry and the widespread use of Chilean nitrate fertilizer. Between May and June 2011, DTSC installed 13 monitoring wells within Pyrite Quarry (Zone 2) to investigate the quarry as a potential perchlorate source. Analytical results of groundwater samples showed perchlorate in the new wells, however the results of the investigation led to the belief that additional perchlorate sources were not sufficiently delineated. Therefore, concurrently with the DTSC Site activities in the last 5 years, EPA has initiated two investigations adjacent to the Site. Due in part to the inability of DTSC to delineate the western lateral extent of the perchlorate plume, in 2013, EPA began a remedial investigation/feasibility study (RI/FS) of perchlorate in the quarry and adjacent areas. Known as EPA Investigation Area 1, this area was suspected to be contributing perchlorate from blasting operations at the quarry and a former rocket engine testing facility on properties west of the Site. The EPA investigation involved installation of monitoring wells and an evaluation of the nature and extent of the perchlorate contamination in those areas. EPA is in the process of completing the RI report for EPA Investigation Area 1; it will include both a Human Health Risk Assessment and an Ecological Risk Assessment.

In March of 2012, DTSC submitted the Draft Zone 4 FS (Kleinfelder, 2012), which developed and evaluated remedial action alternatives for perchlorate in groundwater in Zone 4. DTSC agreed to perform

a data gap investigation (DGI) to supplement the Zone 4 RI and attempt to close data gaps pertaining to the distribution of perchlorate in groundwater and its impacts. The major work elements within the Agreement to Perform Response Actions Statement of Work (DTSC, 2014) are:

- Site-wide activities
  - Project management plan
  - Site-wide public participation plan
  - Groundwater and surface water monitoring plan and sampling and analysis plan (SAP)
  - Groundwater and surface water sampling
  - Data management plan
  - Annual Site evaluation reports
  - Site-wide monthly progress reports
  - Weekly reports, during significant field events

- Zones 1-3 Activities
  - Supplemental FS addendum

- Zone 4 Activities
  - Zone 4 DGI SAP
  - Zone 4 DGI field work
  - Zone 4 DGI report
  - Zone 4 monitored natural attenuation evaluation
  - Groundwater modeling work plan, recalibration and technical memorandum
  - Revised Zone 4 FS report

The above listed work is being conducted to support a final Site-wide ROD, which will incorporate or revise the four previously selected interim remedies as well as select a final remedy for Zone 4. EPA will establish a groundwater cleanup goal for perchlorate within the Site-wide ROD, the ROD is scheduled for completion in 2021.

The field work for the DGI commenced in February 2015, and as of March 2016, 48 new monitoring wells have been installed in Zone 4.

As part of sampling activities for the Zone 4 DGI and the study of EPA Investigation Area 1, select groundwater samples are being analyzed for perchlorate isotopes. The analysis is to aid in identifying perchlorate source types. Analysis may provide a line of evidence to delineate perchlorate sources, differentiating between perchlorate originating from the former Stringfellow facility perchlorate originating from other sources. Three principal perchlorate type sources have been identified in groundwater of the Chino and San Bernardino Basins: (1) synthetic perchlorate (from aerospace, military, and other industrial activities as well as fireworks and road flare); (2) so-called Atacama perchlorate associated with widespread use of imported Chilean nitrate fertilizer for citrus cultivation; and (3) indigenous natural perchlorate that is deposited with wet and dry atmospheric deposition at a number of locations across North America (Sturchio, et al. 2012). Each of the three perchlorate sources listed above have a characteristic range in isotopic composition, these ranges in isotopic composition are distinct and provide a robust means by which to identify the type source of perchlorate in groundwater, or to estimate the mixing proportions if multiple sources are present.

In 2014, EPA initiated an investigation into activities conducted in the area now occupied by a car auction company, immediately to the east of Zone 2. A company that manufactured and tested rocket propellants formerly used this area, now identified as EPA Investigation Area 2. This area includes a pond where illegal disposal may have taken place in the 1980s, and other activities may have occurred in the vicinity. Results of groundwater samples collected from Zones 2 and 3 led to the belief that this area may be contributing perchlorate to the groundwater plume. The 2014 EPA investigation involved the installation of several monitoring wells, as well as groundwater and soil sampling. The investigation report for EPA Investigation Area 2 is currently being completed.

Another major activity that has occurred in the last five years has been the construction of the new pretreatment plant, the PCTF. Located immediately north of the existing PTP, the PCTF will replace the PTP as the central location for treatment of the A and B waste streams, as well at the point of discharge of treated effluent to the Brine Line. The PCTF is designed to treat all of the COCs found at Stringfellow, as well as to provide areas to add treatment processes if new contaminants emerge. DTSC completed PCTF construction in December of 2015; the facility will begin treating Site groundwater by the end of 2016 in a yearlong shakedown and optimization process.

Several activities related to the assessment of risk occurred on the Site in the last five years. In 2013, an addendum to the 2005 screening level ecological risk assessment (SLERA) was completed. This addendum evaluated concentrations of background metals at the Site. The report concluded that no metals found in Site soil exceeded background levels in a statistically meaningful way. An indoor air sampling event occurred in 2014 and 2015 in order to evaluate the risk of vapor intrusion to the users of the various commercial/industrial buildings located on the Site. As a result of this investigation, it was concluded that vapor intrusion was not a source of unacceptable risk or hazard at the Site itself. More details on work completed on the risk assessment and concerning vapor intrusion is located in Appendix E.

As mentioned above, both a Human Health Risk Assessment and an Ecological Risk Assessment are being prepared as part of the study of EPA Investigation Area 1. EPA will review collected data to determine if the conclusions of the SLERA conducted by DTSC are still valid.

3.3. Community Notification, Involvement and Site Interviews

A public notice was made available by a local newspaper posting in *The Riverside Press-Enterprise*, on 5/11/2016, stating that there was a five-year review and inviting the public to submit any comments to the EPA. The results of the review and the report will be made available at the Site information repository located at the Jurupa Valley Regional Library, located at 9244 Galena St., Riverside, CA 92509.

Additionally, EPA is in the process of updating the existing Community Involvement Plan. EPA issued the original plan in 2004 and updated the document in 2009. The purpose of most recent update is to provide new DTSC and EPA contacts, Site maps, and a revised summary of outreach activities.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy implemented to date**.** The results of these interviews are summarized below. Interview questions and transcripts are contained in Appendix G.

Three interviews were conducted for the FYR, with the DTSC Senior Engineering Geologist, the project manager for the EPA technical contractor (CH2M Hill), and the DTSC On Site Engineer. The interviewees outlined the successes that the current groundwater extraction and treatment systems have had with respect to containing and capturing Site contaminants, although plume capture is not complete in some locations. One interviewee mentioned that there is capture in all four zones and outlined the declining trends of TCE and perchlorate. This interviewee also mentioned the ongoing optimization efforts, along with efforts to fill in data gaps related to perchlorate sources. The interviewees also pointed out that construction of the PCTF was almost complete, available thereafter to improve treatment activities at the Site. All three interviewees mentioned the emergence of hexavalent chromium in Site groundwater. DTSC has been monitoring groundwater for the contaminant, and it will likely be integrated into the treatment program in the future. The interviewees also mentioned that there are several investigations ongoing that will hopefully fill in data gaps regarding secondary perchlorate sources, better well locations to improve groundwater capture, and the overall lithology of the Site. Finally, the interviewees noted the ongoing development efforts at adjacent properties in Pyrite Canyon.

3.4. Data Review

Evaluation of groundwater, surface water, and soil data collected between 2011 and 2015 was conducted as part of this Fifth FYR. Interim groundwater remediation goals for TCE and chloroform were established in the fourth interim ROD and apply to Zone 4; none of the other RODs established remediation goals for any contaminants. The established remediation goals are 5 µg/L for TCE (Federal MCL) and the health-based level of 6 µg/L for chloroform. Additionally, perchlorate concentrations in groundwater are being monitored and its distribution evaluated prior to future remedy implementation. Currently, perchlorate concentrations are compared to the California MCL of 6 µg/L. See Appendix C for more details on the data review.

In Zone 1, the groundwater RAOs specify reducing the potential for the release and migration of Site contaminants to groundwater, and to control, recover, and treat contaminated liquids in Zone 1 using diversion, dewatering (i.e., lowering of the water level), extraction, and on-Site pretreatment systems. The remedy is in place, although additions and optimization of the extraction network occur as needed. Capture in Zone 1A is incomplete, and there are indications that the clay barrier wall is not entirely effective at limiting the flow of contaminants into downgradient zones. In Zone 1B, capture is also incomplete. The results of the data review analysis indicate that improvements to the Zone 1 extraction system may be warranted in order to capture all contaminant mass migrating into Zone 2. The data review also indicated the presence of hexavalent chromium in select Zone 1 wells.

In Zone 2, the RAO for the groundwater remedial system is to prevent further downgradient migration of contaminated groundwater from Zone 2 to Zone 3. A capture zone analysis was performed and found that certain areas of Zone 2 had little to no contaminant capture, indicating that additional well coverage is needed. A statistical trend analyses of contaminant concentration trends also shows a lack of downward trends for TCE and perchlorate. Combined with the capture zone analysis, this indicates that the remedy is not fully preventing contaminants from entering Zone 3. Review of Zone 2 data shows hexavalent chromium, not a Site COC at this time, is present in a limited number of these wells. Zone 2 is in hydraulic communication with EPA Investigation Area 1 and Investigation Area 2, where the off-Site contributions of perchlorate to the Site groundwater plume are being actively explored.

As described in Section 2.2, the PTP treats extracted groundwater and the effluent is discharged to the Brine Line. This effluent is subject to pretreatment standards, which must be met in order for water to be legally discharged. Table 9 lists these limits. All discharges in the last five years from the PTP to the Brine Line complied with the standards.

The RAO for Zone 3 is the containment and treatment of contaminated groundwater. The 2014 groundwater sampling event showed TCE and perchlorate exceedances of the applicable MCLs for 31 percent and 80 percent of the samples, respectively. However, gradual decreases in concentrations over time show at least partial effectiveness of Zone 3 and other upgradient remedies. Additional measures, such as the optimization of monitoring wells or installation of new extraction wells, are necessary to resolve data gaps identified by capture zone analysis. There were five hexavalent chromium detections in Zone 3 wells during the 2014 sampling period (Kleinfelder, 2015). Only one of these was above the California MCL, the elevated concentrations at this well are believed to be due to cement grout intrusion into the well.

The RAOs for the Zone 4 groundwater remedy are to prevent further migration of contaminated groundwater and to restore groundwater to ARARs or background concentration levels. Restoration of groundwater quality in Zone 4 is intended to allow the unrestricted, to the extent possible, use of groundwater in this zone, in an effort to be consistent with the RWQCB's *Water Quality Control Plan for the Santa Ana River Basin* (RWQCB, 2011), which designates groundwater in Zone 4 as having a present or potential beneficial use for municipal supply. The Zone 4 data shows that TCE and chloroform concentrations are decreasing, although the number of perchlorate exceedances remains high. There are still a number of data gaps with respect to Zone 4, and a DGI intended to supplement existing information is currently underway. This investigation includes soil and surface water sampling, the installation of groundwater monitoring wells, collection and analysis of Zone 4 groundwater samples for perchlorate and other parameters. This information will be used to support an evaluation of remedial alternatives, and a revision of the draft *Zone 4 Feasibility Study Report for Perchlorate in Groundwater* (Kleinfelder, 2012).

EPA evaluated vapor intrusion risk for residential receptors in Zone 4, using 2014 groundwater monitoring data. TCE, a compound that volatilizes readily and can be a source of vapor intrusion risk, is present in Zone 4 groundwater in levels exceeding the MCL and as high as 9.4 µg/L. Based on preliminary evaluations the risk of vapor intrusion to residential receptors is within an acceptable risk range. However, EPA will confirm protectiveness with the collection of soil gas samples located above the areas where TCE concentrations in groundwater exceed the MCL. This sampling will be completed by September 31, 2018. If soil gas samples contain TCE above acceptable concentration levels EPA will take additional steps to ensure the protectivenesss of human health.

The data evaluated for this FYR included soil and surface water sampling data. Soil sample collection has occurred on an irregular basis and for a variety of reasons, including supplementing the human health risk assessment, for safety measures, and for the study of EPA Investigation Areas 1 and 2. Perchlorate concentrations from these sampling efforts ranged in concentration from nondetect to 160 µg/kg. Although it appears perchlorate contamination in soil is widespread across the Site, analysis of data collected to date show concentrations far less than the applicable industrial land use regional screening level (RSL) of 820 mg/kg. Detections of chloroform and TCE in soil were also were found at low concentrations and in a limited number of the samples. In the fall of 2015, composite soil samples were

taken at locations throughout Zone 4, as part of the Zone 4 DGI. These sample locations correspond with the locations of new monitoring wells as well as at soil boring-only locations. These samples will be analyzed for perchlorate and nitrate, and should provide better understanding of the concentrations of perchlorate in soil across Zone 4.

As part of the study of EPA Investigation Areas 1 and 2 surface water sampling at the Site has occurred after major rain events. Perchlorate was found in most surface water samples collected in the drainage channels downgradient from Zone 1, sometimes at concentrations exceeding the California MCL.

3.5. Site Inspection

The Site inspection was conducted on January 21, 2016. In attendance were Daewon Rojas-Mickelson from EPA Region IX, Susan Fears and William Rowe from DTSC, and Jayson Osborne from the U.S. Army Corps of Engineers (USACE), Seattle District. The purpose of the inspection was to assess the protectiveness of the remedy.

The Site visit attendees conducted a visual inspection of general Site conditions, the Zone 1 cap, treatment plants, drainage features, and surrounding areas. The Site inspection also included a review of all major O&M documents, as-built documents, and maintenance logs. In general, all remedy features, including wells, treatment facilities, drainage features, and access controls appeared to be in good repair. Refer to the complete trip report and inspection checklist in Appendixes H and I for complete details.

4. Technical Assessment

4.1. Question A: Is the Remedy Functioning as Intended by the Decision Documents?

4.1.1. Remedial Action Performance

Yes, the remedy for the Stringfellow Superfund Site is operating and functioning as intended, with a few exceptions.

Upgradient of Zone 1, the surface water is actively diverted around the original chemical disposal area, and the area is capped to prevent direct contact. Fencing and 24-hour security remain in place to prevent direct and indirect contact with Zone 1 contaminants. The clay barrier dam on the border between Zone 1A and 1B, as well as the large extraction wellfield, prevents the downgradient migration of most contaminated groundwater, although some contaminants in the deeper weathered and unweathered bedrock continue to move to Zone 2 (see Appendix C). Extracted water from Zone 1 is treated at the PTP and discharged to the Brine Line. Complete dewatering of Zone 1 has not occurred, with problems remaining related to extracting groundwater from the deeper bedrock layers.

In some areas of Zone 2 there is limited or no well coverage, and statistical trend analyses show a lack of downward trends for TCE and perchlorate, indicating that the Zone 1 and Zone 2 remedies do not have sufficient groundwater capture (see Appendix C). The lack of downward perchlorate trends may be related to off-Site contributions from EPA Investigation Area 1 and 2. Optimization efforts are ongoing, and attempts to fill data gaps within Zone 2 are proceeding.

The LCTF and associated wellfield for Zone 3 are functioning as designed, and analysis of monitoring data indicates that concentrations of contaminated groundwater are decreasing. However, a 2015 capture zone analysis shows that certain areas of Zone 3 do not have effective capture and that potential off-Site sources (of perchlorate in particular) may be contributing to the continued downgradient movement of the plume (see Appendix C). As in Zones 1 and 2, DTSC is conducting well optimization efforts to increase the overall effectiveness of the remedy.

The CWTS in Zone 4 is functioning as designed, and continues to provide clean water to private users for irrigation purposes. A downward trend has been shown for TCE in 12 of 59 parameter tests performed on Zone 4 groundwater, indicating that groundwater restoration is being achieved in certain wells. Perchlorate continues to be prevalent in all aquifer units, although off-Site sources may be contributing to the plume. Containment of ROD identified COCs appears to be effective, although perchlorate concentrations downgradient of the capture system are still high. DTSC is conducting a DGI (see Section 3.2) in Zone 4, and continues to add wells to fill data gaps about sources of perchlorate. Despite its effectiveness, the remedy as implemented in Zone 4 is incomplete and is in need of further information to optimize and complete the remedy.

In the fourth interim ROD, DTSC estimated that extraction, treatment, and reinjection of Zone 4 groundwater would reach ARARs within 25 years. However, since that estimate, perchlorate has emerged as a major contaminant on the Site, and treatment of perchlorate is ongoing. The fourth interim ROD

definitively states that the Zone 4 remedy is an interim measure, and EPA expects the addition of perchlorate as a Site COC in the final Site-wide ROD. This will necessitate a revision of the time estimate to reach ARARs.

4.1.2. System Operations/O&M in all Zones

System O&M procedures continue to maintain the effectiveness of the remedy in Zones 1-4. The PTP operates two days a week, while the LCTF and the CWTS operate 24 hours per day. All three extraction and treatment systems are under 24-hour-per-day monitoring by DTSC and their contractors. The clay cap in Zone 1 is well maintained, and there is frequent weeding and vegetation removal. A leak was recently repaired at one of the CWTS GAC vessels. Other than this repair, there have been no equipment breakdowns or changes in effectiveness, and there have been no major changes in O&M costs in the last 5 years. See Section 2.4 for more information.

