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Selma Pressure Treating Company Superfund Site
Selma, California
Explanation of Significant Differences
OU2 Groundwater
August, 2005

Prepared by the United States Environmental Protection Agency, Region IX
Site Cleanup Branch, Superfund Division

EXPLANATION OF SIGNIFICANT DIFFERENCES

Introduction to the Site and Statement of Purpose

This Explanation of Significant Differences (ESD) is for the Selma Pressure Treating Superfund Site (Site), in Selma, California. The Site is approximately 15 miles south of the City of Fresno. This is the third ESD (ESD3) for the Selma Site and applies solely to the groundwater Operable Unit (OU). Groundwater at the Site is contaminated with hexavalent chromium (Cr+6). The United States Environmental Protection Agency (USEPA) is the lead agency for this Site and the State of California Department of Toxic Substances Control (DTSC) is the support agency.

On September 24, 1988, USEPA signed the Record of Decision (1988 ROD) for both soils and groundwater at the Site. Subsequent to the 1998 ROD, a 1993 ESD1, 1997 ESD2 and a 2003 ROD Amendment (for soils only) were created. The 1988 ROD and subsequent decision documents were developed in accordance with Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, and Title 40 Code of Federal Regulations (CFR) part 300.435 (c)(2)(i) (55 Federal Register 8666, 8852 March 8, 1990) of the NCP. ESD3 will be part of the Site Administrative Record file ((NCP 300.825(a) (2)).

The 1988 ROD, as amended by ESD1 and ESD2, established "pump and treat" (using precipitation, coagulation and flocculation technology), as the remedy for groundwater. The cleanup standard for Cr+6 is the Maximum Contaminant Level (MCL) of 50 parts per billion (ppb). The treated water is discharged to onsite surface percolation ponds. In 2003, USEPA modeled the effectiveness of plume containment and recovery. The 2003 indicated that 30 years of pumping under the current well configuration would not be sufficient to completely mitigate the groundwater contamination at the Site. As a result, USEPA decided to examine modifications to enhance effectiveness of the existing system.

Based on consideration of newly available technology, process options, and additional data gathered through onsite pilot testing, USEPA has decided to supplement the existing pump and treat system with in situ bioremediation to reduce Cr+6 to its less toxic, less mobile trivalent form (Cr+3). This action does not fundamentally alter the overall approach to the selected groundwater remedy, as described in the 1988 ROD, 1993 ESD1, and 1997 ESD2. The proposed enhancement to the current remedy is expected to provide cost-savings, increased human health protection, and a reduced cleanup timeframe. The scope and the cleanup standards do not change.

Site History, Contamination, and the Selected Remedy

The Site is approximately 18 acres in size, including a 4-acre wood treatment facility and 14 acres of former vineyards that were used for Site drainage. The Site area is zoned for heavy industrial use. The Site is located in a transition zone between agricultural, residential, and industrial areas. Despite a scarcity of water, regional irrigation makes this one of the most productive agricultural regions in the world. Located in the center of the fertile San Joaquin Valley, the area is known for its many vineyards.

The Consolidated Irrigation District provides the majority of the irrigation water supply in the area. The surface water irrigation supply is supplemented by groundwater resources in the vicinity of the Site. Groundwater resources also supply the necessary domestic water for the surrounding communities and scattered county residences. However contaminated groundwater from the Site is not used for municipal water supply. The regional groundwater gradient in the vicinity of the Site is to the southwest. The groundwater resources in the area of the Site have been classified as a Sole-Source-Aquifer by the USEPA, under the Safe Drinking Water Act, Title 42 United States Code (USC) 1424(e). Under USEPA's Groundwater Protection Strategy (1984), the aquifer in the Site area has been classified as a Class IIA current drinking water source with other beneficial uses.

