URS

September 19, 2007

Mr. Eric Yunker
Superfund Project Manager
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street (SFD-7-3)
San Francisco, CA 94105

Subject: **RAC IX Contract No. W-98-225**
Cooper Drum Company WA No. 247-RDRD-091N
Transmittal of Final OU1 Groundwater Remedial Design Report

Dear Mr. Yunker:

This letter transmits two copies of the OU1 Groundwater Remedial Design Report for the Cooper Drum Company Superfund Site in South Gate, California. DTSC and EPA Region 9 comments have been incorporated into the final document.

If you have any questions or require further information, please contact me at (916) 679-2049.

Sincerely,

URS Group, Inc.

Don Gruber
Task Manager

Edmund D. Tarter
Project Engineer

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Attachment

cc: Lori Parnass DTSC (1 copy w/attachment)
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GROUNDWATER REMEDIAL DESIGN REPORT
OPERABLE UNIT 1
COOPER DRUM COMPANY SUPERFUND SITE

Prepared for:

Contract No. 68-W-98-225/WA No. 247-RDRD-091N
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, California 94105

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
AOP	advanced oxidation process
ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
COC	contaminant of concern
CPT	cone penetrometer test
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPVC	chlorinated polyvinyl chloride
CQCP	Construction Quality Control Plan
DCA	dichloroethane
DCE	dichloroethene
DCP	dichloropropane
DEW	downgradient extraction well
DHS	Department of Health Services
DO	dissolved oxygen
DPA	Drum Processing Area
DPE	dual-phase extraction
DTSC	California Department of Toxic Substances Control
EH&S	environmental health and safety
EPA	United States Environmental Protection Agency
EW	extraction well
GAC	granular activated carbon
gpm	gallons per minute
H_2O_2	hydrogen peroxide
HASP	Health and Safety Plan
HDPE	high density polyethylene
HRA	health risk assessment
HRC	Hydrogen Release Compound
H&S	health and safety
HWA	Hard Wash Area
ISCO	in situ chemical oxidation
LEL	lower explosive limit
LACDHS	Los Angeles County Department of Health Services
LACSD	Los Angeles County Sanitary District
LGAC	liquid-phase granular activated carbon

ACRONYMS AND ABBREVIATIONS (CONTINUED)

MCL	California maximum contaminant level
mg/L	milligrams per liter
mV	millivolts
MW	monitoring well
NAPL	non-aqueous phase liquids
NCP	Natural Oil and Hazardous Substances Pollution Contingency Plan
NEC	Natural Electrical Code
NFPA	Natural Fire Protection Association
NPL	Natural Priorities List
O_3	ozone
O&M	operation and maintenance
OD	outer diameter
ORP	oxidation-reduction potential
OSWER	EPA's Office of Solid Waste and Emergency Response
OU	operable unit
PCE	tetrachloroethene
PFD	process flow diagram
PLC	programmable logic controller
ppb	parts per billion
PQL	practical quantification limit
PRG	preliminary remediation goal
PRP	potentially responsible party
psi	pounds per square inch
PVC	polyvinyl chloride
POTW	Publicly Owned Treatment Works
QA	quality assurance
RA	remedial action
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RD	remedial design
RDR	Remedial Design Report
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
ROI	radius of influence
RPO	remedial process optimization
RWQCB	Regional Water Quality Control Board

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TBC	to-be-considered
TCE	trichloroethene
TCP	trichloropropane
TDS	total dissolved solids
TEFC	totally enclosed, fan-cooled
URS	URS Group, Inc.
VC	vinyl chloride
VOC	volatile organic compound
μg/L	micrograms per liter

ES.0 EXECUTIVE SUMMARY

This Remedial Design Report (RDR) presents the detailed design of the selected remedial action (RA) for the groundwater Operable Unit 1 (OU1) at the Cooper Drum Company Site (Site), located at 9316 South Atlantic Avenue, in South Gate, Los Angeles County, California.

The OU1 (alternatively referred to as "impacted groundwater" or simply, "groundwater," throughout this report) RA includes remedial systems for the source area and hydraulic control (containment) and treatment for the leading edge of the groundwater plume.

The groundwater Source Area RA (Source Area System) consists of the following components:

- Injection of ozone and hydrogen peroxide into the source area groundwater (i.e., in situ chemical oxidation [ISCO] using injection wells that form a permeable barrier to groundwater flow);
- Extraction of groundwater downgradient of the ISCO barrier; and
- Aboveground treatment and re-injection of this extracted groundwater upgradient of the ISCO barrier.

The groundwater Downgradient Containment and Treatment RA (Downgradient Containment/Treatment System) includes:

- Extraction of groundwater near the leading edge of the plume;
- Installation of a permeable bioremediation barrier in the mid-plume area upgradient of the groundwater extraction; and
- Discharge to sanitary sewer, with pretreatment of the extracted groundwater, if needed.

This RDR provides the design criteria, including the design assumptions and parameters, used in developing the remedial design (RD) for OU1.

ES.1 SITE HISTORY

Since 1941, the Site was used by several companies to recondition and recycle used steel drums that once contained various industrial chemicals. The Cooper Drum Company operated from 1972 to 1992, reconditioning drums using a process that consisted of flushing and stripping the drums for painting and resale. Drum process waste was collected in open concrete sumps and trenches, resulting in releases to soil and groundwater beneath the site.

By 1992, when the drum reconditioning business had been sold to Waymire Drum Company, the Cooper Drum Company facilities were retrofitted to provide an aboveground, enclosed system for containing liquids and wastes. Closed-top steel tanks were installed over the sumps, and the trenches were replaced with hard piping. The former hard-wash area (HWA) was closed and replaced with a new HWA in the Drum Processing Area (DPA), which also provided hard piping and secondary containment. Waymire Drum Company continued to operate the facility until 1996. Consolidated Drum Company was the drum-reconditioning operator at the Site from 1996 until their departure in 2003. The facility was fitted to process plastic totes (large square containers) during this period.

Since 2003, drum processing operations no longer occur at the Site and all drum processing equipment has been removed from the Site. Following the removal the drum processing operations, there were four new tenants at the Site, including a pallet company, a trucking and towing company, and two automotive repair/ salvage companies. As of June 2006, the automotive repair/salvage companies moved operations off site and the pallet company expanded there operations to the vacant property.

The United States Environmental Protection Agency (EPA) conducted remedial investigation (RI) activities for Cooper Drum from 1996 to 2001. In June 2001, EPA added the Site to the National Priority List (NPL) of hazardous waste sites requiring remedial action. Site investigations conducted as part of the RI identified the former HWA as the primary source of contamination. The DPA also was identified as a source of contamination as a result of chemical spills that were documented during the 1980s. Following the remedial investigation/feasibility study (RI/FS) process, the Record of Decision (ROD) for the Site was signed on September 28, 2002.

ES.2 CONTAMINANTS OF CONCERN AND CLEANUP GOALS

Twelve hazardous substances are considered contaminants of concern (COCs) in OU1 groundwater: 1,2,3-trichloropropane (TCP); trichloroethene (TCE); 1,2-dichloroethane (DCA); vinyl chloride (VC); 1,2-dichloropropane (DCP); 1,1-DCA; cis-1,2-dichloroethene (DCE); tetrachloroethene (PCE); trans-1, 2-DCE; benzene; 1,1-DCE; and 1,4-dioxane.

Except for 1,4-dioxane, which is a semivolatile organic compound (SVOC), all the other COCs are volatile organic compounds (VOCs). As stated in the ROD, the remedial action objective (RAO) for groundwater is restoration of the groundwater (through treatment) for beneficial use. Therefore, the cleanup goal for the majority of the Site VOCs is to achieve maximum contaminant levels (MCLs). However, the cleanup goal for 1,2,3-TCP and 1,4-dioxane (for which an MCL has not been defined) is to achieve the practical quantification limit (PQL) and the preliminary remediation goal (PRG) for protecting sources of drinking water, respectively. See Table 2-1 for a list of all groundwater COCs and their respective cleanup goals.

ES.3 HYDROGEOLOGIC FEATURES

The main hydrogeologic features penetrated by borings and wells completed during the RI field investigation include the Bellflower Aquiclude, the perched aquifer, the Gaspur Aquifer, and the Exposition Aquifer. These units constitute a shallow aquifer and a deeper aquifer. The shallow aquifer consists of the saturated portion of the Bellflower Aquiclude, which incorporates the perched aquifer (approximately 35 to 40 feet below ground surface [bgs]), and the Gaspur Aquifer. The Bellflower Aquiclude extends to a depth of approximately 70 feet bgs, where the Gaspur Aquifer, which extends to a depth of approximately 110 to 120 feet bgs, underlies it. The upper portion of the deeper aquifer system is represented by the Exposition Aquifer, which underlies the shallow aquifer. The Exposition Aquifer has not been impacted by contamination originating from the Site.

Data from investigations at the Site and adjacent sites indicates that groundwater flows in a predominantly southerly direction. Additionally, the groundwater contamination from adjacent sites have commingled with and impacted the Site plume.

ES.4 ROD SELECTED REMEDY FOR OU1 GROUNDWATER

The Cooper Drum ROD (EPA, 2002) states the following selected remedy for the OU1 contaminated groundwater:

> "The cleanup strategy for groundwater contaminated with VOCs will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source. An extraction/treatment system will be used for containment and remediation. Chemical in situ treatment will also be used to enhance the treatment of VOCs in groundwater, minimize the need for extraction, and reduce the potential for other VOC plumes in the vicinity to impact Cooper Drum."

The groundwater remedy design strategy, as described in Sections ES.5 and ES.6, respectively, for the contaminated plumes in the source area and the downgradient area, is consistent with the ROD selected remedy.

ES.5 DESIGN STRATEGY FOR OU1 SOURCE AREA

The remedial alternative selected to reduce COC concentrations in the OU1 Source Area is use of ISCO in conjunction with groundwater extraction, treatment, and injection. The OU1 Source Area Design is shown on Sheet C-1 of the design drawings, included under a separate tab to this volume (Volume I) of the report.

Ozone will be used as the primary oxidant during the ISCO activities. Hydrogen peroxide may also be used as a co-oxidant depending on site conditions and the results of the ozone-only injection. The remediation equipment will be capable of injecting both the oxidants.

The results of a bench-scale test and a field treatability test of ISCO, using ozone and hydrogen peroxide (O_3/H_2O_2), have indicated that complete destruction of the Site COCs can be achieved. The destruction mechanism is through direct oxidation by ozone, as well as oxidation by the hydroxyl radical, a potent and non-selective oxidizing reagent. The hydroxyl radical forms when ozone alone is applied, but its formation is enhanced when ozone is combined with hydrogen peroxide in appropriate molar ratios (i.e., less than 1.0 mole: mole of O_3/H_2O_2).

Oxidant injection wells will be installed in the source area (as delineated by a composite 100 parts per billion [ppb] concentration contour of TCE, cis-1,2-DCE, and 1,4-dioxane originating in the former HWA), forming a permeable, V-shaped barrier to the groundwater. Twelve new O_3/H_2O_2 injection wells (henceforth referred to as peroxone wells; denoted P_{ox}-1 through P_{ox}-12) will be installed in the source area. Three existing peroxone wells (M_{ox}-1, M_{ox}-2, and M_{ox}-3), previously used during the field treatability study, will also be utilized. The O_3/H_2O_2 will be supplied via a commercially available ISCO system. Additional components of the OU1 Source Area design strategy will include the following.

- Extraction of groundwater downgradient of the ISCO barrier.
- Aboveground treatment and injection of this extracted groundwater upgradient of the ISCO barrier.

The extraction well, installed downgradient of the ISCO barrier, will provide hydraulic control in the source area, and maximize groundwater flow through the permeable barrier. Based upon flow modeling results, use of groundwater extraction and injection upgradient may also shorten the cleanup time. The placement of the extraction will be geared toward capture of the 10 ppb isoconcentration contour for 1,4-dioxane and any portions of the source area plume that lie beyond the ISCO system area of influence. The extracted groundwater, estimated at approximately 25 gallons per minute (gpm), will be treated aboveground in a VOC and 1,4-dioxane treatment unit. This unit will also be used for cleanup of approximately 5 gpm of groundwater extracted from the perched aquifer (as described in the RDR for soil). A liquid-phase granular activated carbon (LGAC) unit will be used as required, to further polish the treated water. The treated groundwater, at a total rate of approximately 30 gpm, will then be injected into the shallow Gaspur Aquifer via two injection wells, at 15 gpm each, placed upgradient of the permeable ISCO barrier.