4.1.3. Implementation of Institutional Controls and Other Measures

The four interim RODs for the Site do not include provisions for institutional controls in Zones 1-3 due to there being no exposure pathways in those zones. The sole purpose of groundwater extraction in these zones is related to remedial objectives. Additionally, access controls such as fencing and 24-hour security prevent direct and indirect exposures in these zones. Construction of habitable structures over VOC contaminated groundwater could present a concern of vapor intrusion. Institutional controls do exist in Zone 4 in the form of well restrictions that effectively prevent exposure to contaminated groundwater. The area of Glen Avon (now incorporated in the City of Jurupa Valley, CA) has been connected to municipal water supply since 1989, and Riverside County restricts potable well installations in the groundwater underlying Zone 4 as per Section 15 Riverside County Ordinance 682, which states, “It shall be unlawful for any person or entity to drill, dig, excavate, or bore any water well at any location where sources of pollution or contamination are known to exist, have existed, or otherwise substantial risk exists that water from that location may become contaminated or polluted even though the well may be properly constructed and maintained.” Extraction of water underlying Zone 4 from existing wells is not allowed for any purpose other than Site remediation and irrigation. As a result of these institutional controls, exposure to Site contaminants is prevented.

4.2. Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

The assumptions used at the time of remedy selection that would affect protectiveness in any of the four zones are still valid. ARARs listed in the first through the fourth interim RODs were reviewed to evaluate changes, additions, or deletions. This ARAR analysis, completed for all zones, is presented in Appendix D. Two chemical-specific ARARs were specified for Zone 4 only, and both of these ARARs have not changed. Action-specific ARARs include the NPDES effluent standards for treated water discharge and Resource Conservation and Recovery Act (RCRA) land disposal requirements for the PTP. No other federal or state laws and regulations for ARARs have been promulgated or changed over the past five years in a manner that affects the substance of any selected remedies for the Site; therefore, the protectiveness of such other ARARs also remains unchanged.

EPA performed a toxicity and risk assessment analysis as part of this FYR to determine if the assumptions used in performing the baseline risk assessments remain valid for all four zones (Appendix E). There have been no changes in toxicity or other contaminant characteristics that could affect the protectiveness of the remedy. Additionally, there have been no changes to risk assessment methods that could affect the protectiveness of the remedy.

There is one potential additional exposure pathway, vapor intrusion, which needs to be further investigated. It is not believed to affect protectiveness of the remedy. The risk of vapor intrusion at the Site has been evaluated in the last five years, and it was concluded that there was no risk to receptors in enclosed spaces in Zones 1-3. Vapor intrusion risk was also calculated for residential receptors in Zone 4, using 2014 groundwater monitoring data. TCE, a compound that volatilizes readily and can be a source of vapor intrusion risk, is present in Zone 4 groundwater in levels exceeding the MCL, and as high as 9.4 µg/L. Based on preliminary evaluations the risk of vapor intrusion to residential receptors is within an acceptable risk range. However, EPA will confirm this with the collection of soil gas samples located above the areas where TCE concentrations in groundwater exceed the MCL. This sampling will be completed by September 31, 2018. If soil gas samples contain TCE above acceptable concentration levels additional steps will be taken to ensure there is not a risk to residential receptors in Zone 4. See Appendices C and E for a complete discussion of vapor intrusion at the Site.

4.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

5. Issues/Recommendations

Table 4. Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s):	**Issue Category: Remedy Performance**			
	Issue: Alluvium is not completely dewatered to bedrock in Zone 1.			
	Recommendation: Evaluate additional methods of dewatering and contaminant removal in Zone 1.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	9/30/2021

Issues and Recommendations Identified in the Five-Year Review:				
OU(s):	**Issue Category: Remedy Performance**			
	Issue: Weathered and unweathered bedrock along the western portion of the clay barrier dam may not be completely sealed by the grout curtain.			
	Recommendation: Evaluate the apparent hydraulic connection under the clay barrier, between Zone 1B and Zone 2.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	9/30/2021

OU(s):	**Issue Category: Other** Off-Site sources			
	Issue: Perchlorate in Zones 2 and 3 is not fully characterized by the existing well system. Perchlorate in Zone 4 is not fully characterized and a background concentration level needs to be established.			
	Recommendation: Evaluate the possibility of further optimization and well placement in the areas with little to no capture or well coverage.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	9/30/2021

OU(s):	**Issue Category: Remedy Performance**

	Issue: A 2015 capture zone analysis showed that contaminant capture is incomplete in Zones 1B, 2, and 3, particularly in the western and southern portions of each respective zone.			
	Recommendation: Evaluate the possibility of further optimization and well placement in the areas with little to no capture or well coverage.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	9/30/2021

OU(s):	**Issue Category: Remedy Performance**			
	Issue: Vapor intrusion of TCE, although within the generally acceptable risk range, may be occurring in Zone 4 based on a preliminary evaluation of groundwater data.			
	Recommendation: Collect soil gas samples from locations in Zone 4 that overlie TCE groundwater concentrations of 5 µg/L or greater and evaluate the risk of vapor intrusion within the two years.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	9/30/2018

5.1. *Other Findings*

In addition, the following recommendations could improve performance of the remedy and reduce risks of exposure to human receptors; these recommendations do not affect current and/or future protectiveness and were identified during the FYR:

- Hexavalent chromium has been identified in Zones 1-4 in recent groundwater sampling events. However, this contaminant was not found in Zone 4 wells above the State of California MCL of 10 µg/L, indicating that extraction systems upgradient are effective in removing contaminant mass.
- Interviews conducted during the FYR process indicate that landowners adjacent to the Site are exploring the possibility of expanding or redeveloping the land within Pyrite Canyon. Although no new future exposure scenarios are expected, potential land use changes must be closely monitored.

6. Protectiveness Statement

Table 5. Protectiveness Statement

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The selected interim remedies at the Stringfellow Superfund Site are protective of human health and the environment in the short-term because exposure pathways that could result in unacceptable risks are being controlled. However, to be protective in the long-term, the following actions should be completed: • Evaluate additional methods of dewatering and contaminant removal in Zone 1. • Evaluate the apparent hydraulic connection under the clay barrier, between Zone 1B and Zone 2. • Evaluate the possibility of further optimization and well placement in the areas with little to no capture or well coverage. • Collect soil gas samples from locations in Zone 4 that overlie TCE groundwater concentrations of 5 µg/L or greater and evaluate the risk of vapor intrusion within the two years.	

7. Next Review

The next FYR report for the Stringfellow Superfund Site is required 5 years from the completion date of this review.

Appendix A: List of Documents Reviewed

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Tetra Tech. 2014. *Final Stringfellow Blast Fracturing Pilot Study Report*. Lafayette, CA, February 20, 2014.

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Appendix B: Site Chronology

Date	Event
August 1956	Hazardous waste disposal operations at Stringfellow commenced.
1969	Excessive rainfall leads to overflow of former disposal ponds.
February 1972	Site contaminants first detected in groundwater down-gradient of waste disposal area.
November 1972	Hazardous waste disposal operations at Stringfellow Site ceased.
1975	Water Board initiates response actions and studies.
November 1978	Controlled release of contaminated water to Pyrite Creek; discharge supervised by Water Board.
1978-1981	Water Board removed 6.5 million gallons (MG) of contaminated water and dichloro-diphenyl- trichloroethane (DDT)-contaminated soil.
1980	USEPA performed initial Site inspection. Ten MG of contaminated water removed; containment barriers installed and surface drainage was improved.
October 1981	Stringfellow Site placed on the USEPA Interim Priorities List of Hazardous Waste Sites.
1981	California Department of Health Services began the investigation and cleanup at the Site.
July 22, 1983	USEPA issued first ROD.
September 8, 1983	Stringfellow Site placed on USEPA National Priorities List (NPL).
1983-1984	"Fast-track" Remedial Investigation/Feasibility Study (RI/FS) conducted by USEPA.
July 18, 1984	USEPA issued second ROD (addressed Zones 1 and 2).
September 18, 1984	Start of Remedial Design (RD) for Zone 2 groundwater extraction system.
November 29, 1984	Start of Remedial Action (RA) for Zone 2 groundwater extraction system.
1985	On-Site PTP startup in Zone 2.
June 25, 1987	USEPA issued third ROD (addressed Zones 1 and 3).
September 30, 1987	Start of RD for Zone 3 groundwater extraction system.
May 1988	PRP agreed to construct certain components of the third ROD remedial actions.
June 1988	USEPA and DTSC issued Proposed Plan to address Zone 4 groundwater contamination.
August 31, 1988	Completion of RD for Zone 3 groundwater extraction system.
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.
July 25, 1990	Start of RD for Zone 4 groundwater extraction system.
September 30, 1990	USEPA issued fourth ROD (addressed Zones 1 through 4).
1992	A consent decree between USEPA and the potentially responsible parties (PRPs).
February 1993	USEPA issued First Five-year Review Report.
January 3, 1995	Completion of RA for Zone 4 groundwater extraction system.
1995	Construction completed on Zone 1 dewatering system (fourth ROD).
1996	The State of California took over PTP operations.
1997	PRPs installed and started up the Community Wellhead Treatment System (CWTS).
July 9, 1998	Explanation of Significant Differences (ESD) issued for the second ROD.
October 1998	Construction of effluent pipeline extending to SARI pipeline completed.
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 Feasibility Study (SFS) Report for Zones 1 through 4.
April - May 2001	DTSC detected perchlorate at Site and began perchlorate investigation in Zone 4.
June 2001	Volatile Organic Compound (VOC) emissions recovery systems installed at the PTP.
September 2001	USEPA issued Second Five-year Review Report.
January – March 2002	Installation of 28 new monitoring wells in Zone 3.
March 2002	Phase I audit conducted for historical uses of perchlorate in Glen Avon area in Zone 4.
2002	All residents with private wells in Zone 4 were connected to the public water supply.
June 2003	Perchlorate detected in water supply wells east of Site.
October 2003	Interim Pesticide Removal System (IPRS) installed at PTP in Zone 2.
December 2003	DTSC amended the CWTS with resin beds to treat perchlorate.
2004	Zone 4 RI for perchlorate initiated.
2005	Permanent Pesticide Removal System (PRS) installed at PTP in Zone 2.
August 2005	DTSC completed seismic reflection survey for Zone 4 and cone penetrometer testing.
2004 – 2007	Bench-Scale testing for New PTP conducted.
August 2005	Final Screening-Level Ecological Risk Assessment (SLERA) completed.
September 2006	Third Five Year Review report issued by USEPA.
January 2007	Three monitoring wells in Zone 1 converted to extraction wells.
February 2006 –	Pilot-Scale testing for proposed New PTP train conducted.
2009	Air strippers installed at PTP in Zone 2.
June 2009	Final Health Risk Assessment for Zone 4 completed.
July 2009	Final Supplemental Feasibility Study for Zones 1, 2, and 3 completed.
July 2009	New PTP Design began (referred to as Pyrite Canyon Treatment Facility [PCTF]).
June 2010	Installed secondary containment for the decontamination pad.
February 5, 2010	Final Zone 4 RI report completed.
November 2010	Pilot Study of In-Situ Bioremediation of Zone 4 perchlorate completed.
July 7, 2010	Three monitoring wells converted to extraction wells in Zone 3.
December 2010	Proposed boundaries for Zone 4 Institutional Controls updated.
December 2010	Bedrock aquifer testing completed in Zones 1-4 wells.
September 2011	Converted Zone 1 groundwater monitoring wells (OC-10D & OC-10B) to extraction wells.
September 2011	Fourth Five Year Review report issued by USEPA.
March 2012	The Draft Zone 4 Feasibility Study is submitted for EPA review.
April 2012	The technical Impracticability Evaluation Report (TIE) is issued by DTSC.
March 2014	EPA issues Administrative Agreement on Consent to Perform Response Action.
February 2015	DTSC initiates field work for the Final Zone 4 Data Gap Investigation.
2015	EPA Investigation Area 1 and 2 field work completed.
July 2016	PCTF construction is complete, plant commissioning in progress.

Appendix C: Data Review

Groundwater, surface water, and soil data collected between 2011 and 2015 were evaluated as part of this Fifth Five-Year Review (FYR). Interim remediation goals for trichloroethylene (TCE) and chloroform were established in the fourth interim ROD; none of the other RODs established remediation goals for any contaminants. The fourth interim ROD established remediation goals of 5 micrograms per liter (µg/L), the federal maximum contaminant level (MCL) for TCE and the health-based level of 6 µg/L for chloroform. Additionally, perchlorate is being monitored and its distribution evaluated prior to future remedy implementation. Currently perchlorate concentrations are compared to the California MCL of 6 µg/L.

Groundwater

Over 875 wells (monitoring, extraction, injection, sumps, piezometers, non-potable residential/domestic, and water supply) are currently installed as part of the Stringfellow Superfund Site (Site) remedy. The California State Department of Toxic Substances Control (DTSC) collected or attempted to collect data from 552 of these wells/devices during the most recent 2014 sampling events (Geo-Logic Associates, 2014b).
A majority of the wells are screened within the alluvium, weathered bedrock, or unweathered bedrock, with others being screened across multiple aquifer units (Kleinfelder, 2015).

Since the end of the previous FYR period ending April 2011 and through the first quarter 2016, the following wells were installed or modified by DTSC:

- Zone 1
  - Two Zone 1 monitoring wells (OC-10D & OC-10B) were converted to extraction wells
  - Seven monitoring wells and nine piezometers were installed in Zone 1B

- Zone 2
  - 13 monitoring wells were installed on Pyrite Quarry property

- Zone 3
  - 11 monitoring wells and five extraction wells were installed
  - One monitoring well was converted to an extraction well

- Zone 4
  - 48 monitoring wells were installed as part of the Zone 4 data gap investigation (DGI)

In addition, the U.S. Environmental Protection Agency (EPA) installed the following wells, which are currently included in DTSC's groundwater monitoring program:

- 22 monitoring wells within EPA Investigation Area 1
- 14 monitoring wells within EPA Investigation Area 2

Groundwater samples from monitoring and extraction wells are obtained annually and tested for volatile organic compound (VOCs), perchlorate, and other constituents such as para-chlorobenzene-sulfonic acid (pCBSA) and metals. Additional quarterly monitoring events occur for newly installed wells. A minimum

of two synoptic water level gauging rounds are obtained from monitoring wells located in Zones 1 through 4, generally in the spring and fall of each year (Kleinfelder, 2015).

Groundwater at the Site is extracted from pumping wells in each zone and treated at three treatment plants. These include the Mid-Canyon Pretreatment Plant (PTP) in Zone 2, the Lower Canyon Treatment Facility (LCTF) in Zone 3, and the Community Wellhead Treatment System (CWTS) in Zone 4. Extracted groundwater is divided into five waste streams, designated A-Stream through E-Stream, which are directed to the treatment plants. Analytical testing of the various waste streams occurs on a weekly basis for contaminants of concern (COCs) in order to assess system influent concentrations, determine mass removal, and assess breakthrough of the granular activated carbon (GAC) and resin (Veolia, 2016).

The A-Stream of extracted groundwater is composed of influent from 35 extraction wells, along with 15 upgradient and four perimeter extraction wells/sumps that are used to minimize the amount of clean water entering the Site from the slopes of the Jurupa Mountains. This effectively limits the generation of additional contaminated leachate/groundwater. The A-Stream is also composed of groundwater extracted from Zone 1B located to the south of the clay barrier that separates Zone 1A from 1B, and contains nine extraction wells and a French drain. Additionally, there are eight extraction wells that form the influent to the B-Stream from Zone 2. Both the A- and B-Streams are treated at the PTP (see Table 6).

Table 6: Summary of Wells Routed to Each Waste Stream and Treatment Plant

Summary of Wells Routed to Each Waste Stream and Treatment Plant
2014 Annual Groundwater Monitoring And
Remedy Effectiveness Evaluation Report
Stringfellow Superfund Site

PTP					LCTF Plant		CWTS Plant	Upgradient
A Stream			B Stream	Perimeter	C Stream	D Stream	E Stream	
DGB-111	OW-22	OW-61A	IW-2	OW-45D2	LE-2	CTN-TW1	CTP-TW1	T-4B
FD	OW-23	OW-72D**	IW-3	UDG-3	LE-6	CTS-TW1	CTP-TW2	UGB-1
IW-1	OW-26D2	OW-76DB**	IW-B	UGB-4	LE-7			UGB-3
MW-22	OW-27D2	UDG-5	IW-C	UGB-10	LE-8			UGB-6
OC-1B	OW-28B1		MA-1		LEM-12LD			UGB-7
OC-6D	OW-32D1		MA-4		LMO-1			UGB-8
OC-10BR	OW-33D2		MB-1		OW-80D			UGB-9
OC-10DR	OW-36B1		MW-19B		OW-87D			UGB-102
OUM-1*	OW-37D1				OW-90D			UGB-109
OUM-2*	OW-39D1				OW-91D			UW-1
OW-1	OW-41D1				OW-96D			UW-2
OW-2	OW-42D2				OW-97D			UW-3
OW-4	OW-43D1							UW-6
OW-5	OW-47D1							
OW-6B	OW-50A1							
OW-8	OW-53D2							
OW-9	OW-54A							
OW-10	OW-55A							
OW-11	OW-56A							
OW-12	OW-57D							
OW-15D	OW-58A							
OW-21*	OW-59A							

Notes:
PTP = Pretreatment Plant
LCTF = Lower Canyon Treatment Facility
CWTS = Community Wellhead Treatment System
* Well OW-21 was decommissioned and Pump Barrels OUM-1 and OUM-2 were connected to the existing French drain beneath the north area of Zone 1 in 2013
** Installed in 2013

A second treatment facility, LCTF handles the C- and D-Streams. The C-Stream is composed of influent from 12 extraction wells from Zone 3. The D-Stream is composed of influent from two Zone 4 extraction wells located south of Highway 60. Lastly, the E-Stream is composed of influent from two extraction

wells located in the southern portion of Zone 4, which are referred to as the "Tree Farm" wells. The influent from these wells is treated at the CWTS.