The wood treatment facility was used to treat lumber products almost continuously from 1936 until 1994. At least two general methods of wood preservation were used. Before 1965, lumber was dipped into a mixture of pentachlorophenol (PCP) and oil, and then was dried on open racks, where the excess liquid dripped off. In 1965, the Site was converted to a pressure-treating process, which consisted of two basic steps: conditioning the wood to reduce moisture content and increase permeability, and impregnating the wood with chemical preservatives.

From 1936 to 1971, chemical wastes from the treatment plant were disposed of onsite in percolation ditches, dry wells, an unlined pond, and a sludge pit. Chemical wood preservatives also were released to the ground, particularly in the wood treatment area, as a result of spillage, dripping, and leaking. Waste fluids were discharged through pipelines that ran along the boundaries of the former vineyards into offsite drainage areas and ditches. The chemical preservatives known to have been used at the Site include:

- Fluor-chromium-arsenate-phenol
- Chromated copper arsenate (CCA)
- Pentachlorphenol (PCP)
- Copper-8-quinolinolate
- Landscape timber (LST) concentrate
- Woodtox 140 RTU (contains PCP)
- Heavy oil penta 5% solution

In 1971, the State of California collected samples from an unlined sump on the property and concluded that the discharges posed a serious threat. From 1971 to 1981, the California Regional Water Quality Control Board (CRWQCB) regulated the discharges from the facility pursuant to a Waste Discharge Requirements Order. On January 31, 1981, the USEPA Field Investigation Team conducted an investigation in accordance with Section 3007 of the Resource Conservation and Recover Act.

Between 1981 and 1984, CRWQCB, USEPA, and California Department of Health Services (DHS) pursued efforts to have the former wood treatment companies, Selma Pressure Treating Company (SPT) and Selma Leasing Company (SLC), investigate the Site to determine the extent of contamination. These parties never performed cleanup work at the site and entered into a cash-out settlement in 1996.

The Site was placed on the National Priorities List (NPL) in September, 1983. In 1988, USEPA issued the Remedial Investigation/Feasibility Study (RI/FS) and signed the ROD. The 1993 ESD1 changed the term cleanup goal to cleanup standard; reduced the soil cleanup standard for arsenic from 50 parts per million (ppm) to 25 ppm; identified additional areas of soil contamination to be excavated that were not included in the 1988 ROD; added a newly promulgated MCL of 1 ppb as a groundwater cleanup standard for pentachlorphenol (PCP); modified the groundwater extraction, treatment and reinjection system to a phased, observational approach; and removed the K001 classification as defined in 40 C.F.R. 261.32 for wastes generated from the Site. The 1997 ESD2 changed the recharge method for treated groundwater from reinjection, to onsite percolation ponds.

Based on the 1988 ROD, ESD1 and ESD2, USEPA constructed the groundwater treatment system for the Site. This included construction of eight extraction wells, associated pipelines, two large percolation ponds, and the groundwater treatment plant. The groundwater treatment system is a modified precipitation, coagulation and flocculation process that is performed at a neutral pH. The groundwater treatment plant began operation on September 21, 1998, and has been in continuous operation since that date. The Remedial Action Report documenting completed construction activities for the groundwater remedial action was completed in September 2000. The groundwater treatment plant has been treating an average of 200 gallons per minute (gpm) containing an average concentration of 350 to 360 ppb of Chromium+6 in the influent (blended from all extraction wells), which is treated before discharge from the plant.

A ROD Amendment was prepared in 2003 for soils only. The ROD Amendment revised the remedy for soils to: 1) create a consolidated disposal area (RCRA cap) for soils that had been treated and capped onsite in several locations, and 2) cap additional untreated soils left in place, with a modified asphalt ultra-low permeability barrier.

Basis for the Document

As previously mentioned, in 2003, USEPA recalibrated the Site groundwater model to evaluate the effectiveness of plume containment and recovery. The original groundwater model was developed in 1997 in support of the groundwater extraction system design. The 2003 model indicated that 30 years of pumping under the current well configuration would not be sufficient to completely mitigate the groundwater contamination at the Site. For the area on the north side of Highway 99 (Figure 1) the following factors were identified as being limiting to a timelier cleanup:

- New extraction wells installed in the former Retort Area (contamination source area) would produce limited amounts of groundwater.