ISCO system operation is anticipated to continue over a period of three years, after which the capture and treatment of the residual COCs in groundwater would be addressed by the extraction/treatment system(s) in the source area and/or downgradient area. The ISCO remediation equipment will be housed on Site, in a closed warehouse located along Rayo Avenue, adjacent to the aboveground treatment compound.

ES.6 DESIGN STRATEGY FOR OU1 DOWNGRADIENT CONTAINMENT AND TREATMENT STRATEGY

The OU1 downgradient containment and treatment strategy includes extraction of groundwater at the leading edge of the OU1 contamination plume and the use of an in situ permeable bioremediation barrier (for enhanced reductive dechlorination) to expedite remediation of a portion of the plume between the source area system and the downgradient containment and treatment system.

Two groundwater extraction wells (designed to extract approximately 20 gpm each) will be installed at the leading edge of the 5 ppb TCE groundwater plume (downgradient of the source area extraction well, along McCallum Avenue). A 350-foot-long permeable bioremediation barrier also is to be installed upgradient of the extraction wells, along Southern Avenue, to enhance reductive dechlorination of VOCs in groundwater, as it flows across the barrier. The groundwater RA design currently includes piping of the extracted water back to the Source Area groundwater treatment plant and after treatment (including for 1,4-dioxane, if necessary), to discharge the water to the sanitary sewer location on site. However, a final determination as to whether pretreatment of the extracted water prior to discharge will be necessary can only be made when the two groundwater extraction wells are installed and sampled.

The placement and operation of the groundwater extraction wells will be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect would be to further enhance/accelerate the treatment of Site groundwater and to reduce the time until cleanup goals are reached. Installation of a permeable bioremediation barrier along Southern Avenue would reduce the targeted treatment area for pump and treat to the area between Southern and McCallum Avenues. As mid-plume COC concentrations are biodegraded along Southern Avenue, the results of the Hydrogen Release Compound (HRC) pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced, possibly from upwards of 35 years down to 20 years or less.

1.0 INTRODUCTION

In June 2001, the United States Environmental Protection Agency (EPA) added the Cooper Drum Company Site (Site) to the National Priorities List (NPL) of hazardous wastes sites requiring remedial action. URS Group, Inc. (URS) completed a remedial investigation/feasibility study (RI/FS) report for the Site in May 2002. The RI/FS summarized previous investigations; the nature and extent of contamination; a human health risk assessment (HRA); contaminants of concern (COCs); remedial investigation (RI) activities, conclusions, and recommendations; remedial action objectives (RAOs); and an evaluation of remedial action (RA) alternatives. The selected RAs are detailed in the *Record of Decision, Cooper Drum Company, City of Southgate, California Record of Decision* (EPA, 2002). The Site has been categorized into two operable units (OUs) for the remedial phase: OU1 (alternatively referred to as "impacted groundwater" or simply, "groundwater," throughout this report) consists of the impacted shallow (Gaspur) aquifer; and OU2 consists of the impacted soil and a perched aquifer in the source area. This Remedial Design Report (RDR) presents the detailed design for the groundwater (OU1) RA. The detailed design for the soil and perched aquifer (OU2) RA is presented in the report titled *Soil Remedial Design Report Operable Unit 2 Cooper Drum Company Superfund Site* (URS, 2007a).

1.1 PURPOSE AND OBJECTIVES

This RDR presents the design for the selected impacted groundwater RA at the Cooper Drum Company Site in South Gate, Los Angeles County, California (see Figure 1-1). The groundwater RA includes remedial systems for the source area and hydraulic control (containment) and treatment for the leading edge of the groundwater plume.

The groundwater Source Area RA (Source Area System) consists of the following components:

- Injection of ozone and hydrogen peroxide into the source area groundwater (i.e., in situ chemical oxidation [ISCO] using injection wells that form a permeable barrier to groundwater flow);
- Extraction of groundwater downgradient of the ISCO barrier; and
- Aboveground treatment and re-injection of this extracted groundwater upgradient of the ISCO barrier.

The groundwater Downgradient Containment and Treatment RA (Downgradient Containment/Treatment System) includes:

- Extraction of groundwater near the leading edge of the plume;
- Installation of a permeable bioremediation barrier in the mid-plume area upgradient of the groundwater extraction; and
- Discharge to sanitary sewer, with pretreatment of the extracted water, if needed.

This RDR provides the design criteria, including the design, assumptions, and parameters used in developing the groundwater remedial design (RD). The RA was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund

Amendments and Reauthorization Act of 1986 (SARA), and, to the extent possible, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The selection was based on the Administrative Record file for the Cooper Drum Company Site and is detailed in the Record of Decision (ROD) (EPA, 2002).

As stated in the ROD, the cleanup strategy for the Site will use a combination of methods to achieve remedial goals:

- An extraction/treatment system will be used for containment and remediation;
- In situ treatment, in the form of oxidation and/or enhanced reductive dechlorination, will also be used to enhance the treatment of volatile organic compounds (VOCs) in groundwater, minimize the need for extraction, and reduce the potential impact for other VOC plumes in the vicinity to impact Cooper Drum; and
- Treated groundwater will be reinjected into the contaminated aquifer, and/or discharged to the Publicly Owned Treatment Works (POTW) sanitary sewer system.

The RA for impacted groundwater as delineated in this RDR encompasses all the components of the ROD selected remedy. The only exception to the ROD is the addition of the semivolatile organic compound (SVOC) 1,4-dioxane as a Site groundwater COC, as a result of the discovery of this compound during the RD investigation. An advanced oxidation process has been added to the RA to address remediation of this SVOC in the groundwater.

The RA for impacted soil is presented in the above-referenced design document (URS, 2007a). The proposed OU2 soil RA includes:

- Dual-phase extraction (DPE) in two areas of the Site that are believed to be the source areas for vadose zone contamination: the former Hard Wash Area (HWA) and the Drum Processing Area (DPA) (see Figure 1-2);
- The DPE will include soil vapor extraction (SVE) and dewatering of the shallow perched zone, which appears to be continuous beneath the Site;
- Groundwater extracted from the perched aquifer will be treated with an ex situ (aboveground) treatment system; and
- The treatment system effluent will be reinjected into the shallow aquifer along with groundwater from the herein described Source Area RA.

It is anticipated that the OU2/soil RA will be performed prior to, or concurrently with, the OU1/groundwater RA. For improved cost-effectiveness, the same ex situ groundwater treatment system can be used for both OUs. The proposed ISCO barrier in the groundwater source area would be directly beneath the DPE system in the HWA. Therefore, concurrent operation of the groundwater and soil RAs would also afford control of ozone and other off-gases that may escape into the vadose zone from the groundwater.

1.2 SITE DESCRIPTION AND HISTORY

1.2.1 Site Description

The Site is located at 9316 South Atlantic Avenue in South Gate, Los Angeles County, California. It is identified as EPA ID CAD 055753370 (Latitude 33 56’ 49” N, Longitude 118 11’42”W). The Site, which consists of 3.8 acres of mixed residential, commercial, and industrial land use, is 10 miles south of Los Angeles and approximately 1,600 feet west of the Los Angeles River (Figure 1-1). Site facilities include drum processing and storage areas, an office, a warehouse, and maintenance buildings. The HWA is in the northeastern area of the Site, which also includes a covered shed area. The drum processing building, which is referred to as the DPA in this report, is located along the southern property boundary. All buildings have concrete floors, and the entire facility has been asphalt-paved since 1986. The Tweedy School on the adjacent property has been closed since 1988 because of a concern that children attending the school could be exposed to contamination migrating off site.

1.2.2 Site History

Following is a history of the Site use for the reconditioning and recycling of steel drums containing residual chemicals.

- Since 1941, the northern portion of the Site has been owned and operated by drum recycling companies. The use and ownership of the southern portion of the Site prior to 1971 is unclear. The Cooper Drum Company purchased both parcels and operated the facility from 1972 until 1992.
- Reconditioning activities took place within the present-day DPA (Figure 1-2), in the central portion of the Site. When necessary, heavy duty cleaning, called “hard washing,” was performed in the northeastern portion of the Site (the former HWA shown on Figure 1-2). Caustic fluids, generated by reconditioning and hard washing activities, and waste materials removed from inside the drums were collected in open concrete sumps and trenches. This led to the contamination of the soil and groundwater beneath the Site. Recent investigations have shown that most contamination at the Site can be traced to the HWA and the DPA.
- By 1992, when the drum reconditioning business had been sold to Waymire Drum Company, the Cooper Drum Company facilities were retrofitted to provide an aboveground, enclosed system for containing liquids and wastes. Closed-top steel tanks were installed over the sumps, and the trenches were replaced with hard piping. The former HWA was closed and replaced with a new HWA in the DPA, which also provided hard piping and secondary containment.
- Waymire Drum Company continued to operate the facility until 1996. Consolidated Drum Company was the drum-reconditioning operator at the Site from 1996 until their departure in 2003. The facility was fitted to process plastic totes (large square containers) during this period.

By 1992, an aboveground, enclosed system was used for containing liquids and wastes. The Cooper Drum Company continued to operate the facility until 1992. In 1992, the drum reconditioning business was sold to Waymire Drum Company, which operated the facility until 1996. Since 1996, Consolidated Drum Company has been the drum-reconditioning operator at the Site. The facility was fitted to process plastic totes (large square containers) during this period.

1.2.3 Current Site Operations

Consolidated Drum Company terminated its lease with the Cooper Trust in October 2003 and moved its operations to off-site facilities. All drum-recycling equipment and associated containment piping and tanks were removed from the Site. Currently, the Site is fully operational; however, drum operations no longer occur at the Site. There were four new tenants, including a pallet company, a trucking and towing company, and two automotive repair/salvage companies. As of June 2006, the automotive repair/salvage companies moved operations off-site and the pallet company expanded its operations to the vacant property.

1.3 Report Organization

This RDR includes the following:

- Section 1.0 A brief introduction of the Site, Site history and current Site operations
- Section 2.0 A summary of the remedial investigations performed at the Site
- Section 3.0 A summary of the Record of Decision for the Site
- Section 4.0 The general design strategy and detailed design for the remediation of impacted groundwater
- Section 5.0 The construction and implementation details
- Section 6.0 The environmental and public impact reduction plan
- Section 7.0 References

2.0 REMEDIAL INVESTIGATION SUMMARY

2.1 PREVIOUS INVESTIGATIONS

From 1984 through 1989, the Los Angeles County Department of Health Services (LACDHS) issued several Notices of Violation to the Cooper Drum Company as a result of incidents involving the release of hazardous substances at the Site. The LADHS required the Cooper Drum Company to conduct investigations of soil and groundwater. In 1989, the California Department of Health Services, now known as the Department of Toxic Substances Control (DTSC), also collected soil samples from under the DPA. These studies, coupled with investigations conducted as part of the RI/FS, identified 13 hazardous substances as COCs in groundwater. Except for 1,4-dioxane, which is considered an SVOC, all the other Site COCs are VOCs. The groundwater COCs and their cleanup levels are listed in Table 2-1.

Under LADHS direction, consultants for the Cooper Drum Company excavated and removed contaminated soil from the property and from the adjacent Tweedy Elementary School, after caustic fluids leaked from trenches under the DPA building onto school property. To assess impacts to groundwater in the uppermost aquifer beneath the Site (approximately 40 to 80 feet below ground surface [bgs]), four monitoring wells were installed on Site and one upgradient well was installed off Site.

The groundwater beneath the Site was identified as contaminated with VOCs. In 1987, the City of South Gate closed four municipal water supply wells found to contain PCE. These wells are in South Gate Park, within 1,500 feet southwest of the Site. At that time, the City listed the Cooper Drum Company as a possible source of the PCE contamination; however, recent investigations indicate that groundwater contamination found beneath the Site did not contribute to the deeper groundwater contamination affecting those municipal wells. The groundwater contamination originating from the Site is moving to the south, not toward the municipal wells. It is confined to the upper aquifer and is not currently affecting any drinking water supplies in the City of South Gate, because the municipal wells are completed in deeper aquifers.