Water treated at both the LCTF and the PTP is discharged to the Inland Empire Brine Line (Brine Line), which transports the water several miles to a publically owned treatment works (POTW). The effluent that is discharged to the Brine Line must meet pretreatment standards set by the regulating agency, the Santa Ana Watershed Project Authority (SAWPA) (Table 7). The water treated at the CWTS is either used by the nearby tree farm or local residents for irrigation or discharged into Pyrite Creek. The CWTS discharge is regulated under the National Pollutant Discharge Elimination System (NPDES), and all discharged water must meet effluent standards (Tables 9-13). All discharges under these programs, whether to the Brine Line, Pyrite Creek, or the irrigation taps, were conducted in compliance with the applicable permits. In 2014, a total of 368 groundwater samples obtained from extraction, monitoring, and water supply wells, as well as from piezometers, were analyzed for perchlorate, 356 samples were analyzed for VOCs, and 308 were analyzed for pCBSA. pCBSA is a pesticide derivative of dichlorodiphenyltrichloroethane (DDT), and is referred to in Site documents as a Stringfellow indicator compound. The number of samples collected by COCs and aquifer type are summarized in Table 8.

Table 7. Inland Empire Brine Line Discharge Pretreatment Standards, SAWPA Permit #D1079-2

POLLUTANT	Instantaneous Limit (mg/L)	Daily Maximum (mg/L)	Monthly Average (mg/L)	Daily Maximum (Lbs./Day)	Purchased Treatment Capacity (Lbs./Day)	Monthly Average (Lbs./Day)
Flow (Purchased Capacity)[11]	0.259 MGD[13]	-	-	-	-	-
pH[2]	6.0 - 12.0	6.0 - 12.0	-	-	-	-
Biochemical Oxygen Demand (BOD)[4]	Note 5	-	-	15,000	613.456	-
Total Suspended Solids (TSS)[4]	No Limit	-	-	-	460.036	-
Arsenic	2.0	2.0	-	3.12	-	-
Cadmium	0.064	0.064	-	0.10	-	-
Calcium	-	-	-	-	-	-
Chromium - Total	2.0	2.0	-	3.12	-	-
Copper	3.0	3.0	-	4.68	-	-
Cyanide – Amenable	1.0	1.0	-	1.56	-	-
Cyanide - Total	1.2	1.2	-	1.87	-	-
Dissolved Organic Carbon (DOC)[5]	700	700	-	-	-	-
Fats, Oils, and Grease (FOG)[6]	500	500	-	-	-	-
Hardness - Total	-	-	-	-	-	-
Lead	0.58	0.58	-	0.905	-	-
Mercury	0.03	0.03	-	0.047	-	-
Nickel	3.51	3.51	-	5.47	-	-
Oil/Grease - Mineral/Petroleum[6]	100.0	100.0	-	-	-	-
Pesticides[7]	0.01	0.01	-	0.016	-	-
Polychlorinated Biphenyls[8] (PCBs)	0.01	0.01	-	0.016	-	-
Silver	0.43	0.43	-	0.671	-	-
Sulfide -Dissolved	0.50	0.50	-	-	-	-
Sulfide - Total	5.0	5.0	-	7.80	-	-
Total Dissolved Solids (TDS)	-	-	-	-	-	-
Total Toxic Organics (TTOs)[9]	0.58	0.58	-	0.905	-	-
Volatile Suspended Solids (VSS)	-	-	-	-	-	-
Zinc	0.7	0.7	-	1.09	-	-
Radioactivity[10]	-	-	-	-	-	-

The extraction systems treated approximately 458.7 million gallons (MG) of contaminated groundwater between 1999 and 2007 (Tetra Tech, 2010), which averages approximately 57.3 MG per year. Between 2011 and 2014, a total of approximately 233 MG of contaminated groundwater was treated, averaging approximately 58.26 MG per year, consistent with previous averages. The amount of groundwater entering the recharge basin from the slopes of the Jurupa Mountains is a function of precipitation and evaporation. The average precipitation between 2001 and 2012 was 11.64 inches (Kleinfelder, 2014). Between 2011 and 2014, the average precipitation was 6.89 inches. As a result of decreased precipitation in recent years, water levels are lower and more alluvium wells are dry.

TCE, chloroform, and perchlorate are the chemicals used to help assess the remedy performance. Although TCE and chloroform remediation goals are only technically applicable to Zone 4 (as per the 1990 fourth interim ROD), it is useful to compare concentrations in Zones 1 through 3 to the remediation goals set for Zone 4. Based on the most recent 2014 annual report (Kleinfelder, 2015), TCE has been detected above ROD remediation goals in all four zones in the alluvium and weathered bedrock, and was detected in Zones 1 through 3 in the unweathered rock. Chloroform was detected in Zones 1, 2 and 4 in the alluvium, in Zones 1 and 2 in the weathered bedrock, and only in Zone 1 in the unweathered bedrock. Perchlorate was detected in all four zones and in all three aquifers. Additionally, pCBSA has been detected in quantities above the California Public Health Standard of 3 milligrams per liter (mg/L) in Zone 1 and 2 alluvium and weathered bedrock, and in Zone 1 unweathered bedrock.

Zone 1

All four RODs selected interim remedial actions to address the hazards and risks posed by contaminants originally disposed in Zone 1. Zone 1 is split into Zone 1A, which includes the source area south to the clay barrier/grout curtain, and Zone 1B, which lies to the south of the barrier. The RODs focus primarily on remedial measures involving Site fencing, erosion control, surface water management, and controlling the source of contaminants (by waste removal, capping/containment, constructing a groundwater barrier, and extraction). The objectives for groundwater in Zone 1 are to reduce the potential for the release and migration of Site contaminants to groundwater; and to control, recover, and treat contaminated liquids in Zone 1 using diversion, dewatering (i.e., lowering of the water level), extraction, and on-Site pretreatment systems.

Site objectives are being achieved through prior remediation efforts, which included removal of waste liquids, excavation of contaminated soil, capping of the waste lagoons, preventing direct contact with waste materials, and limiting contact of waste via runoff controls. Site fencing and signage is in place identifying Site hazards. Extracted water (A-Stream) is being treated and discharged at the PTP. RAOs pertaining to dewatering and containment are further described in the following paragraphs.

The lowering of the water table shows progress is being made toward dewatering Zone 1 down to bedrock. This dewatering is critical to the gradual achievement of the containment objective. During the spring and fall of 2014, 134 monitoring wells, extractions wells/sumps, and piezometers were gauged in Zone 1A, 45 in Zone 1B in spring, and 54 in Zone 1B in fall. In the fall 2014, 61 wells were dry, consisting of 30 alluvium wells (25 in Zone 1A and 5 in Zone 1B) and 31 in weathered bedrock (27 Zone 1A and 4 in Zone 1B). The total flow out of the extraction wells and sumps from all Zone 1A/1B wells/sumps/drains was 6.2 gpm in 2014, which comprises the A-Stream to the PTP. Flow rates in 2011

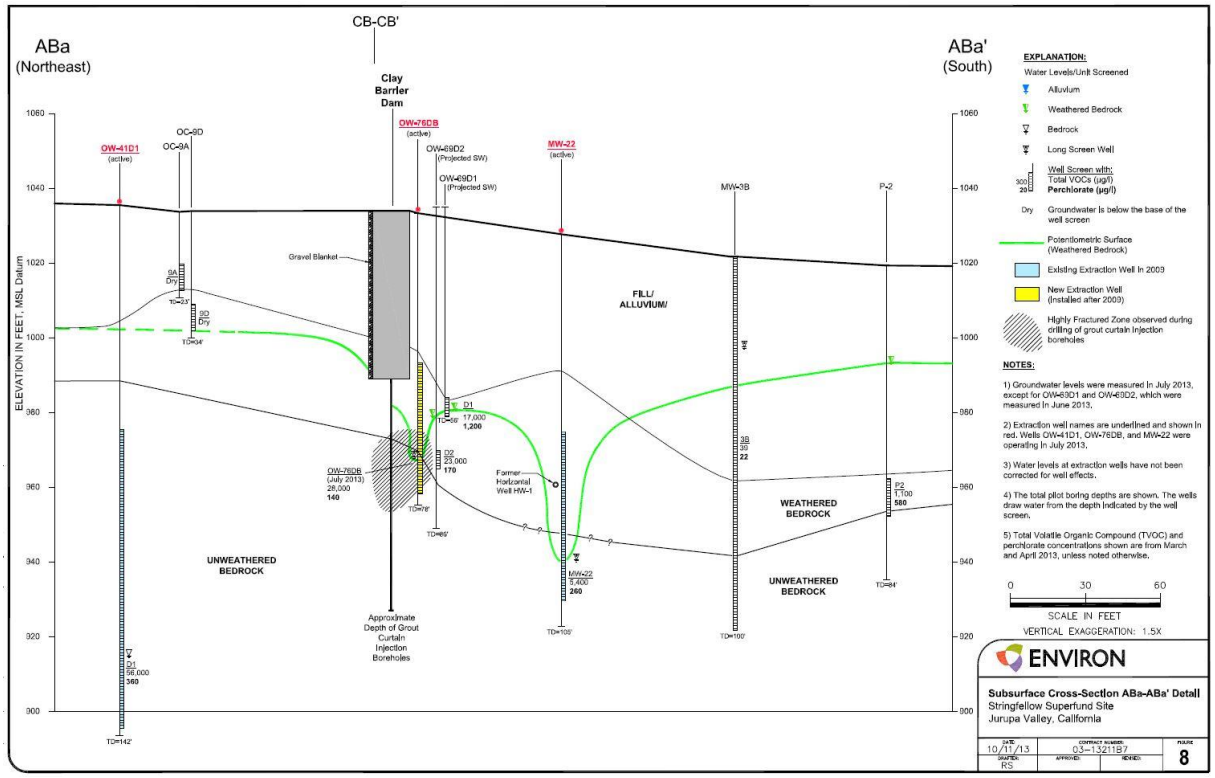
averaged 10.55 gpm and extraction rates have declined on a yearly basis. The total flow from Zone 1 represents approximately 9.5 percent of the total flow for all waste streams.

Zone 1A

The capture of contaminant mass and prevention into further downgradient zones is an objective for Zone 1. The extraction well data and mass flux calculations seem to indicate that the Zone 1A extraction system and clay barrier/grout curtain are not entirely effective in removing contaminant mass and limiting the flow of contaminants into Zone 1B. A mass flux calculation was performed in the 2014 annual groundwater monitoring report (Kleinfelder, 2015), which had not been completed in the previous reports. The mass flux determines the mass in pounds per year leaving one zone and entering another (e.g., Zone 1A to Zone 1B, Zone 1B to Zone 2, etc.). The calculation was based on the respective aquifer width, thickness, hydraulic conductivity, and gradient and iso-contours for TCE, perchlorate, and chloroform crossing the various boundaries. For Zone 1A, 131.34 pounds of TCE was removed via extraction wells, and 11.5 pounds per year of TCE migrated beyond the clay barrier/grout curtain. In 2014, chloroform extraction equaled 26.44 pounds, and 1.5 pounds per year migrated into Zone 1B. Lastly, 2.24 pounds of perchlorate were extracted, and 0.6 pounds per year migrated into Zone 1B.

Lowered water levels as a result of lower precipitation coupled with extraction well pumping has dewatered several of the alluvial and weathered bedrock wells in Zone 1A, which was described as an interim goal of the fourth interim ROD. Many of the wells upgradient of the clay barrier/grout curtain, which separates Zones 1A from 1B, are dry. In the fall of 2014, 24 of 33 alluvium wells and 27 of 70 weathered bedrock wells were dry, including two extraction wells. Figure 3 depicts a cross-section through the clay barrier (north to south), which shows the alluvium and portions of the weathered bedrock dewatered in proximity to the clay barrier (ENVIRON, 2015). The alluvium on the eastern portion of the clay barrier is not dewatered as completely as it is along the center of the clay barrier.

Figure 3. Cross Section ABa-ABa' Across Clay Barrier Wall, July 2013



A highly fractured bedrock area is located along the western section of the clay barrier dam near extraction well OC-10B. Pump tests in wells across the barrier showed hydraulic communication indicating the fractures had not been completely sealed by the grout curtain installed beneath the clay barrier dam (ENVIRON, 2015). Groundwater concentration data in bedrock wells near this area also support this hypothesis. However, data measured for total VOCs has decreased in the downgradient well OC-11B indicating a greater extent of capture. Improvement of the hydraulic control in this area was recommended during the Final 2009 Supplemental FS. DTSC installed additional extraction and monitoring wells in this area. Further evaluation of the hydraulic connection and dewatering effectiveness in this area will be performed to incorporate data from newly installed wells and when wet year conditions are present. Although contamination is migrating into Zone 1B from Zone 1A, active (but incomplete) dewatering/containment is occurring in proximity to the clay barrier/grout curtain. Complete dewatering of the original disposal area (Zone 1A) is a component of the Zone 1 remedy, mandated in the 1990 fourth interim ROD.

Zone 1B

Trend analysis using Mann-Kendall and Thiel-Sen slope statistics were performed on 40 parameters in Zone 1B, with, 6 statistical tests depicting downward trends for TCE and 2 for perchlorate. There were no upward trends, and 32 tests depicted no discernable trends for TCE or perchlorate. TCE and perchlorate data from well OC-11B on the downgradient side of the clay barrier depicts a downward trend. Other wells with downgradient trends were extraction wells MW-22 and IW-1, located downgradient of the clay barrier/grout curtain. The downward trends adjacent to the clay barrier show that containment is occurring

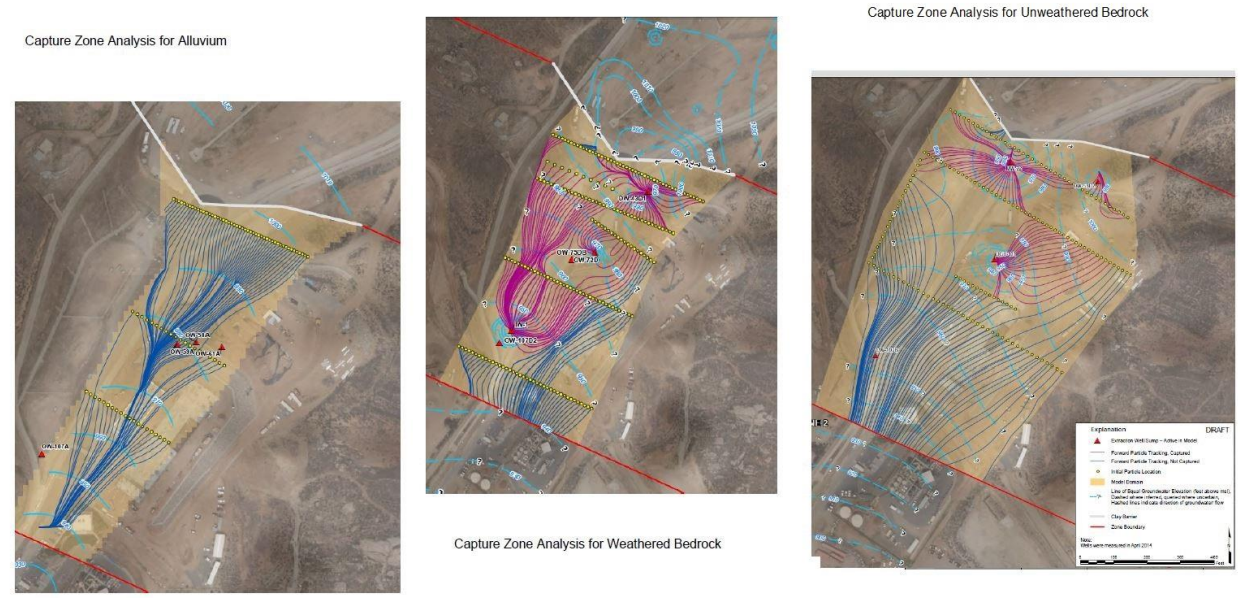
to some degree and that contaminant mass is being removed from the aquifer preventing further contaminant migration. As mentioned above, containment is an objective for Zone 1.

Ten extraction wells exist in Zone 1B, and groundwater extraction rates have declined from 2.6 gpm in 2011 to an average total extraction rate of approximately 0.95 gpm in 2014. The extraction system in Zone 1B is intended to capture any contaminants that are not contained by the clay barrier and grout curtain. Extraction wells are screened within the alluvium and the weathered/unweathered bedrock. Based on the 2014 DTSC annual report, and the 2015 ENVIRON Zone 1B Evaluation, recommendations have been made to install additional monitoring wells and piezometers, as well as to conduct additional pump tests to determine hydraulic conductivity of the aquifers and fracture interconnectedness. A subset of the recommended wells have been installed, and the need for additional wells will be evaluated following an analysis of the current data set. Based on the 2014 report, there are approximately 50 monitoring wells within Zone 1B to assess contaminant capture/migration.

As mentioned previously, DTSC performed mass flux calculations in their most recent annual report (2015). Extraction wells removed 3.62 pounds of TCE, while 21.6 pounds per year migrated into Zone 2 from Zone 1B. Similarly, 0.95 pounds of chloroform were extracted from the wells, while 6.92 pounds per year migrated into Zone 2. Extraction wells also removed 0.64 pounds of perchlorate, while 13.4 pounds per year migrated into Zone 2.

Capture zone analyses were completed for the alluvium, weathered bedrock, and unweathered bedrock (Figure 4). The results of these analyses indicate that improvements to the extraction system may be warranted in order to capture mass leaving Zone 1B and entering Zone 2.