- Existing extraction wells EW-1A and 2A are not deep enough to capture contaminants now located in the intermediate groundwater depth zone.

- There are no extraction wells on the west side of the plume.

Possible ways to increase the efficiency and effectiveness of the pump and treat system were considered. These included:

- Installation of more or deeper extraction wells in selected areas.
- Increasing pump sizes in some areas to pump more contaminated groundwater.
- Increasing capacity of the treatment plant, if needed.

However, the current extraction and treatment system was designed for a ten year life of operation and will likely require extensive repairs and costly replacements in the next few years.

The current operation, monitoring and maintenance costs average $600,000 per year. Assuming a 30 year present value and not taking into consideration the cost of potential major maintenance cost, the net present worth of continuing the current pump and treat remedy for 30 years approaches $32,000,000.

This cost was reviewed as part of the Long Term Remedial Action (LTRA) process. Since the original ROD was issued, a number of innovative technologies have been developed for groundwater remediation. Innovative technologies were evaluated as part of the LTRA, including chemical reduction and permeable reactive barriers. Chemical reduction was expected to be more costly than the current remedy and potentially would generate sulfide in the aquifer. Permeable reactive barriers would be of limited effectiveness due to the excessive depth of the plume and relatively slow groundwater movement. In situ bioremediation was evaluated and passed the initial screening as a potentially viable and cost effective technology. This technology offers the advantages of a natural process that uses food grade substrates to enhance the metabolism of naturally occurring microorganisms to produce a reducing environment, sufficient to reduce Cr+6 to Cr+3.

Bench scale (lab) tests were conducted to evaluate the potential suitability of this technology at the Site. Testing was performed in triplicate. The testing evaluated three potential substrates; lactate, molasses, and EHC™ (proprietary slow release carbon substrate). The relative performance of each substrate for reducing Chromium+6 was evaluated. Other parameters that were assessed during the testing included the potential for the technology to mobilize arsenic, the toxicity impacts to indigenous microorganisms from high Chromium+6 environments, and the conditions which could remobilize Chromium+3. The testing conditions were optimized under aerobic conditions.

The results of the bench scale testing were considered successful and the following conclusions were reached:

- EHC performed the best; very rapidly reducing Chromium +6 in less than 14 days, but it is more expensive than other methods and is more difficult to deliver to the groundwater.

- Molasses is more effective than sodium lactate in reducing Chromium+6; the lactate did not result in complete Chromium+6 reduction.

- Biodegradation was observed even at Chromium+6 concentrations up to 80,000 milligrams per liter (mg/l), eliminating concerns about toxicity to indigenous microorganisms from high contaminant levels.

- Cr+6 reduction occurred prior to nitrate reduction and can actually occur with oxygen present (even before an oxygen-deficient/reducing condition is achieved).

- Cometabolic biodegradation may be a significant biodegradation process.

- Chromium in the +3 oxidation state will not convert back to the former higher +6 oxidation state under natural conditions. During the bench scale testing, a sample in which Chromium+6 had been successfully reduced to Chromium +3 with molasses was injected the aquifer to its normal mildly oxidizing condition. The oxidation potential required for conversion back to Chromium +6 (e.g., introduction of highly oxidizing chemicals) is much greater than site conditions are capable of producing naturally. Oxygen alone is not a strong enough oxidant to convert Chromium +3 to Chromium +6.

Based on results of the bench scale tests, pilot testing was conducted at the Selma Site using molasses. Two initial test borings were installed to determine radial delivery capabilities and fine tune delivery techniques. Sixty nine additional borings were installed during March 2005. The molasses substrate was delivered to the groundwater through the borings array. The substrate delivery system was effectively field modified to optimize-maximize delivery by using the direct push injection method. Test results improved substantially over the observed results from the bench scale testing. The following conclusions were drawn from the field pilot testing:

- At one test well Cr+6 was reduced from a maximum detected concentration of 80,000 ug/l at the water table (average concentration in the well column was about 7,800 ug/l) to less than 10 ug/l within a 3 week time frame; Cr+6 was reduced to less than 10 ug/l in 3 weeks or less in all wells within the pilot treatment area.