The Tweedy School, on the adjacent property, was closed in 1988 because of the concern that children attending the school could be exposed to contamination migrating from the Site and from other industrial operations in the area.

Based on the discovery of the soil and groundwater contamination, EPA first proposed the Cooper Drum Company Site for inclusion on the NPL in 1992. EPA issued the General Notice and 104(e) letters to the Cooper Drum Company owners and operators at that time. During 1993, EPA met with Arthur Cooper, the Site owner and previous operator (before Waymire Drum Company took over operations in 1992), who was considered a potentially responsible party (PRP). The purpose of the meeting was to discuss the special notice letter EPA was planning to send to him and to begin negotiations for an Administrative Order on Consent (AOC) to conduct the RI. Later that same year, the Cooper estate declared bankruptcy upon the death of Mr. Cooper. Given its lack of assets, the Cooper estate was no longer considered a viable PRP to help pay for the Cooper Drum Company investigation and remediation. Consequently, the Site became a fund-lead site, where Superfund trust fund money is used for Site activities. Based on additional Site investigation data collected by EPA, the Site was proposed for the NPL in January 2001. In June 2001, the EPA added the Site to the NPL of hazardous waste sites requiring remedial action.

EPA conducted the RI activities for Cooper Drum from 1996 to 2001. EPA initiated a soil gas survey in 1996 to identify potential hot spots (areas where contaminant concentrations of VOCs are the highest) for a Phase 1 RI. This investigation identified "hot spots" in the vicinity of the former HWA, in the northeastern portion of the property, and in the DPA, in the central portion of the property. The Phase 1 RI was designed to further investigate the potential presence of VOCs, SVOCs, and metals in soil and groundwater beneath the Site and the adjacent Tweedy School property. Based on the results of the Phase 1 RI, EPA expanded its investigation of soil and groundwater to delineate the extent of contamination as part of a Phase 2 RI conducted between September 1998 and March 2001. The complete RI report, Cooper Drum Remedial Investigation Feasibility Study Report (the Site RI/FS) (URS, 2002) was released in May 2002.

The main hydrogeologic features penetrated by borings and wells completed during the RI field investigation include the Bellflower Aquiclude, the perched aquifer, the Gaspur Aquifer, and the Exposition Aquifer. These units constitute a shallow aquifer and a deeper aquifer. The shallow aquifer consists of the saturated portion of the Bellflower Aquiclude, which incorporates the perched aquifer (approximately 35 to 40 feet bgs) and the Gaspur Aquifer. The Bellflower Aquiclude extends to approximately 70 feet bgs, where the Gaspur Aquifer, which extends to a depth of approximately 110 to 120 feet bgs, underlies it. The upper portion of the deeper aquifer system is represented by the Exposition Aquifer, which underlies the shallow aquifer. These hydrogeologic units are presented on generalized geologic cross-sections shown in Figure 2-1.

Nearby properties have undergone investigation as sources of groundwater contamination under the direction of the Los Angeles Regional Water Quality Control Board (RWQCB), including the Jervis Webb site (north of the Site), two former Dial Corporation sites (northeast and east of the Site), and the Seam Master site (southeast of the Site). Data from investigations at these three sites indicate that groundwater flows in a southerly direction. High TCE concentrations in the shallow aquifer have been detected under the Jervis Webb site (33,000 parts per billion [ppb]) and in a downgradient monitoring well (6,700 ppb) 200 feet upgradient from and northeast of the Site. Similar TCE concentrations (up to 16,000 ppb) have been detected in the groundwater beneath the Seam Master site. Given its proximity, the groundwater contamination from Jervis Webb may have commingled with and impacted the Cooper Drum Site plume. Based on investigation activities performed during the RD, groundwater contamination from the Seam Master site has commingled with the downgradient (outside the property boundary) portion of the Cooper Drum Plume. The need to reduce commingling of these two plumes was an important consideration during remedy selection.

The RI/FS (URS, 2002) confirmed that waste collected in open concrete sumps and trenches resulted in releases to soil, and that migration of some of these contaminants impacted the shallow aquifer beneath the Site. The primary source of contamination was the HWA, where drum-processing operations took place until 1976, when they were moved to the DPA on the southern side of the property. The DPA also became a source of contamination as a result of chemical spills that were documented during the 1980s. Beginning in 1987, the Cooper Drum Company facilities were upgraded to prevent any further release of chemical wastes and to meet environmental regulations. By 1992, the former HWA was closed and replaced with a new HWA in the DPA and aboveground, enclosed systems were in place.

Site operations have resulted in the discharge of contaminants to the surface soil, vadose zone, and underlying groundwater. Various chemicals have been released to the Site and VOCs and SVOCs are found in both the vadose zone and groundwater.

2.2 SUPPLEMENTAL RI DATA

The ROD for the Cooper Drum Site was signed on September 28, 2002. The ROD-selected groundwater RA is discussed in Section 3.0 of this RDR.

California DTSC agreed with the selected groundwater remedies stated in the ROD, provided additional data were collected to address data gaps prior to implementation of the selected remedies. EPA included the following component in the selected groundwater remedy to address these concerns.

- Conduct additional groundwater sampling to further define the downgradient extent of the VOC contamination (beyond the property boundary).

This component was addressed and reported in the *Remedial Design Technical Memorandum for Field Sampling Results* (URS, 2006a). Reported data pertinent to soil, soil gas, and the perched aquifer was also presented in the soil RDR (URS, 2007a). However, it was noted in the above-mentioned technical memorandum that additional groundwater sampling was required to accurately define the southeastern groundwater plume boundary. In order to accomplish this, additional depth-discrete groundwater sampling using cone penetrometer testing (CPT) and HydroPunch sampling was conducted during February/March of 2007 and the results were reported in *Addendum No. 2* to the field sampling results (URS, 2007b). This addendum is included as Appendix B to this report. A summary table of historical VOC and 1,4-dioxane groundwater sampling results are also included in Appendix B.

A discussion of the rationale for the CPT/HydroPunch investigation is provided in Section 2.2.1. A summary of the investigation results is presented in Section 2.2.2. On the basis of these results, recommendations for installation of new monitor wells are provided in Section 2.3.

2.2.1 Rationale for the 2007 CPT/HydroPunch Investigation

The 2007 CPT/HydroPunch investigation was performed by EPA to further define the lateral extent of the Cooper Drum Plume and complete the RD for the Site. The CPT/HydroPunch data provide the basis for selecting the locations of new monitor wells. At this time, monitor wells have only been installed within the Cooper Drum plume. New monitor wells would provide a fixed sampling location to:

- Determine groundwater flow direction downgradient of the Site;
- Define plume boundaries;
- Monitor plume migration off-Site; and
- Gauge the effectiveness of remedial actions.

In addition to the above-mentioned reasons, new monitor wells outside the Cooper Drum plume are required to verify the location of other plumes. During the CPT/HydroPunch investigation, depth-discrete groundwater samples collected outside the Cooper Drum plume indicated that the Site plume is commingling with an adjacent plume.

2.2.2 2007 CPT/HydroPunch Sampling Results

Five CPT/HydroPunch borings (CPT-40 through CPT-45) and four HydroPunch-only borings (HydroPunch-8, HydroPunch-26, HydroPunch-35, and HydroPunch-36) were installed between February 26 to March 1, 2007 to obtain lithologic data and/or depth-discrete groundwater samples to further delineate the groundwater contamination. Figure 2-2 shows the CPT and HydroPunch boring locations. The HydroPunch borings were installed at locations which had been sampled during prior investigations (i.e., CPT-8, CPT-26, CPT-35 and CPT-36); therefore, these locations were designated with an HydroPunch, because lithologic data was available from CPTs in the vicinity of the HydroPunch borings.

The lithologic data from the new CPTs were consistent with prior data, which indicated the presence of a relatively sandy unit from approximately 60 to 100 feet bgs. This unit begins in the eastern portion of the Site along Rayo Avenue, and trends to the south and southeast.

VOC and 1,4-dioxane analytical data for the February/March 2007 sampling event are presented in Table 1 of Appendix B (included in Volume II of this report). Select VOC and 1,4-dioxane results are presented on Figure 2-2, which has an expanded base map and also includes the August 2006 TCE results from monitor wells (URS, 2007c). TCE concentrations are considered representative of the lateral extent of the Cooper Drum plume. Results from the February/March 2007 CPT/HydroPunch investigation indicate the following:

- The leading edge of the Cooper Drum plume (as represented by TCE) appears to be slightly south of McCallum Avenue, as depicted on Figure 2-2. The estimated Cooper Drum plume boundary and the plume(s) boundary(s) to the east cannot be finalized until the groundwater flow direction and COC concentrations can be established, based on sampling results from proposed new monitor wells. Based on the current monitor well data, the recent CPT/HydroPunch data, and the water level data from the Cooper Drum Site, the 5 micrograms per liter (μg/L) TCE contour line boundary for the Site plume was estimated for the purpose of developing the groundwater remedial design. Note that an estimated area of plume convergence (commingling with off-site plumes) is depicted on Figure 2-2.
- VOC concentrations in the downgradient area of the Cooper Drum plume appear to be higher in the lower portion (90 to 110 feet bgs) of the Gaspur Aquifer.
- Concentrations (up to 830 μg/L of TCE) of VOCs south of Southern Avenue are significantly above those observed in the Cooper Drum plume. These elevated VOC concentrations are present from the depth range of approximately 62 to 85 feet bgs, beginning at CPT-40 and continuing to the south at CPT-41, CPT-42 and CPT-45. The VOCs would appear to be emanating from the area of CPT-10 and CPT-21, located in the eastern portion of the Seam Master site. Results from these two CPTs have shown TCE concentrations of up to 16,000 μg/L from this depth range. Assuming the source of VOCs at CPT-45 is from the Seam Master site, groundwater flow directions may be south to southwest.
- The high TCE concentration at the 100-foot bgs depth from CPT-40 (as compared to the shallower results) suggest this contamination may not be associated with the Seam Master site and could be associated with the Jervis Webb site and/or the Cooper Drum plume. Further investigations are required to determine the source of this contamination.
- 1,4-Dioxane concentrations appear to higher in the Cooper Drum plume, as compared to results from the CPTs sampled to the east and downgradient of the Cooper Drum plume. Generally, all

1,4-dioxane results from CPT-40 to CPT-42 and CPT 45 were less than 2 µg/L. The only exception would be the 88-foot bgs sample from CPT-40, which showed a 1,4-dioxane concentration of 12 µg/L.

On the basis of the above sampling results, recommendations for new monitor wells are provided in Section 2.5.

2.3 RECOMMENDATIONS FOR NEW MONITORING WELLS

As discussed above, monitor well installations are necessary to confirm the CPT/HydroPunch depth- discrete sampling results, establish groundwater flow patterns, track plume migration, and evaluate the RA performance. Well installations are also necessary within and to the south of the Seam Master Site to further characterize VOC contamination in that area.

To characterize the Cooper Drum plume, recommendations for new monitor well installation are:

- To address the downgradient extent of the Cooper Drum Plume, two monitor well pairs completed in the middle and lower portion of the shallow Gaspur Aquifer are recommended on McCallum Avenue, in the vicinity of CPT-44 and CPT-43 (see proposed new wells MW-34A/B and MW-35A/B on Figure 2-3).
- Two monitor wells completed in the lower portion of the Gaspur Aquifer at the locations of MW-25 and MW-31 are recommended (see proposed new wells MW-25B and MW-31B on Figure 2-3). At these locations, existing wells MW-25 and MW-31 are completed in the middle portion of the Gaspur Aquifer; and MW-26 and MW-32 are completed in the upper portion of the deeper Exposition Aquifer.
- One monitor well screened from 85 to 90 feet in the Gaspur Aquifer, to be located in the vicinity of CPT-35, adjacent to the curb line on Southern Avenue is recommended (see proposed new well MW-38A on Figure 2-3).
- One monitor well pair completed in the middle and lower portion of the shallow Gaspur Aquifer in the vicinity of CPT-22, inside the Site fence line (see proposed new wells MW-39A/B on Figure 2-3).