Figure 4. Capture Zone Analysis, Zone 1B



Source: Draft 2014 Annual Groundwater Remedy Effectiveness Evaluation, Kleinfelder, Inc. November 2015

Capture Zone Analysis for Alluvium/Weathered and Unweathered Rock - Zone 1B

Zone 2

The remedy selected for Zone 2 in the second ROD included construction of an on-Site PTP (for all Site-related contaminated groundwater) and the installation of a groundwater extraction and barrier system in Zone 2. The RAO for the groundwater remediation system was to prevent further downgradient migration of contaminated groundwater from Zone 2 to Zone 3. Between 2013 and 2015, EPA began investigations in two areas to delineate other possible sources of perchlorate, these areas are not considered part of Zone 2 but are included here for geographic and hydraulic reasons. EPA Investigation Area 1 is to the west of Zones 1-3. It includes Pyrite Quarry, the canyon/valley west of the western ridge forming Pyrite Canyon (also known as the Teledyne area, currently a wildlife preserve), a portion of the Metropolitan Water District pipeline easement, and private property southwest of the quarry (FCC-LLC property). Information obtained by EPA shows that perchlorate was used at Pyrite Quarry and in the Teledyne area. Explosives containing perchlorate were historically used during blasting at Pyrite Quarry. Operations in the Teledyne area are not well documented, but appear to have included ordnance manufacturing from 1965 to about 1971. The EPA Investigation Area 1 study was designed to determine the nature and extent of contamination in this area, and the extent to which contamination in EPA Investigation Area 1 has contributed to surface water or groundwater contamination in Zones 2 through 4.

EPA Investigation Area 2 is east of Zone 2 within Pyrite Canyon, at the location of historical UPCO company activities. Information obtained by EPA indicates that UPCO and its successor Universal Propulsion Company, Inc., a Delaware Corporation (UPCO-DE), operated in Pyrite Canyon in the area surrounding the Stringfellow hazardous waste disposal site from 1965 to 1980 and may have manufactured and tested rocket propellants. In 1983, an unpermitted disposal pond used by UPCO was discovered in the southeast corner of EPA Investigation Area 2. Soil removal was performed in 1984. This area is being investigated as a potential source of contaminants to the Pyrite Canyon groundwater plume. Information obtained will be used to evaluate the need for remediation of this area and to estimate the area's contribution, if any, to the groundwater contamination in Zones 2 through 4.

The extraction system in Zone 2 consists of eight extraction wells. Two wells are screened in the alluvium, one well is screened in the unweathered bedrock, and five wells are screened across multiple intervals. Groundwater extraction rates between 2011 and 2014 have declined for the B-Stream from 23.65 gpm to 7.65 gpm, with a December 2015 flow rate of approximately 7.2 gpm. As with pumping rates, mass removal declined, dropping from 43.85 pounds in 2012 to 23.99 pounds in 2014. On average, Zone 2 contributes 13.25 percent of the total system flow and accounts for 1.35 percent of the total mass removed between 2011 and 2014. Despite flow rates being reduced, groundwater containment/capture is occurring as a result of the extraction system.

In addition to the 8 extraction wells, there are 39 monitoring wells and a non-potable domestic well within Zone 2. During the spring and fall 2014 synoptic gauging events, 33 monitoring/extraction wells and piezometers were gauged. In the fall 2014 event, six wells were dry, four in the alluvium and two in the weathered bedrock. A robust monitoring network is necessary to confirm groundwater flow in the various aquifer units and to assess groundwater capture/containment, an RAO.

In the alluvium of Zone 2, maximum concentrations of TCE, chloroform, perchlorate, and pCBSA decreased in comparison to 2012 maximums. In the weathered bedrock, perchlorate and chloroform

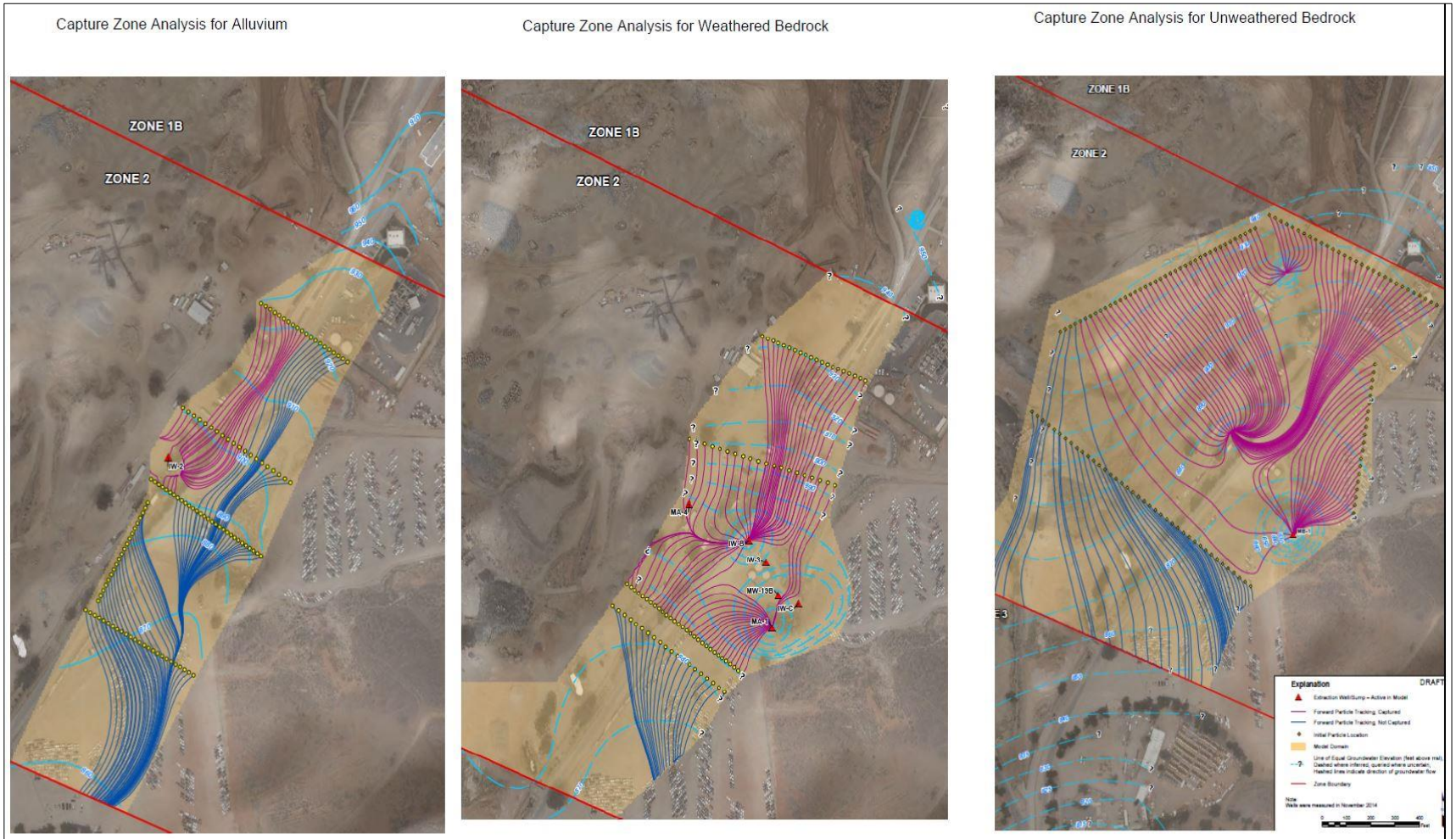
maximums were comparable. However, TCE and pCBSA concentrations increased between 2012 and 2014. All maximum detections in 2012 and 2014 for the weathered bedrock were detected in a single well, MW-30D. In the unweathered bedrock, only three samples were collected (from wells MB-1, MB-2, and MB-3). In 2014, three TCE samples exceeded groundwater standards and there were two perchlorate exceedances. TCE concentrations were comparable in 2014, while perchlorate concentrations decreased. No chloroform groundwater standards were exceeded in 2012 or 2014.

Trend analysis using Mann-Kendall and Thiel-Sen slope statistics were performed on 84 parameters, 42 each for perchlorate and TCE. Of the samples, two parameter tests depicted upward trends for TCE, two tests depicted downward trends for TCE, and one test depicted an upward trend for perchlorate. Of 79 parameter tests, none had a definable trend at an alpha level of 0.05 (95 percent confidence level). Although there have been decreases in maximum concentrations, the lack of statistically downward trends for TCE and perchlorate likely indicate that additional plume capture/containment may be required. As mentioned above, containment is a RAO for Zone 2.

As mentioned previously, DTSC performed mass flux calculations in their most recent annual report (2015). Extraction wells removed 5.92 pounds of TCE, while 0.8 pounds/year migrated into Zone 3. Similarly, for chloroform, 0.67 pounds were extracted from the wells, while no chloroform migrated into Zone 3. For perchlorate, extraction wells removed 7.63 pounds, while 3.6 pounds/year migrated into Zone 3. Mass coming into Zone 2 from Zone 1B should be reduced, if feasible, along with contributions from other potential sources contributing perchlorate to Zone 2.

In 2015, a capture zone analysis was performed for the alluvium, weathered bedrock, and unweathered bedrock. The analysis (Figure 5) shows that there is not much capture in the alluvium to the south and east of well IW-2. Capture of contamination in the weathered bedrock is occurring except in the southern portion of Zone 2; similarly, capture in the unweathered bedrock is fairly complete except south of extraction well MB-1.

Figure 5. Capture Zone Analysis, Zone 2



Source: Draft 2014 Annual Groundwater Remedy Effectiveness Evaluation, Kleinfelder, Inc. November 2015

Capture Zone Analysis for Alluvium/Weathered and Unweathered Rock - Zone 2

Zone 3

The third interim ROD, issued in June 1987, established the containment and treatment of contaminated groundwater as an RAO for Zone 3. 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.

The extraction system in Zone 3 consists of 12 extraction wells, with 5 in the alluvium and 7 in weathered bedrock. Two extraction wells were installed during this FYR period. Groundwater extracted from the 12 wells comprises the C-Stream and is treated at the LCTF. Extraction rates between 2011 and 2014 have declined for the C Stream from 37.5 gpm to 5.75 gpm, with a December 2015 flow rate of approximately 4.1 gpm. Mass removal declined, dropping from 9.77 pounds in 2011 to 1.95 pounds in 2014.
On average, Zone 3 contributes, by flow, 16.1 percent of the total system flow but only accounts for 0.21 percent of the total mass removed between 2011 and 2014.

In addition to the 12 extraction wells, there are 125 monitoring wells, 15 non-potable domestic wells and 4 injection wells in Zone 3. During the spring and fall 2014 synoptic gauging events, 130 monitoring wells, extraction wells, and piezometers were gauged. In the fall 2014 gauging event, 53 wells were dry, 37 in the alluvium and 16 in the weathered bedrock. The number of dry wells was approximately 33 percent of all wells, with drought conditions likely the cause for lower flow rates.

Groundwater analytical sampling data for perchlorate in 2014 indicates that 9 of 13 samples in the alluvium, 42 of 45 samples collected from the weathered bedrock, and 8 of 15 samples from the unweathered bedrock are above the California State MCL. In the alluvium, weathered bedrock, and unweathered bedrock, 6 of 13 TCE samples, 15 of 45 TCE samples and 2 of 16 TCE samples exceeded the federal MCL. There were no exceedances of the chloroform health-based standard in all aquifer units.

In the alluvium, maximum concentrations of TCE, chloroform, and perchlorate were comparable between 2012 and 2014(110 µg/L in. vs. 93 µg/L in). In the weathered bedrock, TCE, perchlorate, chloroform, and pCBSA were comparable between 2012 and 2014. In the unweathered bedrock, TCE, chloroform, and perchlorate concentrations were overall lower but comparable. The maximum detected concentrations in unweathered bedrock for TCE, perchlorate, and chloroform were found in LEO-11B. The analytical results indicate that concentrations are generally decreasing downgradient from the source.

Trend analysis using Mann-Kendall and Thiel-Sen slope statistics were performed on 233 parameters (113 for TCE and 120 for perchlorate). Of these samples, 80 parameter tests for TCE and 74 parameter tests for perchlorate had no definable trend at an alpha level of 0.05 (95 percent confidence level). Thirty tests depicted a statistical downward trend for TCE, and three tests had an upward statistical trend for TCE. With respect to perchlorate, 42 parameter tests depicted a downward trend, and four tests depicted an upward trend. The high proportion of downward statistical trends points to containment and even gradual restoration of groundwater, as a result of groundwater capture within this zone and other hydraulically upgradient zones.

Mass removal and flux calculations indicate that 0.17 pounds of TCE were extracted from Zone 3 extraction wells, and 0.12 pounds per year entered Zone 4. Similarly, 0.01 pounds of chloroform were

extracted from the wells, with no measureable mass flux entering or exited the respective zones. Extraction wells removed 1.3 pounds of perchlorate, while 1.49 pounds per year migrated into Zone 4 (Kleinfelder, 2015). The capture zone analysis for Zone 3 is presented in Figure 6. The analysis shows that there is plume capture/containment occurring with greater capture/containment occurring in the weathered and unweathered bedrock compared to the alluvium. However, there appears to be essentially no capture south of State Highway 60. Similarly, capture along the western side of Zone 3 appears to be lacking in the alluvium and unweathered bedrock (Kleinfelder, 2015).

Figure 6. Capture Zone Analysis, Zone 3

Zone 4

The remedy selected for Zone 4 in the fourth ROD (issued September 1990) was for the installation of the CWTS for pumping and treatment of Site-related groundwater contamination south of State Highway 60 in the City of Jurupa Valley. The RAOs for the Zone 4 groundwater remedy were to prevent further migration of contaminated groundwater and to restore groundwater to ARAR or background levels. Restoration of groundwater quality in the area is intended to allow the unrestricted, to the extent possible, use of groundwater in this zone, in an effort to be consistent with the RWQCB's Water Quality Control Plan for the Santa Ana River Basin (RWQCB, 2011), which designates groundwater in this zone as having a present or potential beneficial use for municipal supply.

During this FYR period, DTSC submitted a draft Zone 4 Feasibility Study report (Kleinfelder, 2012). EPA determined that additional data collection was needed to address data gaps. A Zone 4 DGI intended to supplement the Zone 4 RI/FS is currently underway and includes soil and surface water sampling, the

installation of groundwater monitoring wells, collection and analysis of Zone 4 groundwater samples for perchlorate and other parameters. A revision of the draft Zone 4 FS report for perchlorate in groundwater will incorporate the information gained from the DGI.

The D-Stream groundwater has its source in two extraction wells located in the northern portion of Zone 4. This waste stream is treated at the LCTF, located in Zone 3. Two further downgradient wells, known as the "Tree Farm" wells, are treated at the CWTS plant and compose the E-Stream. The D-Stream averaged a flow rate of approximately 53.5 gpm between 2011 and 2014. The operations, monitoring, and maintenance report indicated that the flow rate in December 2015 was approximately 53.15 gpm, consistent with prior extraction rates (Veolia, 2016). The D-Stream represents approximately 48.4 percent of all of the waste stream flows and is the largest. Between 2011 and 2014, approximately 23.7 pounds of VOCs and perchlorate were removed from this stream. On average, the D-Stream contributed approximately 0.25 percent of all waste stream mass removal.

The E-Stream averaged a flow rate of approximately 14 gpm between 2011 and 2014, with extraction rates declining from 17.3 gpm in 2011 to 11 gpm in 2014. Based on the operations, monitoring, and maintenance report, the flow rate in December 2015 was approximately 3.5 gpm, even lower than the prior annual rate (Veolia, 2016). The E-Stream, on average, represents approximately 12.5 percent of all of the waste stream flows. Between 2011 and 2014, approximately 3.6 pounds of VOCs and perchlorate were removed. Although flow rates have been reduced, mass removal and plume capture/containment is occurring, which is an RAO for Zone 4.

Groundwater analytical sampling data for perchlorate in 2014 indicates that 102 of 143 samples in the alluvium, 9 of 13 samples from the weathered bedrock, and 3 of 6 samples from the unweathered bedrock are above California State MCLs. Several sources of perchlorate are suspected of contributing to the elevated concentrations detected in groundwater, including former disposal activities at Zone 1, possible perchlorate use in EPA Investigation Areas 1 and 2, and widespread use of Chilean nitrate fertilizers containing naturally occurring perchlorate. TCE in groundwater exceeded the federal MCL in 5 of 129 samples in the alluvium and 2 of 13 samples in the weathered rock. No samples in the unweathered bedrock exceeded the federal MCL. There was only one sample in the alluvium exceeding action levels for chloroform and none in the weathered or unweathered bedrock.

In the alluvium groundwater, maximum concentration of TCE, chloroform, and perchlorate were comparable between 2012 and 2014. TCE, perchlorate, and chloroform maximums were comparable in the weathered bedrock. In the unweathered bedrock, maximum concentrations of TCE, chloroform, and perchlorate in 2014 were comparable to 2012 concentrations. The analytical results indicate that concentrations decrease with downgradient distance from Highway 60.

In addition to the 4 extraction wells, there are 450 wells in Zone 4, consisting of: 110 monitoring wells, 61 piezometers, 4 water-supply wells, and 275 non-potable domestic wells. During the spring and fall 2014 synoptic gauging events, 173 monitoring wells, extraction wells, and piezometers were gauged, and in fall 2014, 164 wells were gauged. Data presented in annual report indicates that 10 alluvium wells were dry in fall 2014 (Kleinfelder, 2015). Groundwater flow is predominantly to the south beyond State Highway 60 and turns more southwesterly and eventually westerly as groundwater approaches the Santa Ana River.

Trend analysis using Mann-Kendall and Thiel Sen slope statistics were performed on 143 parameters. Of these samples, 59 parameter tests for TCE and 48 parameter tests for perchlorate had no definable trend at an alpha level of 0.05 (95 percent confidence level). Twelve tests depicted a downward trend for TCE, and one depicted an upward trend for TCE. With respect to perchlorate, 15 tests depicted a downward trend, and 8 tests depicted an upward trend. Statistics were not calculated for the E-Stream wells. The presence of 12 downward trends for TCE and 15 for perchlorate indicates that groundwater restoration is being achieved in certain wells.