- Low concentrations of arsenic were detected (<25 ug/l).

- Some sulfate reduction may be occurring.

- Methanogenesis indicating extremely reducing conditions was not observed.

- Direct push delivery requires substrate overdosing to assure sufficient Cr+6 degradation, to avoid the need for redelivery. Overdosing with substrate results in establishment of excessively reducing conditions, which will have to be balanced and controlled. Excessively reducing conditions result in mobilization of metals (i.e., iron, manganese, and arsenic). An increase in manganese (0.05 mg/l to17 mg/l) and ferrous iron (6 mg/l to 131 mg/l) was observed. The drinking water standards for both of these metals are Secondary MCL's and are not Federally enforceable. These standards, 0.05 mg/l for manganese and 0.3 mg/l for iron, are based on taste, color, staining, and scaling and are not associated with adverse health effects.

- As the aquifer returns to the natural, less reducing conditions, manganese and ferrous iron are expected to return to their pre-treatment state.

- It is expected that the reduction in concentration of Cr+6 to Cr+3, will lower the groundwater concentration of total chromium below the established maximum MCL of 50 ppb.

Based on the success of the field tests conducted (Phase 1), USEPA plans to implement in situ biotreatment on an expanded site-wide basis. USEPA plans four phases of implementation; the pilot study already conducted is considered Phase I. Where the bioremediation approach results in achieving the MCL in portions of the aquifer, use of existing groundwater extraction wells may be discontinued (as would occur with the existing remedy).

Description of Significant Differences

USEPA publishes an ESD when modifications to the selected remedy significantly change, but do not fundamentally alter the overall cleanup approach selected in the ROD. ESD3 alters the performance of Site groundwater cleanup by adding a new type of treatment which shortens the remediation timeframe and lowers the long-term cost. The supplemented remedy will also increase the ability of the remedy to use permanent solutions and alternative treatment technologies to the maximum extent practicable.

The groundwater optimization, in combination with the existing remedy, remains protective of human health and the environment, and continues to comply with Applicable or Relevant and Appropriate Requirements (ARARs) that are identified in the 1988 ROD, and subsequent decision documents. The optimization will involve the following activities that are new to the groundwater remedy. Implementation will be performed in phases, as described below:

1. Phase 2 – Groundwater In Situ Bioremediation/Former Vineyard Area

Remediation under Phase 2 (Figure 1) will involve bioremediation of the former Vineyard Area now known as Selma Disposal Company, using a combination of direct push and recirculation (Figure 2). Remediation will be accomplished through substrate delivery over a large area, based on parameters confirmed and optimized during the pilot test. Detailed work plans and designs will be prepared. Direct push is being used in an area undergoing reuse to expedite cleanup in that area (Figure 1). In the rest of the Vineyard Area, recirculation delivery methods will allow lower substrate dosing levels than were used during the pilot study, yet will still be capable of reducing Cr+6 to Cr+3.

Phase 2 includes:

- Direct push injection in the area where expedited remediation is required.
- Installation of injection and extraction wells for areas of recirculation delivery.
- Installation of monitoring wells and pumps.
- Installation of a skid mounted mixing/injection unit.
- Installation of an interconnecting piping system.

- Installation and startup of the recirculation system.
- Operation, maintenance and monitoring (OM& M) including sampling and analysis (one year).

Total estimated cost of implementing Phase 2 is approximately $1,664,000.

Once contaminant levels consistently fall below MCLs at an extraction well that is part of the original groundwater remedy, the well will be taken offline and included in the plume monitoring program. It is expected that the implementation of Phase 2 will result in the ability to cease operation of the contaminated groundwater extraction system north of Highway 99, which includes extraction wells EW-1A and EW-2A (Figure 1).