Data from the proposed new wells would be used to (1) further characterize COC distribution in the Cooper Drum plume and (2) evaluate the effectiveness of the ISCO barrier in the source area and the permeable bioremediation barrier to be installed along Southern Avenue as part of the RA.

Regarding the Site plume commingling with the adjacent plumes to the east, the following recommendations are made:

- Install one monitor well pair to be completed in the middle and lower portion of the shallow Gaspur Aquifer and located on Southern Avenue in the vicinity of CPT 40 (see proposed new wells MW-37A/B on Figure 2-3). The deeper well would be useful to address deep contamination which may be related to upgradient sources. Water levels from these locations should assist in establishing flow directions from the Seam Master site.

- Install one monitor well pair to be completed in the middle and lower portion of the shallow Gaspur Aquifer and located on Adella Avenue, approximately 100 feet south of the intersection of McCallum Avenue (see proposed new wells MW-36A/B Figure 2-3). It is expected that the well completed in the lower Gaspur Aquifer (approximately 95 to 110 feet bgs) would define the downgradient extent of the Cooper Drum plume, since the VOC concentrations above this depth interval appear to be significantly higher than in other areas of the Cooper Drum plume and not attributed to it.

Therefore, the groundwater RA includes the installation of 13 new monitor wells. As shown on Figure 2-3 and discussed in Section 4.2, the RA also includes installation of three new groundwater extraction wells. One well (SEW-1) will be installed just south of the Site along Rayo Avenue and two wells (DEW-1 and DEW-2) will be installed farther south, along McCallum Avenue. Sheet C-6 (Volume I) shows the design drawing for typical single-completion monitor wells and extraction wells.

Until the new monitor wells are installed, there will remain some uncertainty regarding the treatment requirements for the groundwater extracted by the downgradient extraction wells. For example, it is possible that 1,4-dioxane concentrations may be low enough so as to not require treatment. However, based on VOC sample results from the existing monitor wells and from CPT locations, it is expected that VOC concentrations will be greater than cleanup goals and will, therefore, require treatment. Based on these expectations, and in order to effectively use the Site property and existing infrastructure, the groundwater RA design currently includes piping of the extracted water from the downgradient area back up to the Site groundwater treatment compound for treatment of VOCs and, if required, 1,4-dioxane. A final determination as to whether treatment of this water will be required can only be made after the two new extraction wells are installed and additional sampling data are collected prior to implementation of the RA.

2.4 PILOT STUDY RESULTS AND JUSTIFICATION OF DESIGN ASSUMPTIONS

Two field-scale pilot studies have been completed as part of implementation of the RA:

- Hydrogen Release Compound (HRC) Field Pilot Study (URS, 2005)
- ISCO Field Pilot Study using Ozone and Hydrogen Peroxide (URS, 2006b).

2.4.1 HRC Pilot Test Description

The objective of the HRC field pilot study, performed in December 2003, was to evaluate the effectiveness of enhanced reductive dechlorination in reducing VOC concentrations in the Site groundwater. The pilot test comprised of injecting a combination of a less viscous form of HRC (referred to as “HRC primer”), and HRC with added iron gluconate (referred to as “modified HRC”) into the contaminated groundwater. Prior to the field test, it was surmised that the presence of high levels of sulfate naturally present in Site groundwater (at levels of up to several thousand milligrams per liter) might compromise the technology’s effectiveness because sulfate and other soil and groundwater constituents compete for the donated electrons (which are provided by hydrogen that is released as HRC degrades). Sulfate reduction is not necessarily desirable, because it may result in a build-up of sulfides which can, in turn, lead to “sulfide toxicity” and loss of microbial populations in the aquifer. On the other hand, if the produced sulfide binds with metals, for example with iron naturally present in groundwater or iron introduced by the modified HRC, it will likely precipitate in the form of iron sulfides. Therefore, it was hoped that the modified HRC would provide adequate iron to promote iron sulfide precipitation. The purpose for injection of the less viscous HRC primer was to provide an easily accessible source of hydrogen (electrons), in order to satisfy the electron demand of the competing soil and groundwater constituents.

The HRC test consisted of injecting approximately 4,500 pounds of substrate into a 15-foot by 25-foot grid area (see Figure 2-4, HRC area) in the Site source area. The HRC area is approximately 100 feet upgradient from the ISCO field pilot test area; therefore, contamination originating in the HRC area was expected to impact the oxidation pilot study area after approximately 10 months. The results of groundwater sampling after the start of the HRC pilot study indicated that injection of HRC promoted and enhanced anaerobic bacterial activity and reductive dechlorination, without a significant increase in sulfide concentrations, within distances of 50 feet or more directly downgradient from the test area. (See Appendix D, Volume II, of this report for VOC concentration trends over time in the study area monitor wells.) Based on these results, full-scale application of HRC would be feasible to treat VOCs in groundwater but not to treat 1,4-dioxane (an SVOC) in groundwater. As mentioned above, 1,4-dioxane has been detected in Site groundwater, at levels ranging from below detection levels to several hundred micrograms per liter. By comparison, the drinking water preliminary remediation goal (PRG) for 1,4-dioxane is 6.1 μg/L, and the Department of Health Services (DHS) action level for this compound is 3 μg/L. It was because of the presence of 1,4-dioxane that the ISCO field pilot study was performed.

2.5 ISCO PILOT TEST SUMMARY

This section details the highlights of the ISCO pilot study conducted from July 2005 through June 2006. Additional relevant results and figures are provided in Appendix D, Volume II, of this report. The main purpose of the pilot study was to determine whether inclusion of ISCO in the groundwater remedy for the Site was required to effectively reach the groundwater aquifer cleanup levels. The data monitoring and sampling procedures were geared towards evaluating system performance and checking for reducing COC concentrations without significant rebound. The ISCO technology employed was an advanced oxidation process (AOP) using the application of ozone and hydrogen peroxide.

2.5.1 ISCO Pilot Test Description and Results

The positive findings from an ozone/hydrogen peroxide bench scale study (PRIMA Environmental, 2005) warranted further evaluation during a field pilot-scale study of the technology. The pilot study was conducted approximately 140 feet downgradient from the former HWA, the main contaminant source area. The pilot study installation consisted of a barrier configuration with three ozone/hydrogen peroxide injection wells laterally spaced from 35 and 50 feet apart. The pilot scale study layout is shown on Figure 2-4. Each injection well contained two injection points at approximately 70 and 90 feet bgs (see Figure 2-5). The pilot study monitoring wells (extraction well [EW]-1, monitoring well [MW]-33A/33B, and MW-20/20B) were located downgradient and within a maximum of 30 feet of the three injection wells (M_{OX}-1, M_{OX}-2, and M_{OX}-3). Each monitoring well location included a shallow (approximately 60 to 63 feet bgs) and deep (85 feet bgs) sampling depth.

The pilot study took place over a period of 321 days (approximately 10.5 months). The following general schedule of oxidant injection was employed during this period.

- Ozone only for the first 5 months (148 days) in the three injection wells. Ozone was injected at a rate of 0.5 pound per day for 50 days and then increased to 2 pounds per day for the remainder of the 5-month period.
- Ozone and hydrogen peroxide for the remaining 5.5 months.
- Increasing the ozone and hydrogen peroxide injection rates by focusing the injection into only two injection wells after 8 months, or 244 days. This phase was referred to as “focused injection.”
- Increasing the ozone injection rate (by adding a second ozone generator) from 2 to 4 pounds per day, and reducing the hydrogen peroxide injection rate to 0.7-to-1 moles peroxide per moles ozone (mole: mole) after just over 9 months (281 days), and for the remaining 40 days of the pilot study.

Optimal system operating parameters were eventually achieved by performing the following:

- Using continuous downhole monitoring of the dissolved oxygen (DO) and oxidation reduction potential (ORP) to evaluate the lateral and vertical effect of varying the operating parameters, such as oxidant injection cycles and injection locations;
- Focusing/increasing oxidant injection into two injection wells (M_{OX}-1 and M_{OX}-2);
- Reducing the hydrogen peroxide injection rate; and
- Increasing the ozone injection rate from approximately 2 pounds per day to 4 pounds per day.

Air was also injected following each oxidant injection to enhance oxidant distribution. The air volume was increased from 1.1 to 2.2 standard cubic feet per minute (scfm) after 99 days, and then decreased back to 1.1 scfm after 244 days for the remainder of the pilot study.

Over the first 5 months of the pilot study, COC concentrations generally showed an overall decreased in the three shallow monitor wells and one deep well (one shallow well, MW-33A, showed an increase in TCE prior to the end of the 5-month period). After the 5-month period, when both ozone and hydrogen peroxide were being injected, COC concentrations increased slightly and/or stabilized in the two shallow monitor wells (EW-1 at 63 feet bgs [EW-1-63’] and MW-20) and one deeper well (EW-1 at 85 feet bgs [EW-1-85’]). The stabilized state persisted in one shallow well (EW-1-63’) and continued even after initiation of the focused injection. However, the sampling results at this well conducted 40 days after the ozone injection rate was increased from 2 to 4 pounds showed a decrease of 350 μg/L of 1,4-dioxane and 135 μg/L of TCE. At MW-33A, where TCE concentrations increased prior to the injection of hydrogen peroxide (i.e., towards the end of the first 5-month period), the other COC concentrations continued to show an overall decreasing trend throughout the pilot study. TCE concentrations eventually decreased at this well by 490 μg/L. 1,1-DCA concentrations decreased by an average of 73% in the three shallow wells; this is notable, considering the reluctant nature of chlorinated ethanes to oxidation. Monitoring of the third shallow well (MW-20) was discontinued after injection in the closest injection well (M_{OX}-3) was terminated, as part of the focused injection phase.

In summary, in situ oxidation of Site COCs (including TCE, DCE, DCA, and 1,4-dioxane) was observed in all wells, with significant reductions (up to 90%) in both TCE and 1,4-dioxane concentrations. The largest decreases in concentrations were observed from the three shallow monitoring wells.

Based on the successful destruction of VOCs and 1,4-dioxane, the use of ISCO is now included in the full-scale remedial system for the Site.

3.0 SUMMARY OF RECORD OF DECISION

The ROD for the Cooper Drum Site was signed on September 28, 2002. At the time, the known contaminants in groundwater consisted of VOCs only; therefore, the ROD did not make specific mention of 1,4-dioxane. However, by maintaining a comprehensive approach to cleanup, which employed the use of both in situ and ex situ technologies for cleanup and containment, the ROD-selected remedy for groundwater remains viable for all Site COCs. The RAOs for Cooper Drum, as stated in the ROD, are to protect human health and the environment from exposure to contaminated soil, groundwater, and indoor air, and to restore the groundwater to a potential beneficial use as a drinking water source. The ROD-selected remedy meets these RAOs through treatment of soil and groundwater contaminated with COCs.

3.1 SELECTED ACTION FOR GROUNDWATER

The following paragraphs are excerpts from the Cooper Drum ROD:

- The cleanup strategy for groundwater will use a combination of methods to achieve remedial goals and to restore the potential beneficial use of the aquifer as a drinking water source.
- An ex situ treatment component, consisting of a groundwater extraction and treatment system, will be used for containment and remediation. This ex situ treatment component will utilize presumptive technologies identified in Directive 9283.1-12 from EPA's Office of Solid Waste and Emergency Response (OSWER). One of the presumptive technologies (GAC) will be used for treating aqueous contaminants in the extracted ground water.
- In situ chemical treatment—reductive dechlorination and/or oxidation—will also be used to enhance the treatment of VOCs in groundwater and to minimize the need for extraction and ex situ treatment.
- The actual technologies and sequence of technologies used will be determined during RD. Final selection of these technologies will be based on the outcome of treatability studies to be performed during the RD.

The EPA believes the selected remedy for Cooper Drum meets the threshold criteria and provides the best balance of tradeoffs among the alternatives considered. The EPA expects the selected remedy to satisfy the statutory requirements of CERCLA Section 121(b): (1) protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements (ARARs); (3) cost effectiveness; (4) use of permanent solutions and alternative treatment technologies to the maximum extent practicable; and (5) use of treatment as a principle component.