Capture zone analysis is presented in Figure 7 for Zone 4 alluvium. The analysis shows capture in the area of CTS-TW1, which averaged approximately 37.5 gpm for 2014 (40 gpm in December 2015), whereas there appears to be minimal deflection of the particle paths in proximity to extraction wells CTN-TW1, CTP-TW1, and CTP-TW2.

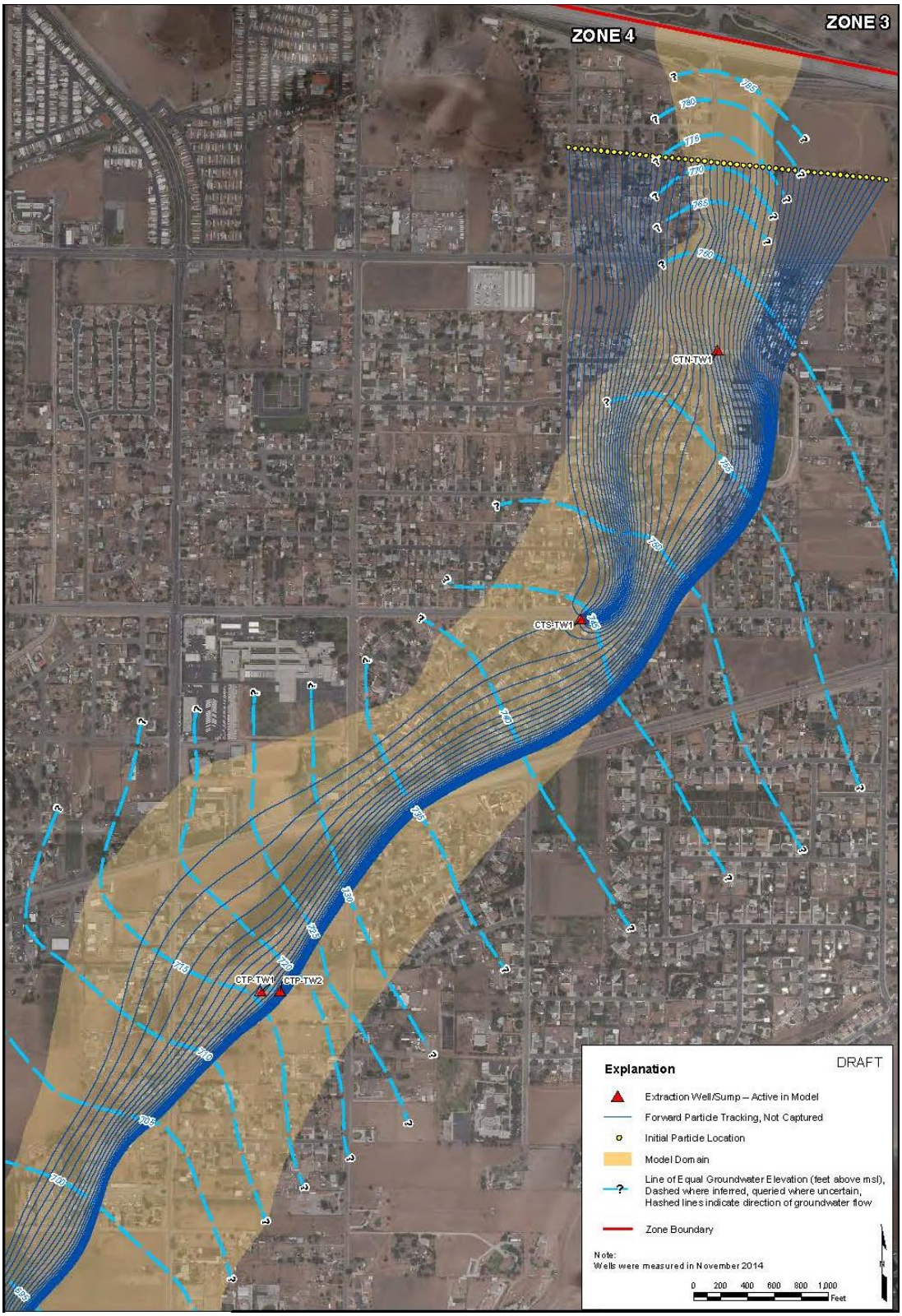
Soil

Due to the soil removal and waste pit capping that occurred in the early 1980s, soil samples have not been taken at regular intervals at the Site. However, soil samples have been taken intermittently throughout the Site for a variety of reasons.

Soil samples were collected as part of the RI for Zone 4 to evaluate risks to human health. Surface soil samples were collected at 10 locations in Zone 4 in 2007 in order to evaluate perchlorate concentrations in that soil. Perchlorate was detected in 9 out of 10 of the samples analyzed, with the highest concentration detected at 42 micrograms per kilogram (µg/kg) (Kleinfelder, 2010b). These soil sample analytical data, along with soil sample analytical data collected in 2001, 2002, and 2003, were used in a human health risk assessment, which concluded that the perchlorate concentrations detected in the soil samples do not pose a health risk (Kleinfelder, 2010b).

In April 2011, a soil sampling investigation was conducted on the current location of the new Pyrite Canyon Treatment Facility (PCTF), which at that time was an empty property owned by another entity. The investigation was conducted in order to screen for potential contaminants in the soil that could affect the property purchase proceedings. Fifty-one total borings were drilled up to 25 feet below ground surface. Diesel and oil range petroleum hydrocarbons were found in isolated pockets at concentrations consistent with minor vehicle leaks and spills, which is consistent with the property's past usage. Perchlorate was found equally distributed throughout the surface soils, although at concentrations no greater than 160 µg/kg, well below the applicable industrial land use regional screening level (RSL) of 820 milligrams per kilogram. No significant metal, VOC, or polychlorinated biphenyl (PCB) contamination was identified in any of the samples. Based on these results, there did

Figure 7. Capture Zone Analysis for Alluvium, Zone 4



not appear to be a human health risk (Tetra Tech, 2012). The property was subsequently purchased, and the construction of the PCTF was completed in December 2015.

In 2012, 20 soil samples were taken at 10 locations in Zone 1 to depths of up to 18 inches in order to provide health and safety information for the continued clearing and grubbing operations that are required as part of future Site activities. Chloroform and TCE were detected in five of the samples, with concentrations ranging from trace (between the method detection limit and reporting limit) to 25 µg/kg. Perchlorate was detected in 17 of the samples in concentrations ranging from 2.0 to 21 µg/kg. Trace concentrations of 2 PCB Aroclors and 5 different pesticide compounds were detected as well (Geo-Logic Associates, 2012).

Also in 2012, at the recommendation of the screening level ecological risk assessment (SLERA) completed in 2005, soil samples were taken on the canyon walls adjacent to Zone 1A to evaluate the background concentrations of metals and their potential risk to ecological receptors in the area. The results were compared to the results of soil samples in Zone 1 taken in 2005 to determine whether on-Site metal concentrations were statistically different than the surrounding concentrations. The evaluation concluded that no metals found in the Stringfellow on-Site soil exceeded background levels in a statistically meaningful way (Kleinfelder, 2012).

EPA collected soil samples from 75 locations as part of the study of EPA Investigation Area 1 in 2013 and at 13 locations in 2015 as part of the study of EPA Investigation Area 2. Analysis of the data indicates that perchlorate is present in soils within these two areas. Evaluation of the soil data is currently being conducted and should allow for better understanding of the distribution of perchlorate across both investigation areas.

In the fall of 2015, composite soil samples were taken at locations throughout Zone 4, as part of the final Zone 4 DGI. These sample locations correspond with the locations of new monitoring wells as well as at soil boring-only locations. These samples will be analyzed for perchlorate and nitrate, and will be used to resolve data quality objectives of the Zone 4 DGI.

Surface Water

Since 2005, DTSC has collected surface water runoff samples after each rain event that achieves certain criteria, known as a “qualifying storm event” (Geo-Logic Associates, 2013). These samples are designed to evaluate the perchlorate concentrations in stormwater runoff. In the last 5 years, surface water was sampled: three times in 2012, and four times in 2014, four times in 2015 and three times in 2016.

In 2012, stormwater was sampled from six locations in Pyrite Canyon after a major storm event. These six locations included one sample location at the weir in Pyrite Creek, positioned such that all surface water entering Zone 1 must drain through the weir. Perchlorate was measured at a concentration of 0.77 µg/L at this location. The five other samples were located at parts to Pyrite Creek receiving runoff from other portions of the canyon, including the adjacent quarry. These samples ranged from 3.5 to 7.5 µg/L, with four of five of the samples exceeding the 6-µg/L California MCL for perchlorate (Geo-Logic Associates, 2013).

In 2014, two qualifying storm events occurring on back-to-back days in February required DTSC to sample runoff on those days. On the first day, three samples were taken, one from the Stringfellow weir location and two from tributaries leading to Pyrite Creek from the adjacent quarry. Perchlorate was measured at a concentration of 0.71 µg/L for the Stringfellow weir, and 2.7 and 1.5 µg/L for the other samples. On the second day of sampling, samples were taken from 12 locations along Pyrite Creek, including 3 samples from immediately downstream of the Site. Perchlorate was not detected in the three downstream samples, while the remaining 9 samples ranged from trace to 39 µg/L, with three of these nine samples exceeding the 6-µg/L California MCL for perchlorate (Geo-Logic Associates, 2014).

EPA collected surface water samples from six locations during the February 2014 event as part of the study of EPA Investigation Area 1. Perchlorate was measured at a maximum concentration of 19 µg/L in a sample taken at the confluence of Pyrite Creek and an ephemeral stream that runs along the western boundary of Pyrite Quarry.

In December of 2014, two more storm events triggered the surface water sampling requirement. On December 2, samples were taken from six locations including the PCTF spillway immediately downstream from the Zone 1 weir and nearby tributaries. Perchlorate was present in all of the samples, with the highest concentration of 5.40 µg/L found at the PCTF spillway. On December 12, ten samples were taken at the same locations after a rain event. Similar to the previous sampling event, the highest concentration (11.00 µg/L) came from the PCTF spillway (Geo-Logic Associates, 2016).

In April 2015, EPA collected a pond water sample as part of the study of EPA Investigation Area 2. Perchlorate was not detected in this sample.

Surface water sampling continues at this time per the *Final Surface Water Sampling and Analysis Plan* (Geo-Logic Associates, 2014) and the *Final Zone 4 Data Gap Investigation Sampling and Analysis Plan* (Kleinfelder, 2015). An updated Site-wide groundwater and surface water sampling plan is currently under review that will combine both sampling regimens into a single document. Due to the apparent differences in perchlorate concentrations in different parts of Pyrite Creek obtained in the previous sampling events, other sources of perchlorate are being actively investigated.

Table 8. Groundwater Samples Analyzed by Aquifer Type & Parameter, 2014

Aquifer	Perchlorate	VOCs	pCBSA
Alluvium	183	169	132
Weathered Bedrock	119	120	111
Unweathered Bedrock	66	67	65
Total	**368**	**356**	**308**

Table 9. NPDES Discharge Limitations, Permit # CAG918001, Order #R8-2012-0027

EFFLUENT LIMITATIONS APPLICABLE TO DISCHARGES INTO OR TRIBUTARY TO RECEIVING WATERS **DESIGNATED MUN** (see Basin Plan Table 3-1)		
Constituent	Maximum Daily Concentration Limit (µg/L)	Average Monthly Concentration Limit (µg/L)
1,1,1-Trichloroethane (TCA)	10	5
1,1-Dichloroethane	10	5
1,1-Dichloroethylene	0.115	0.057
1,2-Dichloroethane	1.0	0.5
1,2-Dichloroethylene (sum of cis & trans)	20	10
1,2-Dichloroethylene (trans)	20	10
1,2- Dichloroethylene (cis)	12	6
1,4-Dioxane	2	1
Benzene	2	1
Carbon Tetrachloride	0.5	0.25
Dichlorobromomethane	1.13	0.56
Ethylbenzene	20	10
Methyl Ethyl Ketone	241	120
Methyl Isobutyl Ketone	241	120
Methyl Tertiary Butyl Ether (MTBE)	26	13
Naphthalene	20	10
Perchlorate	12	6
Tert Butyl Alcohol (TBA)	24	12
Tetrachloroethylene (PCE)	1.6	0.8

Table 10. NPDES Discharge Limitations Con't

EFFLUENT LIMITATIONS APPLICABLE TO DISCHARGES INTO OR TRIBUTARY TO RECEIVING WATERS **DESIGNATED MUN** (see Basin Plan Table 3-1)		
Constituent	Maximum Daily Concentration Limit (µg/L)	Average Monthly Concentration Limit (µg/L)
Toluene	20	10
Total Petroleum Hydrocarbons	200	100
Trichloroethylene (TCE)	5.4	2.7
Vinyl Chloride	1.0	0.5
Xylene (Total)	20	10

Table 11. NPDES Discharge Limitations Con't

EFFLUENT LIMITATIONS APPLICABLE TO DISCHARGES INTO OR TRIBUTARY TO **MUN EXCEPTED** RECEIVING WATERS (see Basin Plan Table 3-1)		
Constituent	Maximum Daily Concentration Limit (µg/L)	Average Monthly Concentration Limit (µg/L)
1,1,1-Trichloroethane (TCA)	10	5
1,1-Dichloroethane	10	5
1,1-Dichloroethylene	12	6
1,2-Dichloroethane	1.0	0.5
1,2-Dichloroethylene (sum of cis & trans)	20	10
1,2- Dichloroethylene (cis)	12	6
1,2-Dichloroethylene (trans)	20	10
1,4-Dioxane	2	1
Benzene	2	1
Carbon Tetrachloride	1.0	0.5
Dichlorobromomethane	10	5
Ethylbenzene	20	10
Methyl Ethyl Ketone	241	120

Table 12. NPDES Discharge Limitations Con't

EFFLUENT LIMITATIONS APPLICABLE TO DISCHARGES INTO OR TRIBUTARY TO **MUN EXCEPTED** RECEIVING WATERS (see Basin Plan Table 3-1)		
Constituent	Maximum Daily Concentration Limit (µg/L)	Average Monthly Concentration Limit (µg/L)
Methyl Isobutyl Ketone	241	120
Methyl Tertiary Butyl Ether (MTBE)	26	13
Naphthalene	20	10
Perchlorate	12	6
Tert Butyl Alcohol (TBA)	24	12
Tetrachloroethene (PCE)	10	5
Toluene	20	10
Total Petroleum Hydrocarbons	200	100
Trichloroethylene (TCE)	10	5
Vinyl Chloride	1.0	0.5
Xylene (total)	20	10

Table 13. NPDES Discharge Limitations Con't

EFFLUENT LIMITATIONS APPLICABLE TO ALL RECEIVING WATERS	
Constituent	Maximum Daily Concentration Limit (mg/l)
Total Dissolved Solids (TDS)	See Section A.6. and Section A.7., below
Total Inorganic Nitrogen (TIN)	See Section A.6. and Section A.7., below
Total Residual Chlorine[3]	0.1 mg/l
Suspended Solids	75 mg/l
Sulfides	0.4 mg/l

Appendix D: ARAR Assessment

ARAR Analysis

Section 121 (d)(2)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) specifies that Superfund remedial actions must meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Applicable requirements are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those cleanup standards and other substantive environmental protection requirements promulgated under federal or state law that, while not directly "applicable" to a CERCLA site, address problems or situations sufficiently similar to those found at a site that their use is well suited to the particular cleanup.

Because remedial design and construction to implement previous Records of Decision (RODs) for the Stringfellow Superfund Site (Site) is complete, ARARs that address those activities are no longer pertinent and are not addressed in this review.

Table 14 illustrates the status of chemical-specific ARARs identified in the selected remedy within the respective RODs or the Site. A remediation goal of 6.0 micrograms per liter (µg/L) for chloroform had been selected based on an excess cancer risk of 10^{-6}, where no state or federal maximum contaminant level (MCL) existed at the time of the fourth interim ROD. Incidentally, the remediation goal for chloroform was consistent with the California action level at that time. Since 2006, chloroform is subject to an MCL within a combined standard for total trihalomethanes (TTHM). The selected remediation goal for chloroform does not exceed the MCL for TTHM, and so the adoption of an MCL does not affect protectiveness. Accordingly, the chloroform ARAR remains 6.0 µg/L. The ARAR for TCE has not changed and continues to be 5.0 µg/L.

Table 14. Summary of Chemical-Specific ARARs

Contaminants of Concern	Relevant Zone	1990 ROD remediation goals (µg/L)	Current State MCL (µg/L)	Current Federal MCL (µg/L)	Is the Remediation Goal above the Current MCL?
Chloroform	Zone 4	6.0	80[1]	80[1]	No
TCE	Zone 4	5.0	5.0	5.0	No

[1] As total trihalomethanes (TTHM).

No other Federal or State laws and regulations for ARARs have been promulgated or changed over the past 5 years in a manner that affects the substance of any selected remedies for the Site, and so the protectiveness of such other ARARs also remains unchanged. These ARARs include:

- Resource Conservation and Recovery Act, 40 Code of Federal Regulations (CFR) Part 148
- Resource Conservation and Recovery Act, 40 CFR Part 264 Subpart J
- Resource Conservation and Recovery Act, 40 CFR Part 270 Subpart F

- Resource Conservation and Recovery Act, 42 United Sates Code (USC) § 6924(m) and 40 CFR Part 268
- Federal Clean Water Act pre-treatment requirements, 40 CFR Part 403)
- National Pollutant Discharge Elimination System, 33 USC § 1317
- South Coast Air Quality Management District Reg. XIII New Source Requirements, Air Quality Management District Rule 1325
- South Coast Air Quality Management District Rule 1167 (rescinded)
- Underground Injection Control Program, 40 CFR § 144.24
- Santa Ana Region Basin Water Quality Control Board, Water Quality Objectives

Perchlorate is a more recently identified contaminant of concern at the Site. No ARAR for perchlorate has been considered, and pending completion of a new or final ROD, there is no remediation strategy or goal for perchlorate. There is no federal MCL for perchlorate. EPA anticipates that an appropriate remedy may consider the California MCL of 6.0 µg/L.