2. Phase 3 – Groundwater In Situ Bioremediation/Under Highway 99 Footprint Area

Phase 3 involves the in situ bioremediation of the contaminant plume footprint area under Highway 99 (Figure 1). Nutrient substrate would be injected and recirculated until Cr+6 levels are reduced below the MCL. Recirculation would be performed using a row of injection and extraction wells on the up-gradient and down-gradient sides of Highway 99. The wells installed under Phase 2 on the north side of the Highway 99 would be reused as injection wells for Phase 3. These would be supplemented by installation of additional injection wells on the north side of Highway 99 and wells on the south side for extraction. Implementation of the remedy would require boring and jacking a tunnel under Highway 99 for pipe and electrical power between wells. Phase 3 includes:

- Installation of injection and extraction wells.
- Installation of monitoring wells and pumps.
- Installation of interconnecting piping systems.
- Boring and jacking a tunnel under Highway 99.
- Installation and startup of the recirculation system.
- OM&M, including sampling and analysis (one year).

Total estimated cost of implementing Phase 3 is $598,000.

3. Phase 4 - Groundwater Extraction System/Groundwater Treatment Plant Enhancement.

Following bioremediation of the upgradient areas in Phases 2 and 3, an optional Phase 4 will be implemented to expedite and optimize the cleanup of the contaminated groundwater plume down-gradient of Highway 99 (Figure 1). The need for this phase will be determined based on the evaluations of Phase 2 and Phase 3. Phase 4 would involve increasing the downgradient extraction rate and the capacity of the existing treatment plant. Implementation would require increasing pump sizes in extraction wells EW-3A, EW-4, EW-5, and EW-6, and increasing flow rates up to 50 gpm each. The electrical supply to each pump would be upgraded. One or more additional extraction wells may be needed. This would be evaluated at the time of design. By the time this phase is implemented, all potentially contaminated groundwater flow would be originating down-gradient of Highway 99. Since the concentrations of Chromium+6 are lower in this downgradient area, flushing of the aquifer through enhanced pumping and conventional treatment is expected to provide the greatest benefit at minimal cost.

Phase 4 would include the following:

- Construction of extraction wells if needed.
- Installation of new pumps and controllers.
- Installation of new double contained piping.
- Installation of the system.

Total estimated cost of implementing Phase 4 would be approximately $153,500. The cost without the additional extraction well is estimated at $78,500.

Support Agency Comments

California Department of Toxic Substances Control has reviewed and concurred on this ESD3.

Public Participation

A public notice will be placed in the local newspaper of general circulation after ESD3 is signed by USEPA. A copy of ESD3 will be placed in the Administrative Record for this site. The Administrative Record is found at the following locations: The USEPA Region IX office in San Francisco, and the Fresno County Library, Selma Branch at the addresses below.*

Statutory Determination

The changes proposed in ESD3 favorably alter the basic features of the original groundwater remedy with respect to cost, and performance per 40 CFR 300.435(c) (2) (ii). The proposed technology modifications aggressively target Chromium+6 contamination which presents the highest Site groundwater risks. The additional measures will reduce the estimated remedial duration based on current modeling and field pilot testing, by an estimated 30 years or more. The net estimated lifetime present worth cost savings is estimated at more than $29,000,000. The overall remedial goals and standards for groundwater remain the same. The proposed remedy remains protective of human health and the environment and as described in this ESD3, fully meets the statutory requirements of the NCP.