3.2 DETAILED DESCRIPTION OF THE ROD-SELECTED REMEDY

The selected remedy consists of extracting COC-contaminated groundwater and treating it aboveground. In situ chemical treatment—reductive dechlorination and/or chemical oxidation—would be used to expedite and enhance treatment, and to reduce the volume of extracted water. The various components of the selected remedy, as described in the Cooper Drum ROD, are:

- Extract groundwater contaminated with VOCs and treat it using liquid-phase activated carbon in vessels at an on-site treatment system. Containment will be provided at the downgradient extent of contamination.
- The treated water will be reinjected into the contaminated groundwater aquifer or discharged to the public sewer system operated by the Los Angeles County Sanitation District (LACSD). Reinjection will reduce the intrusion of and the potential for mixing with other off-site VOC plumes.
- Use in situ chemical treatment, either reductive dechlorination or chemical oxidation, to enhance remediation of VOC-contaminated groundwater. During the remedial design phase, conduct treatability studies to evaluate both methods and determine which works best under site conditions. Data obtained from pilot studies will also be used to determine the specific number and placement of in situ injection points.
- Conduct additional groundwater sampling during the RD phase to further define the downgradient extent of the VOC contamination.
- Continue groundwater monitoring for a period of three years after the monitoring demonstrates that remediation goals have been met.

The ROD also stated the time to reach remedial action goals as 20 years. However, it was noted that the actual time required for active cleanup could be reduced if the in situ chemical treatment was proven effective. Depending on the effectiveness of in situ chemical treatment, monitoring could be the only action needed at Cooper Drum within 5 to 10 years of start of remediation.

3.3 RATIONALE FOR THE SELECTED REMEDY

The principal factors considered in choosing the selected remedy for groundwater are:

1. There is no source material or non-aqueous phase liquids (NAPLs) in the groundwater constituting a principal threat;
2. Low level extraction provides an effective means of minimizing migration of the leading edge of the contaminant plume, without further commingling of on- and off-site plumes;
3. Reinjection of a portion of the treated ground water will enhance recovery of contaminants from the aquifer and will reduce the plume commingling potential;
4. Supplemental in situ chemical treatment may expedite cleanup and reduce volume and toxicity of contaminants in place; and
5. Depending on the success of the in situ chemical treatment, monitoring may become the only action needed at Cooper Drum within 5 to 10 years if it can be demonstrated that contaminant concentrations in the groundwater plume have stabilized at reduced concentrations.

3.4 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Remedial actions selected under CERCLA must comply with ARARs under federal environmental laws or under State environmental or facility-siting laws when those are more stringent than the federal requirements. The ARARs and to-be-considered (TBC) criteria identified in the ROD for the groundwater remedy are included in Appendix C.

If after implementation of the remedy, hazardous waste still remains at the property at levels which are not suitable for unrestricted use of the land, additional institutional controls may be required in the form of a State Land Use Covenant with the property owner. The Covenant shall conform with the requirements of pursuant to Civil Code section 1471, Health and Safety Code section 25355.5 and the California Code of Regulations, Title 22, section 67391.1. However, remediation of groundwater will be required to meet all applicable cleanup goals. Therefore, institutional controls will not be needed for OU1 groundwater.

4.0 DETAILED DESIGN FOR GROUNDWATER REMEDIATION

The following section details the basis for the groundwater remedial design for contaminated groundwater. The design closely follows the ROD selected remedy for groundwater, as delineated in Section 3.0. However, the role of chemical oxidation, both as ex situ and in situ treatment, has been augmented to address the presence of 1,4-dioxane in groundwater.

4.1 STRATEGY FOR FULL-SCALE SYSTEM DESIGN

The lessons-learned from the ISCO and reductive dechlorination pilot studies (Section 2.7) provided a road map for full-scale application of these technologies at the Site. After the system operating parameters were optimized, the ozone/peroxide pilot-scale system was successful in achieving the test objectives of evaluating system performance and reducing COC concentrations without significant rebound. The reductive dechlorination (using HRC) pilot test also was successful in reducing VOC concentrations (but not 1,4-dioxane) in the pilot test area. Based on these observations, the following design strategy was developed for the full-scale groundwater remedial system:

- The in situ oxidation system will include the capability to inject both ozone and hydrogen peroxide. However, operation of the system could begin with injection of ozone only and transition to combined injection of hydrogen peroxide and ozone at less than stoichiometric mole to mole ratio of peroxide to ozone.
- It is possible, though not practical or cost-effective, to attain MCLs for all Site COCs across the entire groundwater plume using ISCO alone. However, it is both practical and cost-effective to use ISCO in the limited confines of the source area plume. As COC concentrations approach MCLs, the oxidation reaction kinetics is expected to be slower than that observed in the pilot study. Therefore, the ISCO system is designed to address COC concentrations greater than 50 μg/L. The portions of the plume less than the design concentration but greater than MCLs will be addressed with groundwater extraction and upgradient injection (in the source area), as well as the downgradient containment and treatment system (as per the ROD).
- Consistent with the ROD selected remedy, the downgradient containment and treatment system will include the following components: (1) enhanced reductive dechlorination with an injected carbon substrate, in the form of a permeable bioremediation barrier, to reduce VOC concentrations and shorten the time to reach cleanup goals; (2) groundwater extraction wells at the leading edge of the 5 ppb combined contaminant plume and downgradient of the bioremediation barrier, to contain the plume with residual VOCs and 1,4-dioxane at levels exceeding cleanup goals; (3) aboveground treatment, as needed, of the extracted groundwater; and (4) discharge of the treated water to the sanitary sewer under an LACSD permit.

4.2 OU1 REMEDIAL DESIGN

4.2.1 Source Area Strategy

The primary remedial alternative designed to reduce COC concentrations to cleanup levels is the use of ISCO, in conjunction with groundwater extraction, treatment and re-injection. Ozone will be used as the primary oxidant during the ISCO activities. Hydrogen peroxide may also be used as a co-oxidant depending on Site conditions and the results of the ozone-only injection. The remediation equipment will be capable of injecting both the oxidants.

Oxidant injection wells will be installed in the source area (which for design purposes is represented by the composite 100 ppb concentration contour of TCE; cis-1,2-DCE; and 1,4-dioxane), forming a permeable V-shaped barrier to the groundwater. The ozone and hydrogen peroxide will be supplied via a commercially available in situ chemical oxidation system. Additional components of the OU1 source area strategy will include the following.

- Extraction of groundwater downgradient of the ISCO barrier.
- Aboveground treatment and injection of this extracted groundwater upgradient of the ISCO barrier.

As indicated in the flow modeling results on Figure 4-1, the extraction well, installed downgradient of the ISCO barrier, will provide hydraulic control in the source area and maximize groundwater flow through the permeable barrier. Additionally, use of groundwater extraction followed by injection upgradient may also help in shortening of the cleanup time as per flow modeling results (Appendix F).

4.2.2 Remedial Design for Source Area Groundwater

The design details the ozone/ hydrogen peroxide (henceforth referred to as peroxone) well, extraction well, and injection well locations and also the depth of the screen intervals in each case. Three existing peroxone injection wells, M_{ox}-1, M_{ox}-2, and M_{ox}-3, were installed on Site for the pilot study evaluation and will also be utilized as part of the design. The existing peroxone injection wells were installed 35 feet to 50 feet apart from one another for maximum overlap of individual well radii of influence (ROIs).

Twelve new peroxone wells, denoted P_{ox}-1 through P_{ox}-12, will be installed in the source area, to approximately 70 to 95 feet bgs. The oxidant injection depths will be 10 feet below the target groundwater contamination; however, the actual screen depth interval will depend on location-specific lithology. Consistent with the maximum injection well spacing during the ISCO pilot test, the ROI of the peroxone injection wells is conservatively estimated to be around 25 feet. Based on this estimate, the new peroxone wells will be placed approximately 50 feet from each other, depending on actual Site conditions. The peroxone injection wells will be installed in a "double V" or triangular-shaped pattern intersecting the groundwater flow direction and will mainly target the northern portion of the source contamination area close to the former HWA (with 100 ppb or greater levels of COC contamination). The OU1 Source Area Design is shown on Sheet C-1 of the design drawings, included as a separate tab to Volume I of this report.

ISCO system operation is anticipated to continue for three years, after which the capture and treatment of the residual COCs in groundwater will be addressed by the extraction/treatment system. The ISCO remediation equipment will be housed in a closed warehouse located along Rayo Avenue, adjacent to the treatment compound (Figure 4-2).

The total depth of the source area extraction well will be approximately 105 feet bgs. The well will be screened from 60 to 100 feet bgs. In addition, there will be a 5-foot deep sump bringing the total depth to 105 feet bgs. The placement of the extraction well will be geared toward capture of the 10 µg/L isoconcentration contour for 1,4-dioxane and any portions of the source area plume that lie beyond the ISCO system area of influence (Figure 4-1). The design flow rate of the extraction well will be 25 gpm, which based on the modeling results will capture most of the 10 µg/L 1,4-dioxane plume without commingling of off-site plumes.

The total depth of each of the two injection wells will be 85 feet bgs. The injection wells (located upgradient of the ISCO barrier, as shown on Figures 4-1 and 4-2) will be screened from 55 to 85 feet bgs. MODFLOW simulations supported the notion that injection would reduce the time to reach cleanup goals by increasing the groundwater flow rates in the treatment area. This is particularly valid in situations where thick sandy layers dominate the aquifer lithology, although the same may not be true in areas where tighter lithologies are present. The subsurface lithology at the Site is dominated by sandy layers that gradually thicken downgradient of the source area. Hence, injection upgradient of source area is expected to be successful in expediting the remediation of COCs. Based on modeling results, the two injection wells will be able to handle 30 gpm: 25 gpm from the source area extraction wells, and 5 gpm from the dewatering of the perched aquifer (as part of the OU2 soil RA).

The injection and extraction well trenching details and well construction details can be found on Sheets C-3 and C-6, respectively, of the design drawings. The design calculations for the pressure losses and the groundwater conveyance pipe sizes are included as Appendix I, Volume II, of this report.

Extracted groundwater will be treated aboveground in a VOC and 1,4-dioxane advanced oxidation process unit that will also be used for cleanup of the perched aquifer groundwater as part of OU2 RA. A liquid-phase granular activated carbon (LGAC) unit also will be used as required, to further polish the treated water. The current design assumes that ISCO in the source area will cease after 3 years of operation. However, operation of the source area extraction well and the aboveground treatment of the extracted water could continue even after ISCO is stopped. The groundwater treatment compound plan is depicted on Sheet S-1 of the design drawings, which are presented under a separate tab in Volume I of this report.

4.2.3 Downgradient Containment and Treatment Strategy

The downgradient containment and treatment strategy includes extraction of groundwater at the leading edge of the impacted groundwater plume and the use of an in situ permeable bioremediation barrier to expedite remediation of a portion of the plume between the source area system and the downgradient containment and treatment system. The use of in situ bioremediation will enhance the ongoing reductive dechlorination of VOCs in groundwater.

The current design includes conveyance of the extracted groundwater back up to the groundwater treatment plant located on site, followed by treatment and discharge to the sanitary sewer location on site, under an LACSD waste discharge permit. However, a final determination as to whether the extracted water will require treatment cannot be made until groundwater extraction wells have been installed, tested, and sampled prior to implementation of the RA.

The groundwater flow modeling results on Figure 4-3 show that groundwater extraction along McCallum Avenue could be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect would be to further enhance/accelerate the treatment of Site groundwater and to reduce the time until cleanup goals are reached. Installation of a permeable bioremediation barrier along Southern Avenue would reduce the targeted treatment area for pump and treat to the area between Southern and McCallum Avenues. As mid-plume COC concentrations are biodegraded along Southern Avenue, the results of the HRC pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced. The downgradient strategy is depicted on Figure 4-3 and on design drawings.

4.2.4 Remedial Design for Downgradient Containment and Treatment of Groundwater

To provide plume containment, the RA will include the installation of two groundwater extraction wells at the leading edge of the 5 μg/L plume downgradient of the source area near McCallum Avenue. Results from a recent CPT/HydroPunch investigation (Section 2.4) indicate that the leading edge of the groundwater plume may be slightly south of McCallum Avenue (Figure 2-2). The downgradient extraction wells will be installed to a total depth of about 115 feet bgs. The wells will be screened from approximately 65 to 112 feet bgs. Each well will pump groundwater at a flow rate of approximately 20 gpm. (For typical extraction well design, see Sheet C-6.)