Appendix E: Human Health and the Environment Risk Assessment

Human Health Risk Assessment Review

In 1987, SAIC, Inc., completed a baseline health risk assessment (HRA) to assess the risks associated with the Stringfellow Superfund Site (Site) in the absence of remedial actions.

The following potential exposure pathways were evaluated:

- Exposure to contaminated groundwater via consumption
- Exposure to contaminated surface water (i.e., runoff originating at the Site) via contact or consumption
- Exposure to contaminated soils via ingestion of soil and inhalation of airborne soil particulates

The analysis concluded that the combined maximum lifetime risk from exposure to groundwater contaminated with trichloroethylene (TCE) and chloroform in the community area, if used for drinking water, exceeds the U.S. Environmental Protection Agency (EPA) risk guidelines. Furthermore, without any remedial action, the contaminants may continue to migrate downgradient in the Glen Avon Basin aquifers, adding to the risk of exposure for the local community.

The analysis determined that the potential exposure to contaminated surface water is considered limited because the Site is capped, drainage improvements have been completed on-Site and in the upgradient areas, and normal rainfall amounts are relatively small. In addition, exposure to contaminated soils is only a concern in the original source zone, now known as Zone 1A.

Because of mitigative measures implemented at the Site, none of these exposure pathways are currently complete. In 2002, residents of Glen Avon (now incorporated in the city of Jurupa Valley) in the proximity of the groundwater plume were connected to municipal water supply, and a County ordinance currently prevents installation of any new drinking water wells. Since groundwater is not used for drinking water consumption in Zones 1 (composed of 1A and 1B), 2, 3 or 4, oral ingestion of contaminated groundwater remains an incomplete exposure pathway. Ongoing cap maintenance and access restrictions continue to control these potential exposure pathways. Therefore, all exposure pathways identified in this HRA are currently incomplete.

A supplemental health risk assessment for Zone 4 was prepared by the ChemRisk Division of McLaren/Hart Environmental Engineering Corporation with the concurrence of Region IX of the EPA in 1995. This HRA was not available for review and has been superseded by a subsequent 2009 HRA performed by Kleinfelder.

A new human HRA was performed for Zone 4 in 2009 in response to the detection of perchlorate and 13 volatile organic compounds (VOCs) in Zone 4 groundwater, as well as perchlorate in Zone 4 soil (Kleinfelder, 2009). Because VOCs may migrate from groundwater to indoor air and may be inhaled by

building occupants, these 13 VOCs were identified as contaminants of potential concern (COPC) and addressed in the HRA, along with perchlorate.

Although previously detected in Zone 4, sulfate and nitrate were excluded from consideration in the 2009 HRA. Zone 4 data showed that all but 3 of 131 groundwater samples contained concentrations of sulfate below the 250 milligrams per liter (mg/L) secondary MCL for sulfate. The distribution of elevated nitrate concentrations throughout Zone 4 was attributed to a regional source of nitrate. Therefore, no apparent elevated "plume" of nitrate, or increased load of nitrate, is associated with the Stringfellow perchlorate plume (Kleinfelder, 2010).

The potential exposure pathways to the Zone 4 COPCs evaluated in the 2009 HRA include the following:

- Exposure of residents and workers via ingestion of contaminated soil, groundwater, homegrown produce, or breast milk (nursing infants only)
- Exposure to VOCs consequent to migration of VOCs from groundwater to indoor air
- Exposure of livestock to contaminated soil and groundwater via ingestion

Currently, residents receive drinking water from the municipal supply, such that all potential pathways that are associated with consuming groundwater are hypothetical only. Actual exposure of residents to perchlorate under current conditions might result from consumption of water from the municipal supply, consumption of homegrown produce irrigated with Zone 4 groundwater, or consumption of produce imported from areas irrigated with water containing perchlorate.

In summary, there continues to be potential exposure pathways identified that could affect the protectiveness of the remedy.

Vapor Intrusion

EPA's understanding of contaminant migration from soil gas and/or groundwater into buildings has evolved over the past few years, leading to the conclusion that vapor intrusion may have a greater potential for posing risk to human health than assumed when the Site RODs were prepared. EPA evaluates the potential for vapor intrusion using a "multiple lines of evidence" approach consistent with its 2015 vapor intrusion guide, *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*, OSWER Publication 9200.2-154, and numerical screening levels are derived in the Vapor Intrusion Screening Level (VISL) calculator: http://www2.epa.gov/vaporintrusion.

Given the applicable OSWER guidance, the presence of high concentrations of VOCs in soils and groundwater, as well as the current and potential future presence of enclosed buildings above the Site, there is a potential for vapor intrusion at the Site.

Indoor air sampling events took place in June 2014 and January 2015. Samples were collected from six locations in 2014 and seven locations in 2015, all within (and immediately around) the Stringfellow Pretreatment Plant in Zone 2. The results of the sampling showed that VOCs, the primary drivers of vapor intrusion risk, were present at concentrations well below their respective risk-based indoor screening levels for commercial/industrial land use. There are currently no residential land use receptors in the

sampling area. As a result, it was concluded that vapor intrusion was not a source of unacceptable risk or hazard at Zones 1-3 of the Site.

Vapor intrusion risk was also calculated for residential receptors in Zone 4, using 2014 groundwater monitoring data. TCE, a compound that can volatilize readily and be a source of vapor intrusion risk, is present in Zone 4 groundwater in levels exceeding the MCL, in concentrations as high as 9.4 µg/L. Using the VISL calculator predicts a 10^{-5} carcinogenic risk to human health via the inhalation pathway of exposure from indoor air. EPA generally considers 10^{-6} to 10^{-4} an acceptable range for long term carcinogenic risk. To protect a more vulnerable population, namely women in the first trimester of pregnancy, from noncancer health effects EPA will conduct soil gas sampling to gain a better understanding of the risk posed by vapor intrusion. This sampling will be completed by September 30, 2018. If analysis of the data indicates the possibility of vapor intrusion occurring, further actions will be taken to mitigate these risks.

Toxicity Values

EPA's Integrated Risk Information System (IRIS) has a program to update toxicity values used by the agency in risk assessment when newer scientific information becomes available. In the past 5 years, there have been a number of changes to the toxicity values for many COCs at the Site. To evaluate the protectiveness of the cleanup standards for this FYR, those standards were compared to EPA's current regional screening levels (RSLs). The RSLs for cancer are chemical-specific concentrations for individual contaminants that correspond to an excess cancer risk level of 1×10^{-6} (or a Hazard Quotient of 1 for non-carcinogens), and they have been developed for a variety of exposures scenarios (e.g., residential, commercial/industrial). RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed to address potential human health exposures. The EPA protective excess cancer risk range is between 1×10^{-6} and 1×10^{-4}. Cleanup levels that fall within this range and are less than the non-cancer RSLs are considered protective. Table 15 below, presents this comparison.

Table 15. Comparison of Tap Water RSL to ROD Cleanup Standards

Contaminant of Concern	2015 Tap Water RSL for Cancer Risk (µg/L)	Protective Cancer Risk Range (µg/L)	2015 Tap Water RSL for non-cancer hazard (µg/L)	Cleanup Standard (µg/L)	Is the Cleanup Standard still Protective?
TCE	0.49	0.49-49	2.8	5	Y[1]
Chloroform	0.22	0.22-22	97	6	Y

[1] Although the non-cancer RSL is less than the cleanup standard for TCE, federal MCLs are set at levels that EPA deems protective of human health.

Any concentration below the cancer RSL indicates that cancer risk is low, while concentrations significantly above the cancer RSL may indicate an increase in cancer risk. For both chloroform and TCE, the cleanup standards values are within the acceptable cancer risk range of 1×10^{-6} to 1×10^{-4}, and are therefore considered protective with respect to cancer risks.

For non-cancer risks, the cleanup standard for chloroform is significantly less than the tap water non-cancer RSL, and therefore that cleanup standard is considered protective. The non-cancer RSL for TCE is less than the cleanup standard, indicating that there may be a risk at this Site from TCE. However,

this cleanup standard is based on either State or Federal MCLs. MCLs are set at levels that EPA deems protective of human health. The cleanup standard for TCE is therefore considered protective for non-cancer risk.

In 2011, EPA conducted an updated assessment for TCE, which included a risk of fetal cardiac malformations due to short-term in utero exposures to TCE as a result of inhalation. This IRIS assessment set a reference concentration of 2 micrograms per cubic meter. In 2014, EPA Region IX issued a memorandum regarding "EPA Region 9 Interim Action Levels and Response Recommendations to Address Potential Developmental Hazards Arising from Inhalation Exposures to TCE in Indoor Air from Subsurface Vapor Intrusion" and EPA's Office of Superfund Remediation and Technology Innovation issued a memorandum to the EPA Regional Superfund offices on "Compilation of Information Relating to Early/Interim Actions at Superfund Sites and the TCE IRIS Assessment" These changes indicate that the risk from TCE to indoor air may be of concern for short-term exposure.

Ecological Review

In 2002, EPA prepared an Ecological Risk Evaluation in order to identify potentially complete ecological exposure pathways at the Site. The evaluation identified the lack of available information concerning contamination in surface soil and sediment as a data gap, and recommended the collection of this type of data. In 2005, a screening level ecological risk assessment (SLERA) was prepared to determine whether significant exposures might be occurring to sensitive Site-specific receptors. The SLERA made the following conclusions:

- There is potential for risk to ecological receptors
- A background metals investigation would help clarify the risk of metals in soil to certain ecological receptors
- A thicker cap over the disposal areas (Zone 1) would help mitigate any potential risks to burrowing animals from the inhalation pathway
- Given uncertainty associated with pCBSA and perchlorate ecotoxicity, these contaminants should be reconsidered as new information becomes available
- Perchlorate should be considered a contaminant of potential ecological concern in soil, and plant samples should be collected to evaluate and estimate the uptake of perchlorate as well as its impacts
- If Site managers decide that the risk to ecological receptors outlined in the SLERA is unacceptable, a new ecological risk assessment should be conducted with further refined exposure parameters

The conclusions of the 2005 SLERA specifically call for two further investigations, which prompted the preparation of a 2013 SLERA Addendum by Kleinfelder. This addendum compared metals concentrations in soil at the Site with background metals concentrations, as well as evaluated the uptake of perchlorate by plants. The report concluded that no metals found in soil from the Site exceeded background levels in a statistically meaningful way. Additionally, the report proposed a screening level for perchlorate in soils, above which negative ecotoxicity effects could be expected in plants. The report further noted that perchlorate concentrations in soil samples collected before the construction of the Pyrite Canyon Treatment Facility were lower than the proposed screening level.

There have been no changes to exposure pathways that may alter the above evaluations of ecological risk.

Appendix F: Press Notice

Bill would ban smoking at state parks

The measure, which cleared one committee, affects Inland beaches, lakes.

By LAYLAN CONNELLY and SUZANNE HURT
STAFF WRITERS

A bill that would end smoking in California's state parks cleared a state Senate committee, a move that brings advocates a step closer to putting out butts on Inland beaches and boating lakes, and in forests and orange groves where smoking still is allowed.

The bill proposed by state Sen. Marty Block, D-San Diego, passed the Senate Committee on Natural Resources and Water on Tuesday with a 7-2 vote.

The proposal would outlaw smoking at the Inland region's nine state parks, recreation areas and other property, from Silverwood Lake, Lake Perris and the Salton Sea to Mount San Jacinto State Park and California Citrus State Historic Park.

The proposed ban includes all of the state parks system in California, which encompasses 40 miles of coastline, 970 miles of lake and river frontage and 4,500 miles of trails. About 67 million people visit state parks each year.

Lake Perris State Recreation Area's Park Superintendent Mark Hudgens said the bill seems like a good idea, but its passage might not have a noticeable impact on Lake Perris or other parks because so few people light up there.

"I truly don't see that many people smoking in our parks," he said.

With committee passage, the bill moves to the Senate Appropriations Committee and from there, the full Senate. The Assembly voted down a similar bill in 2010.

Wildfire risks are a major concern at Inland state parks. Discarded cigarette butts are one of the leading causes of fires in the state.

Last year during California's fourth year of severe drought, wildfire danger led to smoking bans at Mount San Jacinto State Park and Silverwood Lake State Recreation Area, which are both in the San Bernardino National Forest.

The bans were lifted after winter rain and snow, state parks and recreation department spokesman Dennis Weber said.

Block introduced the bill to protect state park visitors, including beachgoers, from secondhand smoke, to shield wildlife and marine creatures from tobacco-related toxins and to prevent fires caused by discarded cigarettes, Block's spokeswoman Maria Lopez said.

The bill also would ban smoking along several miles of coastline at Orange County's five state beaches – Bolsa Chica, Huntington, Crystal Cove, Dana Point and San Clemente – and comes more than a decade after city beaches tackled the issue and extinguished smoking on the sand. The state also manages the trails and open space areas of Crystal Cove and El Moro.

The past decade has seen a major push against smoking in public, with bans at city parks and most college campuses, including the UC system. Smoking already is banned at parks in Banning, Corona, Hemet, Murrieta, Norco, Palm Springs and Temecula.

Smoking is off-limits at Riverside County water parks, Rancho Jurupa Regional Sports Park and its soccer fields, and inside or near county parks buildings. Smoking is allowed in designated areas at two county park facilities in Jurupa Valley, the Carriage House at Crestmore Manor and Eddie Dee Smith Senior Center, county spokesman Ray Smith said.

But smoking is discouraged everywhere else because it doesn't fit the healthy lifestyle promoted through the county's park and trail systems, he said.

San Bernardino County regional parks allow smoking.

Staff writer Fred Swegles contributed to this report.

CONTACT THE WRITERS: [illegible]

Inland smoking rules

All of the Inland region's state parks and recreation areas currently allow smoking outdoors. State law already bans smoking in visitor centers, restrooms and other buildings in state parks, and within 20 feet of doors and windows of any public building.

1. Lake Perris State Recreation Area
2. California Citrus State Historic Park
3. Silverwood Lake State Recreation Area
4. Mount San Jacinto State Park
5. San Timoteo Canyon Park Property
6. Indio Hills Palms Park Property
7. Salton Sea State Recreation Area
8. Wildwood Canyon Park Property
9. Providence Mountains State Recreation Area (temporarily closed)

STAFF GRAPHIC

MARINES

FROM PAGE 1

Mabus on a parade deck and listened as the secretary spoke about integration and his commitment to keeping the U.S. Marine Corps the best of the best.

"This is not about women in combat," he said. "Women have been in combat for a long, long time. We have lost – killed in action – 160 women in Iraq and Afghanistan. This is about certain specific (jobs) being open to women."

Mabus told the Marines that while there has been opposition from Marine Corps brass to opening new roles to women, there is no turning back.

In January 2013, then-Defense Secretary Leon Panetta lifted the ban on women in combat roles. The policy, at the advice of the Defense Department, overturned a 1994 Pentagon rule preventing women from jobs in infantry, artillery, armor and other combat roles.

"We're a stronger Corps every time we've become a more diverse Corps," Mabus said. "In the late 1940s, when African Americans were integrated into the Marine Corps – there was a concern. It was voiced loudly that it was going to ruin the Marine Corps, that it was going to lower standards.

"We are stronger because we have Marines of color. Just like when 'don't ask, don't tell' was stopped, we are stronger because we don't judge people on who they love, but on whether they can do the jobs as Marines."

Mabus' talk at Camp Pendleton was his third visit to a Marine base since Defense Secretary Ash Carter in December ordered all positions open to women. The other bases were Camp Lejeune in North Carolina and Quantico in Virginia.

It also came on the heels of a Marine administrative announcement Friday that said all Marines will fall under the same policies – there will be no more jobs directed just at women.

Marine Corps leaders had sought to keep certain infantry and combat jobs closed to women, citing a gender-integrated task force study at Marine Corps Air Ground Combat Center Twentynine Palms. Results from the study, reported by the Marine Corps Times last year, showed that a majority of women and some men dropped out of the task force, and in one Marine experiment, teams with women performed worse than all-male teams.

On Tuesday, Mabus, who has sided with Carter, said those jobs are now open. But as the Corps continues to move toward integration, boot camp will still remain divided by gender for the time being, he said.

After speaking, Mabus fielded questions. Four of the seven questions were about women in combat.

A male Marine asked if now that women are allowed in combat, would they also be eligible for the draft. Mabus, who said he has three daughters, said he would be in favor of it, but the decision would ultimately be made in Congress.

Gunnery Sgt. Janet Marrufo said after the talk that she appreciated the open discussion.

"It was important for the Marine Corps to do this to clear the air," said the 31-year-old from Temecula. "I agree a more diverse force is a better force."

Marrufo, who works in administration for the Headquarters Support Battalion, said she would have considered going into combat if it had been open to her when she joined 12 years ago. Now a mother of two, she said she likely wouldn't be able to live up to some of the physical requirements.

CONTACT THE WRITER: 714-796-[illegible]

PHOTOS: MINDY SCHAUER, STAFF PHOTOGRAPHER

Surrounded by Marines at Camp Pendleton, Navy Secretary Ray Mabus talks Tuesday about the new policy of opening all jobs in the Corps to women.

Gunnery Sgt. Janet Marrufo of Temecula is interviewed after Navy Secretary Ray Mabus' visit to Camp Pendleton.

"It was important for the Marine Corps to do this to clear the air. I agree a more diverse force is a better force."
GUNNERY SGT. JANET MARRUFO OF TEMECULA

WOMAN KILLED ONE YEAR AFTER SON'S BEATING

By DOUG SAUNDERS
STAFF WRITER

A woman struck and killed Saturday night as she exited her vehicle in Apple Valley has been identified.