Authorizing Signature

Elizabeth J. Adams
Chief, Site Cleanup Branch
Superfund Division

Date August 30, 2005

*Additional information on the Site can be found at:
http://www.epa.gov/region09/cleanup/california.html#f.
Fresno County Library, Selma Branch,
2200 Selma Avenue Selma,
California 93662 (559) 896-3393

USEPA Region IX, Superfund Records Center
75 Hawthorne Street
San Francisco, California 94105
(415) 536-2000

FIGURE 1

PHASE 1, 2, 3, AND 4

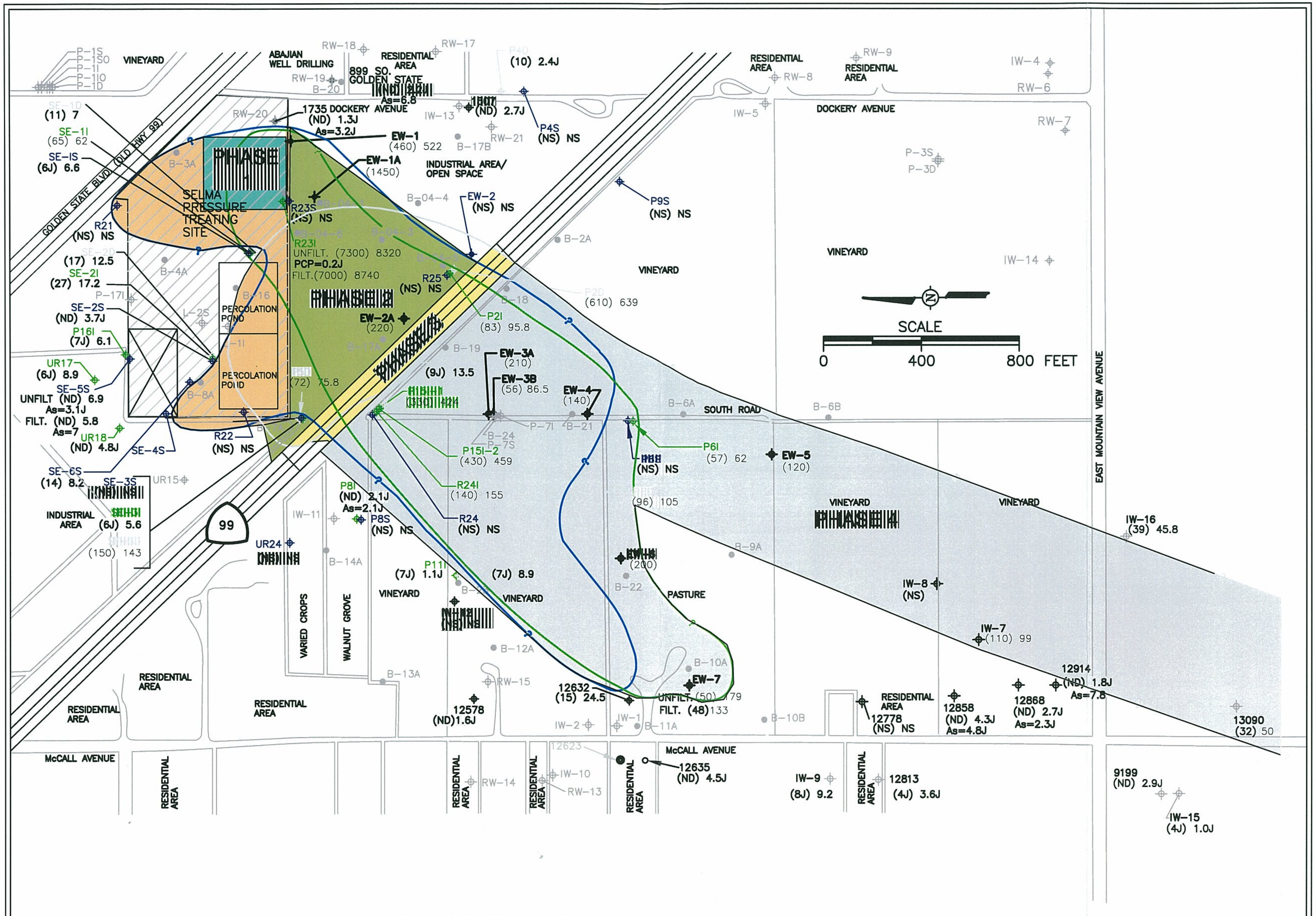

Figure 2 - Phase 2 Direct Push followed by Recirculation