In addition to groundwater extraction, a 350-foot long barrier of an injected reductive dechlorination enhancing substrate will be placed along Southern Avenue (see Sheet C-2 of the design drawings). The substrate will be injected via borings drilled down to approximately 100 feet bgs. The substrate injection depth interval will be from approximately 80 to 100 feet bgs. Groundwater extraction along McCallum will be designed to minimize the impact of adjacent plumes, while also providing hydraulic control of the groundwater through the permeable bioremediation barrier. The combined effect will be to further enhance/accelerate Site groundwater treatment and to reduce the time until cleanup goals are reached. With the addition of the permeable bioremediation barrier, results of the previous HRC pilot test and analytical pore volume modeling indicate that the required operation time of the extraction wells could be significantly reduced, possibly from upwards of 35 years down to 20 years or less. Groundwater monitoring results from wells along Southern Avenue have shown the presence of TCE biodegradation daughter products (cis-1,2-DCE and VC), and negative ORP levels, suggesting that aquifer conditions in the downgradient area are conducive to reductive dechlorination.

In the current design, extracted groundwater is conveyed back up to the groundwater treatment plant located on site (see Sheet C-2 for more detail). Since the groundwater extracted in the downgradient area will flow through a reductive dechlorination bioremediation barrier, it is anticipated that residual 1,4-dioxane concentrations persisting in the groundwater may not be treated effectively by the bioremediation barrier (as shown in the HRC field scale pilot study). In order to attenuate the 1,4-dioxane levels to below cleanup levels, if needed, the advanced oxidation groundwater treatment unit will be used to also treat the groundwater extracted from the leading edge of the Cooper Drum plume. Use of this unit is expected to ensure compliance of all Site VOCs and SVOCs with discharge levels. Additionally, the LGAC vessels will be used to treat any residual/trace VOCs. However, a final determination as to whether treatment of this water will be required cannot be made until results are available from additional samples to be collected during implementation of the RA.

The source area injection wells have adequate capacity to handle the 30 gpm extracted from the perched aquifer and from the source area plume but they cannot handle the additional water (approximately 40 gpm) extracted from the leading edge of the plume. Therefore, extracted and treated water in excess of 30 gpm will be discharged to the sanitary sewer discharge point located on site, under an LACSD waste discharge permit.

A detailed inventory of all the equipment necessary for the groundwater design and the costs involved are included as part of the engineering costs summary, which are provided under a separate tab in this volume (Volume I) of the report. Design drawings also are provided in this volume of the report.

4.2.5 Groundwater Extraction Well Placement and Zone of Capture

One groundwater extraction well will be installed downgradient of the source area (east side of Rayo Avenue near MW-15) to address parts of the groundwater plume where contaminant concentrations are less than the ISCO design concentration, but greater than cleanup levels.

Placement of the downgradient extraction wells, as determined based on flow modeling results and existing Site geology, will be along McCallum Avenue, downgradient of the permeable bioremediation barrier. The complete modeling results are documented in the *OU1 Groundwater Remedy Conceptual Design* (URS, 2007d). A description of the groundwater model and sample modeling results are also included as Appendix F, Volume II, of this report.

Extracted groundwater will be treated in the above-ground treatment system located on site (which will also treat extracted perched groundwater as detailed in the soil RA) prior to being discharged. Discharge of water will be either via injection into two injection wells to be installed upgradient of the source area, or via the sanitary sewer discharge point located on site.

4.2.6 ISCO Radius of Influence

During the ISCO pilot study, the ROI of each oxidant injection well was conservatively assumed to be in the range 10 to 25 feet. The distance between the monitoring wells and the injection locations was therefore, varied (i.e., 10, 15, 20, and 30 feet) in order to evaluate the ROI of the injection wells.

DO and ORP measurements collected during the pilot study using downhole and flow-through cell devices confirmed that the injection well ROI was at least 30 feet (i.e., the largest distance between an injection well and a monitoring well). Additionally, a greater ROI was recorded in the upper injection interval in the shallow aquifer (approximately 50 to 80 feet bgs). This is probably due to the presence of less permeable aquifer material in the 40- to 50-foot bgs interval. Therefore, the maximum spacing between injection wells will be 50 feet (corresponding to a minimum ROI of 25 feet).

4.2.7 ISCO Injection Depth

During the ISCO pilot study, DO and ORP measurements were collected at 5-foot intervals in the wells. Given the short screen intervals in MW-20B (10 feet) and MW-33B (10 feet), the measurements did not reflect a significant change in DO or ORP as a function of depth in these monitor wells. However, the shallow wells (MW-20 and MW-33A) did show increased levels of ORP and DO in the 50- to 55-foot depth interval versus the 60- to 65-foot depth interval in which the oxidants were injected. This was expected based on the pressure buildup in MW-20 and MW-33A, which was caused by the presence of the semi-confining layer just above 50 feet bgs.

Significant information was collected from EW-1, which has a 40-foot screen interval. For three of the five profiling events conducted during the focused injection, a significant increase in ORP (up to 230 millivolts [mV]) and DO (up to 5.2 milligrams per liter [mg/L]) was measured at the 80-foot depth interval (as compared to the deeper interval down to 85 feet bgs), suggesting the vertical offset of the influence of the deeper ISCO injection at 85 feet bgs was 10 feet or less at this location.

Therefore, the results of vertical profiling indicate that, for optimal results, the injection interval should be a maximum of 10 feet below the remediation target area. This is likely due to the cone-like diffusion pattern of the injected ozone/ hydrogen peroxide and air.

4.2.8 Ozone/Hydrogen Peroxide Injection Well Details

The peroxone injection wells will be installed in 10-inch diameter soil borings. The wells will be installed with the following components: two hydrogen peroxide and two ozone injection risers, each completed with 0.02-inch, V-slotted, 1 to 3-foot length screens, within 0.5-inch outer diameter (OD) stainless steel tubing, and check valves to prevent backpressure into the injection lines. The ozone and hydrogen peroxide risers and screens for each depth range will be provided in a pre-fabricated assembly. The deeper injection assembly will be installed with the ozone screen down to approximately 95 feet bgs, 5 feet above the bottom of the injection well boring. (Screen placement will depend on location-specific lithology and actual screen intervals may vary from those specified in this report. The final screen intervals are likely to be determined by the field geologist during installation.) A Monterey No. 3 sand filter pack will be placed surrounding the screen to 1.5 feet above the top of the screen. A 2-foot bentonite seal will then be placed above the sand pack surrounding the 1-foot-long ozone screen, to prevent short-circuiting. The 3-foot-long hydrogen peroxide screen will be positioned above the bentonite seal section. Sand pack will then placed surrounding the hydrogen peroxide screen and to a depth of 2 feet above the top of the screen. The borehole will then be sealed with bentonite up to 78 feet bgs, where another injection unit (the shallow injection assembly) will be placed in the borehole and installed as described for the deeper unit. Following installation of the prefabricated assembly and tubing, each borehole will be filled to the top with grout or bentonite and then completed with a protective, lockable access vault.

Following the injection well installations, trenching will be performed, and the conveyance piping/tubing will be installed from the well vaults to the ISCO trailers. Tubing will be used for delivery of ozone and hydrogen peroxide as per manufacturer recommendations. Teflon tubing contained in an outer polyethylene sleeve is commonly used to convey ozone. Polyvinyl chloride (PVC) tubing is used to convey hydrogen peroxide. All tubing from the injection wells to the ISCO trailers will be bundled and contained in 4-inch Schedule 40 PVC piping.

4.2.9 In Situ Ozone and Hydrogen Peroxide Injection

The benefits of ISCO are two fold: apart from destruction of the COCs that come into contact with the injected oxidants, ISCO processes also increase DO levels in the aquifer and have been shown to stimulate in situ biological activity. In some cases, ISCO has been used to oxidize arsenic, which has been detected in the Site vadose zone during past sampling events. Arsenic is less soluble at its highest oxidation state. Thus, use of ISCO may be beneficial in addressing any existing arsenic contamination at the Site.

The ozone/hydrogen peroxide delivery equipment will be provided by a commercial vendor. It will consist of a trailer-mounted chemical oxidation system, which will direct appropriate flow rates of ozone and hydrogen peroxide into peroxone wells fitted with pre-fabricated injection assemblies, as described above. The system is expected to remediate both adsorbed and dissolved-phase organic compounds.

The trailer system will be set up to inject individual or variable combinations of air, oxygen, ozone, and hydrogen peroxide into the saturated zone. ISCO system specifications are determined based on the pilot-scale study results. Each trailer-mounted ozone system will have the capability to deliver up to 130 pounds per day of up to 95% oxygen, which will be sufficient for the ozone generator to produce up to 15 pounds per day of ozone. The system will be designed for ozone injection rates of 2 pounds per day per injection well (or 1 pound per day per injection interval). This rate, when implemented during the last six weeks of the pilot test, showed the highest rate of COC destruction. It is not known whether higher oxidant injection rates would be beneficial; therefore, the design will allow for modification of the ozone injection rate, pending observed system performance.

At the estimated design rate of 2 pounds per day of ozone per injection well, for 15 injection wells, two such systems would be required to provide adequate ozone. A standard chemical feed pump will deliver the hydrogen peroxide from a tank storing approximately 150 gallons of up to 35% strength hydrogen peroxide. An air compressor with a port gas delivery manifold will provide up to 18 scfm of compressed air at 120 pounds per square inch (psi). The trailer-mounted ISCO delivery system will include a 24-port gas/ chemical delivery manifold with 0.25-inch stainless steel solenoid valves for pulsing oxygen, air, ozone, and/or hydrogen peroxide into the injection wells. The injection process will be controlled through an integrated programmable logic controller (PLC) system that controls valve sequencing and activates all audio/visual alarms. A call-out modem will be included for reporting the system operational status.

4.2.10 Downgradient Containment and Treatment System

The presence of a permeable bioremediation barrier in the downgradient area is expected to reduce the required operation time of the downgradient extraction wells (DEW-1 and DEW-2) by as much as 15 years, according to analytical pore modeling results. The VOC concentrations are expected to meet the action levels. Since 1,4-dioxane is not degraded by the bioremediation barrier (as demonstrated in the HRC field-scale study), the current plan is to use an ex situ groundwater treatment unit, employing advanced oxidative treatment, to treat the 1,4-dioxane and residual VOCs, if needed.. However, a final determination as to whether pretreatment of the extracted water prior to discharge will be necessary can only be made when the two groundwater extraction wells (DEW-1 and DEW-2) and the proposed new monitor well are installed and sampled as part of the RA implementation.

To summarize, the current downgradient system design consists of two downgradient extraction wells near McCallum Avenue, the 350-foot permeable bioremediation barrier along Southern Avenue, and the piping from the extraction wells up to the location of the source area extraction well, where the piping will be plumbed into the pipeline that then continues from the source area extraction well to the on-site treatment compound (see Sheets C-1 and C-2 for detail).

4.2.11 Manifold and Piping Design

The manifold and piping design for the groundwater remedy account for these unique systems: a groundwater extraction and two groundwater injection wells located in the source area, two groundwater extraction wells located in the downgradient edge of the groundwater plume, an in situ ozone and hydrogen peroxide injection system, and an ex situ advanced oxidation and GAC system. Each of these systems require special considerations for manifold design, piping material, and conveyance layout.

Both the source area and downgradient groundwater extraction/injection systems will have flow control valves, check valves, flow meters, and a tee which will allow for sampling and flow pressure measurements inside the well vault. The downgradient wells will tie-in underground and flow back towards the treatment system. As the conveyance line flows near the source area extraction system, the flows will combine and be directed back to the ex situ advanced oxidation system in one pipe. As the flow from each well is individually connected, no aboveground manifold will be required. The piping material for these groundwater extraction systems will be high density polyethylene (HDPE). This material is much stronger than PVC, has less friction losses because of fewer fittings required for installation, and can be installed much quicker than a PVC pipeline. The piping diameters will be a minimum of 2 inches and will match the inlet and outlet diameter of the treatment system to avoid any unnecessary contractions which would require a larger pump to overcome the resulting friction losses.