Anna Marie Clemenson-Wolf, 58, of Hesperia, died after she parked her car in the bike lane on Kiowa Road, south of Del Oro Road, shortly before 9 p.m. and was struck by the driver of a black 1999 Jeep, according to a San Bernardino County coroners news release.

Sheriff's deputies assigned to the Hesperia station confirmed that Clemenson-Wolf is the mother of Francis Jared Pusok, who led deputies on a three-hour chase through Hesperia and into Apple Valley, a pursuit that ended with a videotaped beating of the suspect.

Pusok received a $650,000 settlement from the county about two weeks later.

Clemenson-Wolf died April 9, exactly one year after her son was captured on video by an NBC helicopter news crew as he was being beaten by San Bernardino County sheriff's deputies. Pusok was sought by sheriff's deputies in connection with a residential burglary and motorcycle theft in Lucerne Valley.

Three sheriff's deputies are facing trial on assault charges stemming from the April 9 chase.

Pusok is set to appear back in court in Victorville April 22 to face criminal charges in connection to his arrest, court records show. He was also arrested in a separate incident, an alleged assault, in October.

PUBLIC NOTICE

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY BEGINS FIFTH FIVE-YEAR REVIEW OF CLEANUP AT THE STRINGFELLOW HAZARDOUS WASTE SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) has begun its fifth five-year review of cleanup actions at the Stringfellow Hazardous Waste Superfund Site (Site) located in Riverside County, CA. [illegible]

THE REVIEW PROCESS

[illegible]

COMMUNITY INVOLVEMENT

[illegible]

SITE HISTORY

[illegible]

FOR MORE INFORMATION

[illegible]

[illegible]

ACTINIC KERATOSIS

Check your skin that is typically exposed to the sun.

DO YOU HAVE SUN SPOTS?

If yes, your sun spots may be ACTINIC KERATOSIS

If you have at least 5 spots that look like small, crusty, discolored, scaly patches of skin that can be raised, rough, or sensitive to touch on one or more of the following areas: your face, chest or scalp, you may qualify for an Actinic Keratosis research study being conducted in the Murrieta area.

If qualified, you will receive at no cost:
* A study-related examination of your skin
* Investigational study gel
* Study-related lab tests

You may also receive compensation for your travel time.

Health insurance is not needed.

Call Dermatology Specialists, Inc.
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www.LeoPharmaTrials.com

Appendix G: Interview Forms

Five-Year Review Interview Record			
Site: Stringfellow Superfund Site		**EPA ID No:**	CAT080012826

Interview Type: in-person
Location of Visit: Stringfellow Superfund Site, Jurupa Valley, CA
Date: 1/21/2016
Time: 12:00

Interviewers

Name	Title	Organization
Jayson Osborne	Remediation Biologist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Susan Fears	DTSC	Engineering Geologist		

Summary of Conversation

1) What is your overall impression of the project?
Good. Active and fully funded to do whatever we need to do. Busy with upgrades.

2) Is the remedy functioning as expected? How well is the remedy performing?
Yes. We have shown capture in all four zones and augmented the clay barrier with additional extraction wells.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?
Declining trends in Zones 1-3 for TCE and perchlorate. Zone 4 has only two detections of TCE out of approximately 160 wells.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-Site presence, describe staff and frequency of Site inspections and activities.
Yes. Two full time CA employees and full time contractor (Veolia) support (15 employees full time). Plus 24-hour security.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last 5 years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
Reduced extraction well sampling from semi-annual to annual. Still doing annual monitoring at monitoring wells (quarterly at new wells). No effect on protectiveness.

6) Have there been unexpected O&M difficulties or costs at the Site in the last 5 years? If so, please give details.
New plant was constructed, but that was expected. Same treatment process, just bigger and more automation.

7) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Yes. Zone 1 has had 2 new extraction wells and 13 new monitoring wells installed. Installed 36 new monitoring wells in Zone 4. Optimization of mass removal in Zone 1 is why wells were installed deeper to optimize capture and mass removal. New wells in Zone 4 are for delineation of the contaminant plume.

8) Do you have any comments, suggestions, or recommendations regarding the project?
Continue capture, monitoring, and optimization, especially in Zone 2.

9) What is the status of the current Zone 4 investigations regarding perchlorate?
Field work complete for the DGI investigation. DGI SAP was approved. Samples are still being collected for isotopes. These may take a year for the laboratory to analyze (it is a university laboratory, not a commercial one).

10) Have any new or emerging COCs been identified? If so, have they impacted the effectiveness of the remedy?
Yes. Hex chrome (10 ppb) is the new California MCL. Have been monitoring for it and will integrate into the treatment program. No exceedances detected in Zone 4. Some exceedances in Zone 2 however.

11) What is your sense of the effectiveness of the Community Wellhead Treatment System (CWTS) in Zone 4?
It's pumping water with TCE below cleanup levels – but there is removal of low level perchlorate there.

12) What is the status of the Pyrite Canyon Treatment Facility? Are there any other significant construction activities proposed?

99 percent construction complete. 3 months of commissioning underway. Hope to occupy the facility at end of March/beginning of April. No other significant construction is planned. Might add additional extraction wells. Need to identify secondary sources of perchlorate first. 13) Are you aware of changes in land use or development within Pyrite Canyon? Are there plans for changes in land use or development? *Development of a strip mall (along Granite Hill Drive) may affect well placement in the future. Expansion or build out of warehouses at the car lot could block access to wells or interfere with access. They have not yet signed an access agreement – access to date has been informal. Quarry to west of Site will reach their mining limits within the next 5 years. They will have to perform reclamation and the Site may be developed in future. Currently there is uncontrolled surface water runoff from the quarry into the drainage near the Site.*

Five-Year Review Interview Record			
Site: Stringfellow Superfund Site		**EPA ID No:**	CAT080012826
Interview Type: Phone Location of Visit: N/A Date: 23 February 2016 Time: 1300			

Interviewers		
Name	**Title**	**Organization**
David Clark	Remediation Biologist	USACE

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Emily Keene	CH2M Hill			

Summary of Conversation

1) What is your overall impression of the project?
Overall impression is that there is a lot going on, between multiple investigations and optimization efforts. The Site is moving in the right direction because there is now a clear path forward, with the Site-wide ROD being the ultimate goal. EPA and DTSC entered into an agreement in 2014 to conduct the data gap investigation. The main challenge going forward will be to see how the final FS will work between the multiple investigations ongoing. The Stringfellow perchlorate investigation and the two ongoing EPA investigations will have to be merged at some point in pursuit of the Site-wide ROD, and these extraction systems must be integrated in some manner.

2) Is the remedy functioning as expected? How well is the remedy performing?
The remedy is doing what it can do, and is doing what it is supposed to be doing. The overall remedy is not complete, as the plume is not fully captured. The clay barrier is not 100 percent effective at the weathered bedrock layer. The remedy is currently effective mainly because there simply are no receptors, meaning that the water is not being used for drinking consumption. The optimization efforts by DTSC are meant to correct for the limitations of the current remedy.

3) What does the monitoring (or extraction) data show? Are there any trends that show contaminant levels are decreasing?
Many of the Zone 2 wells have an upward gradient. There is some uncertainty about sources, effective well locations, and the overall lithology of the Site. The trends generally show decreasing concentrations, and the plume is fairly well controlled. There are still concentrations in unweathered bedrock at which extraction and treatment is less effective. DTSC has in the past used pCBSA as an indicator chemical, since it really only has one source and drops out as you go downgradient. However, due to analytical methods, perchlorate was analyzed as pCBSA in the source area before 2012, so DTSC is backing off the use of pCBSA as an indicator chemical.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of Site inspections and activities.
The DTSC contractor is the continuous O&M presence, operating the 3 treatment plants. DTSC and their contractor have submitted monthly reports to EPA to keep the agency apprised of any O&M changes.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last 5 years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
*No. The discharge permits for effluent allow the operator to discharge to the Brine Line or Pyrite Creek. Currently, the new treatment plant [*i.e., the PCTF*] is waiting on its suite of discharge permits. Some plants can only be operated during the day due to contractor staffing requirements.*

6) Have there been unexpected O&M difficulties or costs at the Site in the last 5 years? If so, please give details.
No.

7) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
Ziggy Kostecki would really be the one to ask about that. DTSC has conducted groundwater monitoring optimization efforts on their 400+ wells in an attempt to make them more efficient and save money. DTSC looked at wells that might be redundant, wells that are screened across two different units, well replacement, and looked to remove metals from the sampling regime because they are well understood at the Site.

8) Do you have any comments, suggestions, or recommendations regarding the project?
It is important to prioritize the filling of the data gaps. For example, there are areas in Zone 2 that have little or no well coverage.

9) What is the status of the current Zone 4 investigations regarding perchlorate?
Currently, EPA is investigating two areas outside the Site for addition perchlorate inputs. In Zone 4, the RI was completed along with a draft FS. DTSC proposed a background level for perchlorate of 12 micrograms per kilogram, which is twice the MCL. EPA came back and suggested an isotope analysis for perchlorate, which could determine whether the perchlorate found was from Chilean fertilizer, synthetic, or naturally occurring. EPA and DTSC entered into the DGI agreement, which will involve revising the FS, revising the background concentration for perchlorate and adding more wells. Currently there are more wells being installed, soil sampling, and samples are being taken for the isotope analysis.

10) Have any new or emerging COCs been identified? If so, have they impacted the effectiveness of the remedy?
Recently DTSC has been looking into Hexavalent chromium and 1,4 dioxane through targeting sampling. Generally it appears that these analytes run into Zone 2 from the source area but go no farther. The PCTF actually has areas where treatment modules for these compounds could be added if treatment of them ends up being necessary.

11) What is the status of the Pyrite Canyon Treatment Facility? Are there any other significant construction activities proposed?
The PCTF is fully built and is in the process of being readied for startup. The plan is to startup slowly sometime this year.

12) Are you aware of changes in land use or development within Pyrite Canyon? Are there plans for changes in land use or development?
There are active businesses around Pyrite Canyon. There is the auto auction yard to the east, part of EPA Area 2. They have had plans to grade and pave the area, and expand the footprint. They have conducted their own sampling, and an endangerment assessment. To the west is the quarry. It is a mature quarry, and the owner intends on mining to the mining limits. Mining activity has increased recently. The southern parcel in Pyrite Canyon is for sale. The owners of these sites seem willing to work with DTSC and are receptive to the work being done at the Site.

13) Is there anything else you'd like to add?
EPA redid the Community Involvement Plan in late 2015, updating the one DTSC has completed earlier.

Five-Year Review Interview Record			
Site: Stringfellow Superfund Site		**EPA ID No:**	CAT080012826
Interview Type: Phone Location of Visit: N/A Date: 3 March 2016 Time: 1400			

Interviewers		
Name	**Title**	**Organization**
David Clark	Remediation Biologist	USACE

Interviewees				
Name	**Organization**	**Title**	**Telephone**	**Email**
Ziggy Kostecki	DTSC	Engineer		

Summary of Conversation

1) What is your overall impression of the project?
My impression is that the project is making progress.

2) Is the remedy functioning as expected? From your perspective, how well is the remedy performing?
The treatment plants are operating as designed, and are removing contaminants like they should. However, the ability of the plants to treat the water is limited by slow recharge.

3) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-Site presence, describe staff and frequency of Site inspections and activities.
The project is ongoing 24/7, however like I said before, the ability to treat water is limited by slow recharge. Due to this, the PTP is operated 3 days a week. The LCTF and the CWTS are pumping water continuously. The PTP treatment schedule is limited by recharge, especially in Zones 1 and 2.

4) What recurring inspections or O&M are conducted?
There are yearly inspections and cleaning of the PTP storage tanks. The resin in the CWTS, and the two phases of GAC at the PTP are replaced yearly as well. They would probably be replaced more often if aquifer recharge was faster. Also, the PTP effluent line that runs to the Inland Empire Brine Line is checked yearly.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last 5 years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.
There have been no major changes in the last 5 years, except certain discharge adjustments that are mandated by the SAWPA. The SAWPA permit has changed slightly since 2011, so our discharge must change too. There also have been SAWPA sampling changes.

6) Have there been unexpected O&M difficulties or costs at the Site in the last 5 years? If so, please give details.
No, currently we are changing the lining of the PTP storage tanks.

7) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.
No, the O&M duties have been optimized now so that everything is kept in check. Sometimes new contaminants come up, like Chrome VI that require us to optimize further. But in that example, the PTP can treat Chrome VI so little optimization was needed.

8) Do you have any comments, suggestions, or recommendations regarding the project?
No.

9) What is the status of the Pyrite Canyon Treatment Facility? Are there any other significant construction activities proposed?
Construction on the PCTF is 95 percent complete. Currently we are waiting for the SAWPA discharge permits.

10) Are you aware of changes in land use or development within Pyrite Canyon? Are there plans for changes in land use or development?
The aggregate quarry is currently operating, and some of the surrounding area is used for the storage of auctioned vehicles. The owners are currently working with the city to try to change the zoning so that they can use the areas for industrial use.

Appendix H: Site Inspection Checklist

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Stringfellow Superfund Site	**Date of inspection: 1/21/16**
Location: Pyrite Canyon, Jurupa Valley, CA	**EPA ID:** CAT080012826
Agency, office, or company leading the five-year review: EPA	**Weather/temperature** Clear, 70 degrees

Remedy Includes: (Check all that apply)

- [x] Landfill cover/containment
- [x] Access controls
- [ ] Institutional controls
- [x] Groundwater pump and treatment
- [ ] Surface water collection and treatment
- [x] Other: *e.g. Groundwater monitoring*
  __Groundwater monitoring_____
- [ ] Monitored natural attenuation
- [x] Groundwater containment
- [ ] Vertical barrier walls

Attachments: [ ] Inspection team roster attached [ ] Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____Ziggy Kostecki_____Engineer_____TBD_____
   Name Title Date

   Interviewed [ ] at site [ ] at office [x] by phone Phone no. _____

   Problems, suggestions; [x] Report attached _____

   _____

2. **O&M staff** _____ _____ _____
   Name Title Date

   Interviewed [ ] at site [ ] at office [ ] by phone Phone no. _____

   Problems, suggestions; [ ] Report attached _____

   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency: DTSC
Contact: __Sue Fears _____ Geologist_____ _____1/21/16 ___
Name Title Date Phone no.

Problems; suggestions; [X] Report attached

_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Problems; suggestions; [ ] Report attached

_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Problems; suggestions; [ ] Report attached

_____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Problems; suggestions; [ ] Report attached

_____
_____

4. **Other interviews** (optional) [X] Report attached.

Emily Keene, CH2M Hill, EPA contractor; interviewed on 2/24/16

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

[X] O&M manual	[X] Readily available	[ ] Up to date	[ ] N/A
[X] As-built drawings	[X] Readily available	[ ] Up to date	[ ] N/A
[X] Maintenance logs	[X] Readily available	[ ] Up to date	[ ] N/A

Remarks_____

2. **Site-Specific Health and Safety Plan** [X] Readily available [ ] Up to date [ ] N/A

Contingency plan/emergency response plan [X] Readily available [ ] Up to date [ ] N/A

Remarks_____

3. **O&M and OSHA Training Records** [X] Readily available [ ] Up to date [ ] N/A

Remarks_____

4. **Permits and Service Agreements**

[ ] Air discharge permit	[ ] Readily available	[ ] Up to date	[ ] N/A
[X] Effluent discharge	[X] Readily available	[ ] Up to date	[ ] N/A
[ ] Waste disposal, POTW	[ ] Readily available	[ ] Up to date	[ ] N/A
[ ] Other permits_____	[ ] Readily available	[ ] Up to date	[ ] N/A

Remarks_____

5. **Gas Generation Records** [ ] Readily available [ ] Up to date [ ] N/A

Remarks_____

6. **Settlement Monument Records** [ ] Readily available [ ] Up to date [ ] N/A

Remarks_____

7. **Groundwater Monitoring Records** [X] Readily available [ ] Up to date [ ] N/A

Remarks_____

8. **Leachate Extraction Records** [ ] Readily available [ ] Up to date [ ] N/A

Remarks_____

9.	**Discharge Compliance Records**				
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A	
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A	
	Remarks_____				
10.	**Daily Access/Security Logs**	☒ Readily available	☒ Up to date	☐ N/A	
	Remarks_Site security is present 24/7 and maintains a record of site visitors._____				

IV. O&M COSTS

1. **O&M Organization**

☒ State in-house ☒ Contractor for State

☐ PRP in-house ☐ Contractor for PRP

☐ Federal Facility in-house ☐ Contractor for Federal Facility

☐ Other_____

_____

2. **O&M Cost Records**

☒ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place

Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

_____

_____

_____

_____

_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks___Fencing and gates at the site are in good repair_____

_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks____Signage is present and functional._____

_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

_____

_____

_____

_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks_____

2. **Land use changes on site** ☐ N/A

Remarks___Construction of the new treatment plant was noted. Fill and leveling (for better drainage) of upper landfill cap areas using excavated soils from the new construction was noted._____

3. **Land use changes off site** ☐ N/A

Remarks__The adjacent auto insurance wreck impoundment lot appears to have been recently expanded and the fence extended._____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks_____

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident

Areal extent_____ Depth_____

Remarks_____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent_____ Depth_____
Remarks_____
_____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____
_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks_____
_____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks_____

C. Letdown Channels ☒ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☒ No evidence of settlement

Areal extent_____ Depth_____

Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation

Material type_____ Areal extent_____

Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ No evidence of erosion

Areal extent_____ Depth_____

Remarks_____

4. **Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting

Areal extent_____ Depth_____

Remarks_____

5. **Obstructions** Type_____ ☒ No obstructions

☐ Location shown on site map Areal extent_____

Size_____

Remarks_____

6. **Excessive Vegetative Growth** Type_____

☒ No evidence of excessive growth

☐ Vegetation in channels does not obstruct flow

☐ Location shown on site map Areal extent_____

Remarks_____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☐ Passive

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs Maintenance

☐ N/A

Remarks_____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks_____

3. **Monitoring Wells** (within surface area of landfill)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks_____