The extracted groundwater will pass through an ex situ treatment system for treatment consisting of an advanced oxidation system and two LGAC vessels. The advanced oxidation system is a self-contained system utilizing hydrogen peroxide and ozone to destroy contaminants. Any manifolds and piping for this system will be provided as an integral piece of the system. However, all equipment downstream of the unit will need to be compatible with ozone and hydrogen peroxide for any residual hydrogen peroxide or ozone not consumed in the advanced oxidation system reactor. Teflon inner tubing contained within a polyethylene sleeve, or other manufacturer-approved material, would be appropriate for ozone conveyance. Chlorinated PVC (CPVC), PVC, or other manufacturer-approved material, would be appropriate for hydrogen peroxide conveyance. The LGAC vessels will not require any manifold other than valves to isolate the vessels for operation and maintenance (O&M) activities. The LGAC vessels will be placed in series and will be connected by hoses to allow for simple O&M, switching of vessels from lead to lag following changeouts of spent carbon, and sample ports to monitor breakthrough at each vessel.

The in situ hydrogen peroxide and ozone system manifold is provided by the manufacturer as part of the complete system. The manifold will be fairly complex, consisting of solenoids or actuated valves controlled by a PLC rotating injection points at pre-set time intervals. The manifold will be located inside the treatment system, typically a panel or trailer. The manifold equipment will comprise of materials compatible with hydrogen peroxide and/or ozone. A PVC conduit will typically be required for these tubing materials for underground installation, as they cannot be direct-buried. The tubing is typically Teflon contained within a polyethylene outer sleeve for ozone, PVC for hydrogen peroxide, and/or other manufacturer-approved materials. The outer sleeves or conduits would be approximately ½-inch to 1-inch in diameter. The riser pipes inside the ozone/peroxide injection wells are typically made of ½-inch stainless steel tubing. All piping sizes and materials will require manufacturer approval.

4.3 PERFORMANCE SAMPLING ASSUMPTIONS

Sampling is required to monitor the performance of the source area treatment system. The following assumptions are made regarding treatment system performance and compliance monitoring.

4.3.1 Performance and Compliance Monitoring

System and well samples will be required during the system startup and routine operation to ensure proper operation of the remediation equipment and to evaluate if cleanup goals have been reached. A detailed summary of a typical sampling schedule is tabulated in Tables 4-1 and 4-2, respectively, for performance monitoring of the well network and the treatment system itself.

The frequency and parameters suggested in Table 4-1 are typical for ISCO/bioremediation/groundwater treatment systems. This table also lists the monitor wells that are likely to require monitoring during the various stages of the RA.

Initially all groundwater monitoring wells will be sampled quarterly. As concentrations decline, the sampling frequency is expected to decline as follows:

- Quarterly – groundwater concentrations greater than cleanup goals;
- Semiannual – groundwater concentrations less than cleanup goals during the previous sample event;
- Annual – groundwater concentrations less than cleanup goals for two consecutive sample events; and
- Confirmation sampling if groundwater concentrations remain less than cleanup goals for three consecutive sample events.

If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

Table 4-2 lists the frequency of monitoring for the groundwater treatment system and extraction and injection wells. As shown in this table, more frequent sampling is expected during the first 4 weeks of operation.

The substantive requirements of the WDR permits and LACSD permit (for downgradient discharge) will determine the actual sampling frequencies, parameters, and analytical methods.

4.3.2 Post-Remediation Confirmation Compliance Monitoring

The RD assumes that the source area ISCO system will operate for approximately 3 years. However, this system may be turned off earlier if RA targets are met ahead of schedule. This shutdown will allow for any potential rebound to occur. During this time, quarterly well sampling events for a period of up to 1 year will confirm if concentrations have rebounded to levels above the RA goals. The confirmation sampling will include at least one sample from the source area extraction well and all monitoring wells within the in situ oxidation area. If results show evidence of rebound, a decision will have to be made to restart oxidation, or to allow the aboveground treatment system to treat the residual source area contamination. If concentrations are still below cleanup levels, the source area treatment system will be recommended for shut down.

Once contaminant concentrations across the Site plume have reached target cleanup levels, the groundwater treatment system will be turned off. This shutdown will allow for any potential rebound in the Gaspur Aquifer to occur. During this time, well sampling events, as listed in Table 4-1, will be conducted for up to 3 years, to confirm whether the site is clean or concentrations have rebounded to levels above the cleanup goals. If results show evidence of rebound the system will be restarted. If concentrations remain below target cleanup levels, the Site will be recommended for closure sampling which would include sampling of every monitor and extraction well.

4.4 TREATMENT SYSTEMS MONITORING

The ISCO and aboveground treatment systems will typically include the following components to promote safe and efficient remediation operations. Actual instrumentation will vary depending on the specific vendor supplying a given system.

- <u>Source Area ISCO System</u>:
  - *Oxygen and Ozone Pressure Gauges* on each vapor inflow line and on the manifold headers.
  - *Ozone Pressure Regulator, Ozone Injector Pressure Gauge, Oxygen Flow Switch, and Lower Explosive Limit (LEL) meter*. Ozone and oxygen pressure monitoring is required to regulate the amount of oxygen (and subsequently ozone) being delivered to the 15 online wells.
  - *Flow Rates* monitored via *flow meters* on each line. If the flow rates fall outside of the operating limits, headers may be blocked or plugged.
  - *Temperature Switches* and *Temperature Gauges* to monitor for safe operation. When temperatures exceed the high-temperature set point, a system shutdown will be triggered.
  - *Pressure Switches* on the inlet and outlet side of the ozone compressor. If pressures fall outside of the operating limits, the structural integrity of the pipe/equipment may be exceeded, triggering a system shutdown.
  - *An Hour Meter* to document system performance. It also will communicate to the controller so that the system can be monitored remotely to verify operation.
  - *Tank Float Switches* in the hydrogen peroxide holding tank and the influent groundwater holding tank to monitor for liquid level. These switches monitor the low level, high level, and high/high level in the tanks. These level controls are used with the controller to call for more flow or to stop the flow from the holding tank.

- <u>Aboveground Groundwater Treatment System</u>:
  - *Advanced Oxidation System*
    - *Ozone Pressure Gauges and Check Valves, Automatic Pressure Control and Shutoff Valve* located on the rack-mounted, solid-state ozone generator and ozone manifold of the Oxygen Generation/Distribution System.
    - *Oxygen Flow Controller, which* is required to regulate the amount of oxygen being delivered to the Advanced Oxidation System.
    - *Tank Float Switches* in the hydrogen peroxide holding tank and ozone holding tank to monitor for liquid level. These switches monitor the low level, high level, and high/high level in the tanks. These level controls are used with the controller to call for more flow or to stop the flow from the holding tank.
    - *Inlet Flow Meter* to monitor flow through the advanced oxidation system.
  - *LGAC Unit*

  - ▪ *Pressure Switches* on the inlet, middle, and outlet groundwater conveyance line of the LGAC Vessels. If pressures fall outside of the operating limits, there may be a blockage in the groundwater line, triggering a system shutdown.
- – *Flow Metes* on the effluent/groundwater re-injection line. If the flow rates fall below the operating limits, may cause cavitation and ruin the groundwater injection pumps, and if above operating limits, water may begin to back-flow, causing a system shutdown.
- – *Flow Meter/Totalizer* at the discharge location to monitor the total volume of groundwater discharged.

Controls associated with the treatment systems are typically installed on the system by the manufacturer as part of a typical controls package. A review of the manufacturer's controls will be conducted to ensure all parameters can be controlled such that the system will operate safely and continuously.

4.5 INSTRUMENTATION

The following instrumentation and process components are typical of what will be available on the groundwater remediation system:

- Source Area ISCO System
  - Pressure gauges for each oxidant injection well on the manifold
  - Ozone/peroxide compressor motor thermal overload switch
  - Pressure and temperature monitors on all oxidant injection well lines
- Advanced Oxidation System
  - Pressure gauges for ozone generation/distribution system on the manifold, and oxygen system
  - Ozone detector and destruct unit
- Groundwater Treatment Compound
  - High- and low-temperature shutoff at the treatment system
  - Flow meters on all liquid conveyance lines
  - Pressure Indicators on groundwater lines before the first LGAC vessel, in between both LGAC vessels, and after the second LGAC Vessel
  - Water flow totalizer and system run clocks
  - Localized control panels and central control panel for the submersible groundwater pumps

The remediation system operators also will have other portable monitoring equipment and tools for proper remote system adjustment and operation.

4.6 ELECTRICAL CONTROLS

Electrical equipment will be designed and selected in accordance with the classification of the various areas of the remediation system. In accordance with the National Electrical Code (NEC), and considering the mixture of vapors the system will handle at the Site, the system is assumed to require Class 1, Division 1, electrical components, especially given that the system will be monitored and managed by operating personnel intermittently (after the initial startup). Class 1, Division 1-specified components are designed to operate in atmospheres with potentially explosive or flammable vapors.

System motors will be specified to be totally enclosed, fan-cooled (TEFC), as well as explosion-proof. The motors also will be rated "T," as defined by the NEC, and comply with the National Fire Protection Association (NFPA) 497M (or latest equivalent) to produce lower temperatures on the external housing, to comply with the Class 1, Division 1, criteria. Other electrical components will be specified to operate under outdoor weather conditions for this area. The electrical panel will include all overcurrent protection devices and motor starters as shown on the electrical design drawings (Sheets E-1, E-2, and E-3 of the design drawing package, which is included as a separate attachment to this report). There will be an emergency shut-off switch inside the compound and a system shut-off button on the supervisory control and data acquisition (SCADA) system. The remediation system will be lighted at night for security and safety.

The SCADA system is the central part of the control and automatic data collection systems. It consists of software systems and algorithms used to provide instructions to the plant automation equipment, such as PLC. The SCADA system will be specifically configured to communicate with each well control panel PLC and the main control panel PLC to provide direct control of the data collection system.

4.7 PROCESS SAFETY CHECKLIST

In addition to the mechanical controls mentioned above, which provide safe operation, the system design requires that the remediation system include the following key process safety features. Additional general O&M guidelines are provided as Appendix H of this report.

- O&M manual(s) for pertinent equipment;
- A clearly marked emergency shut-off switch in the treatment compound area;
- Security fencing and lighting;
- NFPA warning signs and placards on the security fence;
- Emergency contact names and phone numbers on the security fence;
- Spill prevention and containment cabinet;
- First aid kit;
- Clearly marked directional flow arrows on the process piping;
- Fire extinguisher; and
- Other safety components, as required.

A process safety review will be accomplished as an expanded component of the quality assurance (QA) review.

The deliverable product resulting from this effort will be a checklist that demonstrates compliance with ARARs and pertinent codes and standards for the project remediation system. This checklist will be a living document that follows the development of the design to the “final” stage and into system installation. It is currently anticipated that approximately one page of text may be incorporated into the process flow diagram (PFD) to record the revision number, date, and initials of the reviewing engineer.

4.8 DESIGN ASSUMPTIONS FOR GROUNDWATER TREATMENT

All design assumptions for the groundwater RA are shown in Table 4-3.

The overall treatment process, as described in the preceding sections, is a combination of in situ ozone and hydrogen peroxide injection with groundwater extraction/injection in the source area, and in situ bioremediation combined with groundwater plume containment and treatment in the downgradient area. For ease of access, the treatment compound will be located on-site (see Sheet C-1). The same treatment compound will be used to treat groundwater from the perched and Gaspur Aquifers. This compound also will hold the equipment for the soil RA (see Sheets P-2 and S-1 for detailed drawings). The treatment compound will be capable of injecting 30 gallons per minute (gpm) of treated groundwater through the injection wells. It will also be capable of discharging an additional 40 gpm to the sanitary sewer location on site. The total extracted water, estimated at 70 gpm, will comprise of the following: 5 gpm from the perched aquifer via the soil RA, 25 gpm from the source area extraction well, and 40 gpm from the two downgradient extraction well.