4. **Leachate Extraction Wells**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A

Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☐ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ↕ Needs Maintenance

Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs Maintenance

Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs Maintenance ☐ N/A

Remarks_____

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks_____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks_____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A

☐ Siltation not evident

Remarks_____

2. **Erosion** Areal extent_____ Depth_____

☐ Erosion not evident

Remarks_____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks_____

4. **Dam** ☐ Functioning ☐ N/A

Remarks_____

H. Retaining Walls ☐ Applicable ☐ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____
_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks_____
_____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4. **Discharge Structure** ☐ Functioning ☐ N/A
Remarks_____
_____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Performance Monitoring** Type of monitoring_____
☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching
Head differential_____
Remarks_____
_____

IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable ☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks_____	
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks_____	
3. **Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks_____	
B. Surface Water Collection Structures, Pumps, and Pipelines	☐ Applicable ☐ N/A
1. **Collection Structures, Pumps, and Electrical** ☐ Good condition ☐ Needs Maintenance Remarks_____	
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks_____	
3. **Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks_____	

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters_____

☐ Additive (*e.g.*, chelation agent, flocculent)_____

☐ Others_____

☐ Good condition ☐ Needs Maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of groundwater treated annually_____

☐ Quantity of surface water treated annually_____

Remarks_____

_____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ↕ Needs Maintenance

Remarks_____

_____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance

Remarks_____

_____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs Maintenance

Remarks_____

_____

5. **Treatment Building(s)**

☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks_____

_____

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks_____

_____

D. Monitoring Data

1. Monitoring Data

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs Maintenance ☐ N/A

Remarks_____

_____

X. Other Remedies

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

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B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. _____ _____ _____ _____ _____ _____ _____ _____ _____
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. _____ _____ _____ _____ _____ _____ _____ _____ _____
D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _____ _____ _____ _____ _____ _____ _____ _____ _____

Appendix I: Photographs from Site Inspection Visit and Trip Report

Trip Report
Stringfellow Superfund Site, Jurupa Valley, CA

1. INTRODUCTION

a. Date of Visit: 1/21/2016
b. Location: Pyrite Canyon, Jurupa Valley, CA
c. Purpose: A Site visit was conducted to visually inspect and document the conditions of the remedy, the Site, and the surrounding area for inclusion into the Five-Year Review Report.
d. Participants: *List all attendees*

Daewon Rojas-Mickelson	EPA	415-947-4191
Sue Fears	CA DTSC	916-255-6530
William Rowe	CA DTSC	916-255-6566
Jayson Osborne	USACE, Seattle District	206-369-2615

2. SUMMARY

Ms. Fears stated that the north cap had been filled with excavation spoils from the construction of the new treatment plant. The north cap was then graded for proper drainage of precipitation runoff. The south cap is unchanged. She stated that the clay cap is not visible and that the concrete drainage swales across the cap are new.

Ms. Fears stated that the Resource Conservation and Recovery Act (RCRA) cap (Photo 12) is new and covers drums left on the Site from the time that the U.S. Environmental Protection Agency (EPA) was performing initial cleanup actions (Figures 2 and 13).

Ms. Fears stated that the U.S. Geological Survey (USGS) seismic station to the west of the Site (Photo 13) is new. Operation of the seismic station has no impact on operation and maintenance of the Superfund Site.

Ms. Fears stated that the new treatment plant was complete and currently undergoing commissioning. She further stated that the schedule for completion of commissioning had slipped from June 2015 to March 2016. Following completion of commissioning and beneficial occupancy of the facility, the California State Department of Toxic Substances Control (DTSC) will perform its own internal commissioning process before the plant becomes fully operational.

Ms. Fears stated that the treatment plant is staffed with two full-time, on-Site employees from DTSC and approximately 15 full-time, on-Site employees of DTSC's contractor. Additionally, the Site is watched by a 24-hour security service.

Ms. Fears stated that the community wellhead treatment system is not located in the best area (i.e., it is on the edge of the groundwater contaminant plume, rather than in the middle). This system operates only during the day for 4 to 6 hours. An operator from DTSC's contractor (Veolia) inspects the system every 2 hours when it is running.

Ms. Fears stated that notes from the latest Stringfellow Advisory Committee are available, and the U.S. Army Corps of Engineers (USACE) may request a copy if desired.

Ms. Fears stated that efforts to identify secondary sources of contaminants are underway.

Ms. Fears stated that in Zone 3, three new, deeper extraction wells were installed in the 2009 through 2011 timeframe. This development is likely captured in the last Five Year Review.

Ms. Fears stated that in Zone 4, trichloroethylene (TCE) levels may be dropping. Most levels are around 5 micrograms per liter; one well was non-detect for TCE.

Ms. Fears stated that virtually all documents for the Site are uploaded to and available on Envirostor (DTSC's public document Internet portal).

Ms. Fears stated that the monitoring report for 2014 is complete and they are currently working on completing the monitoring report for 2015.

Ms. Fears stated that recently an ecological risk assessment of the Site was completed. The conclusion of this assessment was that the Site posed no risk to ecological receptors. Therefore, the remedy as currently being implemented is valid for protection of ecological receptors.

3. DISCUSSION

All attendees arrived on Site at approximately 9 a.m.; all attendees left the Site at approximately 2 p.m.

The carbon vessels at the Zone 4 community wellhead treatment system are in poor repair. One vessel (T-801) is out of service. The other vessel (T-802) is leaking around the top and needs to be replaced (Photo 37).

4. ACTIONS

USACE will incorporate information obtained from the Site visit into the Five Year Review report.

Jayson Osborne
Biologist
CENWS-EN-TS-ET

Site Visit Photos

Photo 1. Zone 1 Cap from the East

Looking north onto Zone 1 cap from east end of clay barrier dam. (Note: clay dam is subsurface and not visible in the photo.)

Photo 2. Zone 1 RCRA Cap
Approximately midway; looking west. Black feature is an RCRA cap.

Photo 3. North Cap (View Looking South)

Soil from the foundation excavation for the new treatment plant has been placed on the cap in Zone 1 to level the cap and correct some drainage issues.

Photo 4. North Cap

Photo 5. Road on North End of Cap (Looking West)

Photo 6. Wells and Drainage Channels North of Cap
Outside of fenced area.

Photo 7. Drainage Area Northwest of Cap (Outside Fenced Area)

Photo 8. New Concrete Drainage Gutters Installed on the Cap
These gutters lead to the drainage channel on the west edge of the cap.

Photo 9. North Cap (Looking East)

Photo 10. Filled Sinkhole (Foreground)

Photo 11. North Cap (Looking Northeast)

Photo 12. New RCRA Cap (Black Structure, View Looking South)

Photo 13. USGS Seismic Station Located Immediately West of the Cap

Photo 14. Drainage Channels Immediately Northwest of the Cap

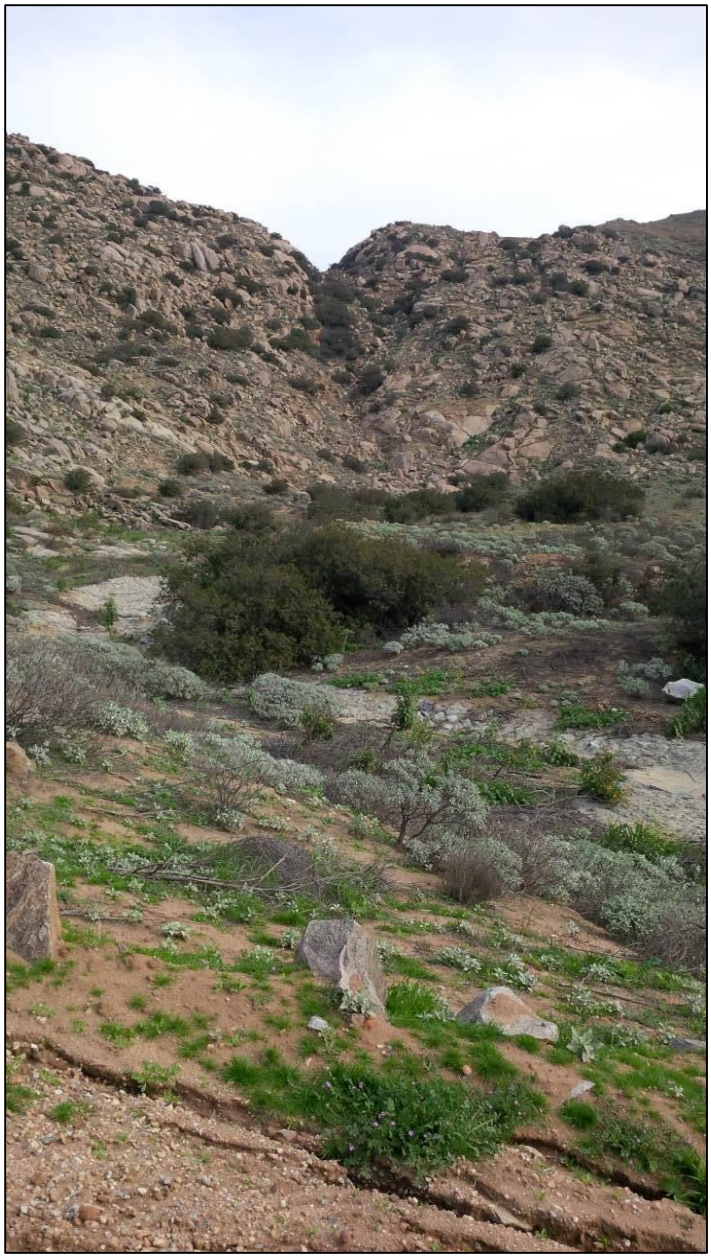

Photo 15. Concrete and Riprap Drainage Channel (Gray) North of the Cap

Photo 16. Concrete and Riprap Drainage Channel (Another View)

Photo 17. Concrete and Riprap Drainage Channel (Gray) Northwest of the Cap

Photo 18. Same Location as Figure H-18, Facing Opposite Direction

Photo 19. Culvert below Wash West of the Cap

Photo 20. Same Location as Figure H-19, Facing Opposite Direction

Photo 21. View of New Treatment Plant (Facing Southeast)

Photo 22. PCTF 1

Photo 23. PCTF 2

Photo 24. PCTF 3

will select a groundwater cleanup goal for perchlorate

Photo 25. PCTF 4

Photo 26. PCTF 5

Photo 27. PCTF 6

Photo 28. PCTF 7

Photo 29. New Administration Building next to PCTF

Photo 30. Pre-Treatment Plant (PTP)

Photo 31. PTP (another view)

Photo 32. Existing PTP Effluent Storage Tanks

Photo 33. Weir below Zone 1

Photo 34. Looking Upstream from Zone 1 Weir

Photo 35. Hydrograph Adjacent to Weir

Photo 36. Zone 4 CWTS

Photo 37. Detail of Leaking GAC Vessel at Zone 4 CWTS

Photo 38. Buried Effluent Line for Treated Water from Zone 4 CWTS
Discharge point is at creek in the trees in the background of the photo.

Photo 39. Discharge Point for Treated Water from Zone 4 CWTS

Photo 40. South Well in Zone 4

Photo 41. Access Point to Brine Line Discharge Line in Zone 4

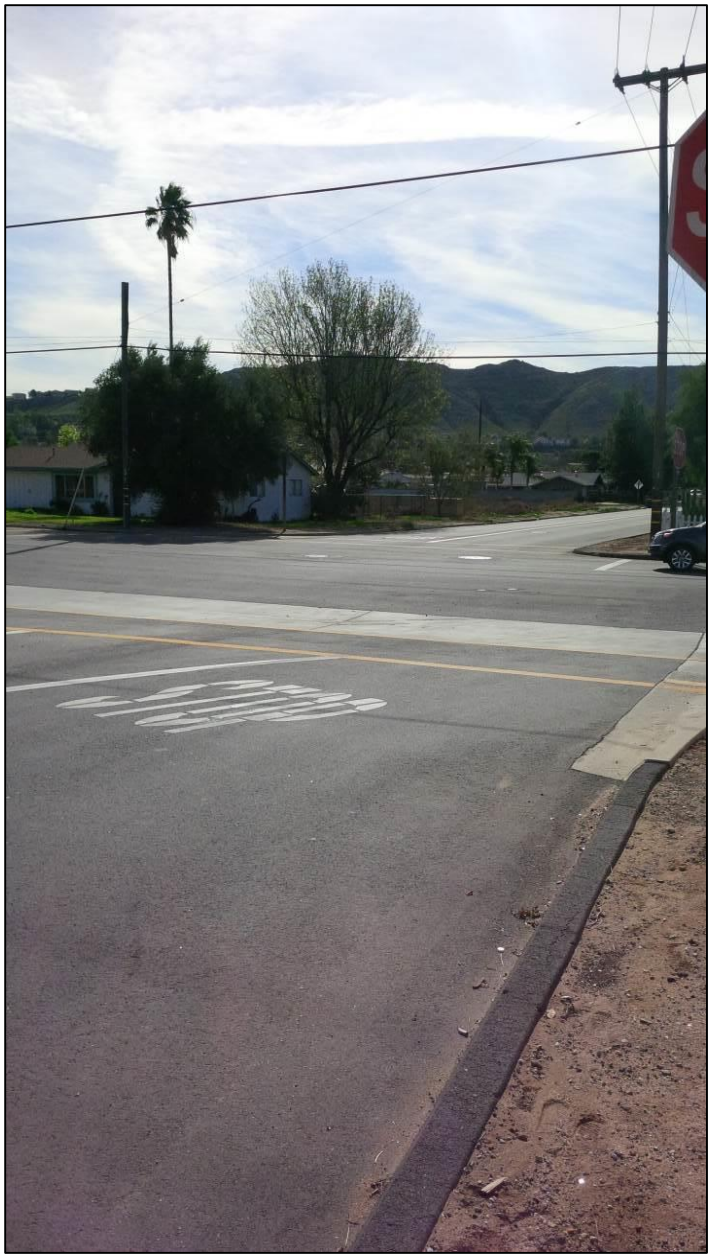

Photo 42. Manhole Access to Confluence with Main Brine Line in Zone 4

Photo 43. North Well in Zone 4

Photo 44. LCTF (Left) and Line of Extraction Wells (Right)

Photo 45. Auto Recycling Lot Adjacent to Zone 3

Photo 46. Storage Tanks near PTP

Photo 47. New Fence around Expansion Area of Auto Recycling Lot

Photo 48. Electrical Boxes Next to Storage Tanks Pictured in Figure H-46

Photo 49. Quarry Immediately to the West of the Site

Photo 50. Bookshelf of Monthly O&M Reports at the PTP Administration Building

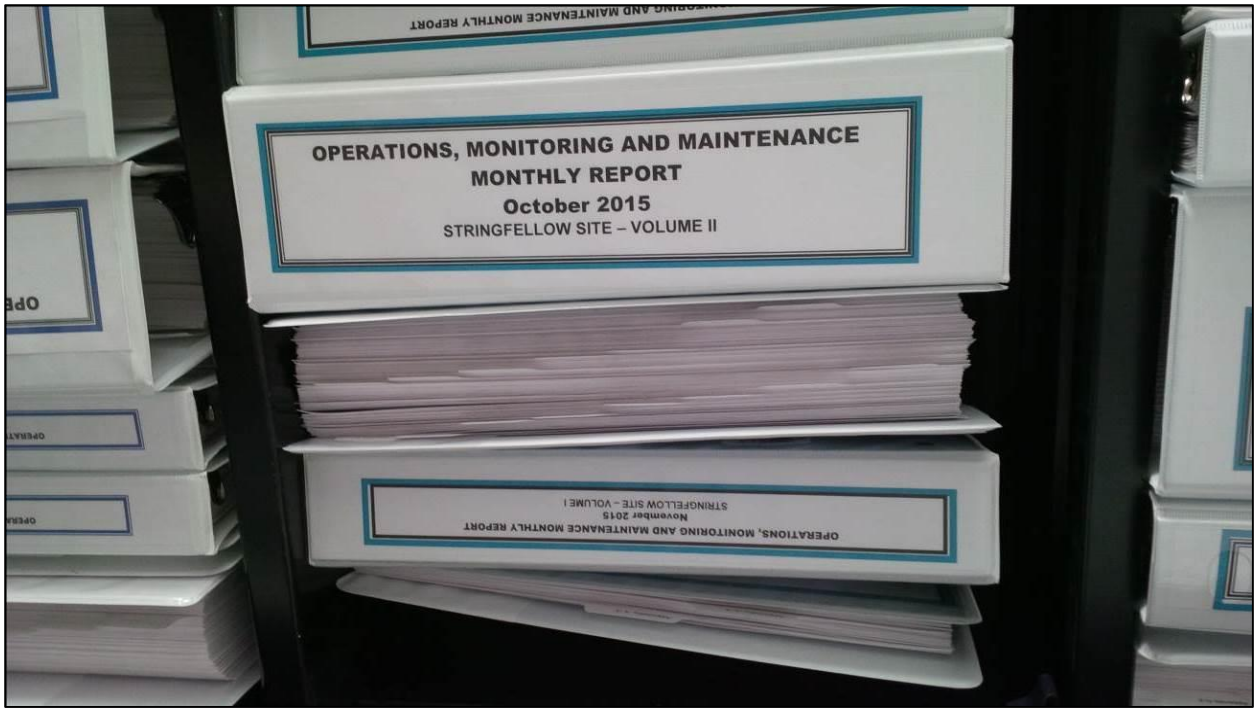

Photo 51. Detail of Monthly O&M Reports Pictured in Figure 82