4.8.1 Media, Byproducts, and Process Rates

The ISCO in the source area will not produce byproducts. Because of the use of in situ technology, the extracted groundwater is anticipated to have relatively low COC concentrations. The extracted groundwater will be plumbed to the on-site treatment compound and will be treated aboveground via a commercially available advanced oxidation unit and a LGAC unit. The byproducts from the groundwater treatment system will be treated water that meets the discharge requirements and spent liquid-phase granular activated carbon.

The design flow rate of groundwater extracted downgradient of the ISCO barrier is 25 gpm. Another 5 gpm is expected from dewatering of the perched aquifer. The anticipated total flow rate from the downgradient containment system is estimated at 40 gpm. The extracted and treated water will be discharged via two pathways: approximately 30 gpm will be injected into the Gaspur Aquifer upgradient of the ISCO barrier, and the remaining water will be discharged to sanitary sewer under a LACSD permit.

4.8.2 Waste Stream Qualities

Local Sanitary Sewer District

Discharge to the LACSD sanitary sewer has a maximum design rate of 40 gpm. The quality discharge limits for LACSD parameters including flow rates, temperature, pH, total dissolved solids (TDS), select metals, and organics (i.e., VOCs and 1,4-dioxane) will be monitored and controlled carefully. The trench details for sewer discharge sampling box are shown on Sheet C-4 of the design drawings.

Liquid-Phase Granular Activated Carbon

LGAC will be selected, handled and disposed with the assistance of a pre-qualified carbon vendor. The plant operators will supervise the carbon changeouts. After the change-out, the carbon vendor will perform the actual carbon removal and regeneration for future use, or disposal to a licensed landfill.

4.8.3 Performance Standards

Performance standards focus on the following objectives:

- Operator and personnel safety
- Process efficiency and zero health and safety (H&S) or environmental health and safety (EH&S) incidents
- Cost-effectiveness

Remediation system design will incorporate mechanical and electrical safeguards. Operator training, safety consciousness, and experience will be required for safe operation. The remediation system will include design flexibility to maximize process efficiency. Operator training, along with engineering technical services, will be required to meet the second objective of process efficiency with zero H&S incidents. Accomplishing the first two objectives listed above, along with maximizing run time, will help achieve the third objective, cost-effectiveness.

4.8.4 Long-Term Performance Monitoring

The system operators, with the help of the supervising engineers, will monitor long-term system performance. Key parameters, such as contaminant levels, discharge limitations, and system efficiency, will be tracked and monitored. Remedial process optimization (RPO) reviews will be implemented as necessary.

4.8.5 Project Quality Checklist, Pertinent Codes, and Standards

The Project Quality Checklist includes a section on Process Safety, ARARs, Pertinent Codes, and Standards. This checklist is a living document that will follow the development of the design to the “final” stage and into installation. The checklist is currently anticipated to consist of approximately one page of text that may be incorporated into the PFD engineering drawing. It will also record the revision number, date, and reviewing engineer initials.

4.8.6 Other Technical Factors

As other technical factors become apparent regarding the remediation system design or O&M, this RDR will be revised and recorded, as appropriate. Revisions to the RDR and/or engineering drawings must be approved by EPA Region 9.

5.0 CONSTRUCTION AND IMPLEMENTATION

5.1 PLANS

The following plans must be provided before implementation of the RA

The Remedial Action Work Plan (RAWP) identifies construction and implementation issues to be carried out by the remedial action contractor. The RAWP will include a Site Health and Safety Plan (HASP), Sampling and Analysis Plant (SAP), and the Construction Quality Control Plan (CQCP).

A generalized CQCP has been included as Appendix G (Volume II) of the RDR. The RAWP, HASP, and SAP will be prepared by the remedial action contractor. The CQCP is intended to establish project organization and includes requirements for independent evaluation of the construction conformance with the design specifications.

A Construction Completion Report will be prepared by the construction contractor that includes discussion of field design changes, as-builts, quality control results, and health and safety documentation.

A generalized O&M manual for the groundwater treatment system has been included as Appendix H (Volume II) of this RDR, however a more specific O&M manual, which includes system and vendor-specific guidelines must be provided by the construction contractor. The O&M manual will be provided in conjunction with the RAWP. The O&M manual will include: (1) a description of the treatment system operation; (2) a description of potential operating problems and solutions; (3) specifications and maintenance schedules for all equipment.

5.2 DESIGN DRAWINGS

A full set of design drawings are included in this volume of the RDR (Volume I). These design drawings for the RA have been previously referenced in prior sections of this report. Additionally, a full-sized set of drawings are attached.

5.3 SPECIFICATIONS

Complete specifications for the remedial action are provided in Volume III of this RDR and are intended to accompany the Drawings package for use in the field during construction.

5.4 SCHEDULE

A RA schedule also is included in this volume of the RDR (Volume I). The schedule includes both the OU1 groundwater and OU2 soil RA. Because a start date for the RA has not been determined, the schedule is based on days to complete each task following start of construction activities.

5.5 COST ESTIMATE

An RA cost estimate has been prepared based on the RD presented herein and is provided under a separate tab in this volume of the RDR (Volume I). The total estimated capital cost for the groundwater RA is approximately $2,220,000. This estimate assumes that construction of the RA occurs in the first year (i.e., capital costs are not inflated or discounted). The total present worth O&M cost is estimated at $3,810,000. This estimate accounts for inflation, as well as a discount rate of 7%, over the 23-year duration of the project (assuming that only confirmation monitoring will occur during the last 3 years). Based on these estimates of the capital and the present worth O&M costs, the total cost for implementation of the groundwater RA is approximately $6,030,000 in 2007 dollars.

The cost estimate was prepared using prior experience and actual subcontractor bids. The cost estimate is expected to be within plus 15 percent and minus 5 percent.

5.6 CONTRACTOR QUALIFICATIONS

The contractor shall have three to five years experience with soil and groundwater remediation systems, and piping systems. The contractor will be responsible for the quality performance of the work specified and preparation of products and reports as required for completion of installation of systems. The contractor will also manage all solid wastes generated during construction and trenching of the site including sampling and disposal of wastes. The contractor will provide technical and administrative services, monitor, supervise, review work performed, coordinate budgeting and scheduling to assure that the project is completed within budget, on schedule, and in accordance with approved procedures and applicable laws and regulations. All employees or subcontractors performing work on this site will be 40-hour trained under CFR 1910.120 and CCR title 8-5192. The contractor shall be bonded and licensed in the state of California, providing references and descriptions of previous related work. The contractor will identify the potential physical and chemical hazards that may be encountered; and will specify health and safety control measures to be implemented throughout the course of the project.

5.7 COOPER DRUM PROPERTY SITE ACCESS

The area of the Cooper Drum property where remediation equipment will be installed must be vacated and secured during the RA. This will enable safety and prevent exposure to hazardous substances during installation and operation of the remedial systems.

5.8 OFF-SITE EASEMENT AND ACCESS.

Since the Cooper Drum Site is bordered between Coryal Street and Rayo Avenue, with downgradiant extraction wells located on McCallum Avenue and additional monitoring wells to be located between Southern Avenue and McCallum Avenue, it is expected that the contractor will gain required permits, easements, and rights of way to access lands or public areas. The contractor will need to prepare traffic plans, and schedule traffic controls prior to the start of work, taking in consideration delays and restrictions in the work schedule to accommodate possible delays due to weather, traffic, easement and access restrictions.

6.0 ENVIRONMENTAL AND PUBLIC IMPACT REDUCTION PLAN

The overall remediation system will be designed and constructed with the objective of reducing environmental and public impacts. As stated in Section 4.9.3, Performance Standards, system operation objectives will be to achieve the following parameters.

- Operator and personnel safety
- Process efficiency with zero H&S or EH&S incidents
- Cost-effectiveness

These objectives will ensure little or no impact on the environment and the public. In addition, the remediation system will include security, electrical grounding, visual impact reduction, security fencing, and spill containment. Details of these additional environmental and public impact reduction plans follow.

6.1 SECURITY AND FENCING

Security features on the system include automatic alarm settings on the process equipment and corresponding automatic notification to the responsible system operators. In addition, the system will include dusk-to-dawn lighting and automatic electrical shut-offs, in the event vandals tamper with the equipment and cause an auto-trip alarm.

The treatment compound for the aboveground groundwater treatment unit and the soil RA will include 8-foot chain-link fencing with lockable gates for entry and exit and security slats that will block the view of the process equipment to reduce public curiosity (see Sheet C-5 for fence details). Additionally, the entire compound will be surrounded by painted bollards to prevent accidents caused by on-site traffic (see Sheet S-1).

The ISCO trailers will be housed inside an on-Site warehouse along Rayo Avenue, south of the former HWA. Since most of the trailers will be housed indoors, it is unlikely that the system will cause any public safety concerns. Nevertheless, all safety protocols will be in place to minimize risk.

6.2 ELECTRICAL GROUNDING

The remediation system will be designed and installed with electrical grounding to minimize the potential for operator electrocution. Electrical grounding is also required because this system will process impacted groundwater. Noise abatement features will be included on the key pieces of process equipment.

6.3 VISUAL SCREENING

Security fencing will be installed with colored slats in the chain-link for visual screening. This type of fencing is very durable, secure, and suitable for this type of application. The screening should reduce complaints regarding visual concerns from local residents. Additionally, painted (yellow) bollards will surround the treatment compound.

6.4 SPILL CONTAINMENT

The remediation system will be constructed with spill containment features. The containment sump will include a sump pump and an alarm feature that will be tied into an automatic interlock for system shutdown.

7.0 REFERENCES

PRIMA Environmental, 2005. *ISCO Using Ozone and Hydrogen Peroxide – Bench-Scale Study*.

United States Environmental Protection Agency (EPA), 2002. *Record of Decision, Cooper Drum Company, City of Southgate, California*.

URS Group, Inc. (URS), 2002. *Cooper Drum Remedial Investigation Feasibility Study Report*.

URS, 2005. *Final Results of HRC Field Pilot Study*. April.

URS, 2006a. *Remedial Design Technical Memorandum for Field Sampling Results*. July.

URS, 2006b. *Field Pilot Study of ISCO Using Ozone and Hydrogen Peroxide*. December.

URS, 2007a. *Soil Remedial Design Report Operable Unit 2 Cooper Drum Superfund Site*. September.

URS, 2007b. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 2 CPT/HydroPunch Sampling Results February/March 2007.* June.

URS, 2007c. *Remedial Design Technical Memorandum for Field Sampling Results, Addendum No. 1 Groundwater Monitoring Report August 2006.* March.

URS, 2007d. *OU1 Groundwater Remedy Conceptual Design, Cooper Drum Company Site, South Gate, CA.* May.

TABLES

TABLE 2-1

Groundwater Contaminants of Concern and Cleanup Levels
Cooper Drum Company Superfund Site, South Gate, CA

Medium	Contaminant of Concern	Cleanup Level (µg/L)	Basis for Cleanup Level
Groundwater (VOCs)	1,1-Dichloroethane (1,1-DCA)	5	MCL[a]
	1,1-Dichloroethene (1,1-DCE)	6	MCL
	1,2-Dichloroethane (1,2-DCA)	0.5	MCL
	1,2-Dichloropropane (1,2-DCP)	5	MCL
	1,2,3-Trichloropropane (1,2,3-TCP)	1	PQL[b]
	Benzene	1.0	MCL
	cis-1,2-Dichloroethene (cis-1,2-DCE)	6	MCL
	trans-1,2-Dichloroethene (trans-1,2-DCE)	10	MCL
	Tetrachloroethene (PCE)	5	MCL
	Trichloroethene (TCE)	5	MCL
	Vinyl chloride	0.5	MCL
Groundwater (SVOC)	1,4-Dioxane	6.1	PRG[c,d]

[a] MCLs from Title 22 California Code of Regulation Section 64431 and 64444, unless otherwise specified.
[b] No MCL established for 1,2,3-trichloropropane. The PQL was identified as a remedial goal.
[c] No MCL established for 1,4-dioxane. The concentration is for the ingestion of drinking water only and does not account for potential dermal and inhalation exposure. EPA has established a screening criterion for PRGs.
[d] Cleanup action level will be reassessed and any revisions will be incorporated into the remedial action.

EPA = United States Environmental Protection Agency
MCL = California primary maximum contaminant level
PQL = practical quantification limit
PRG = EPA preliminary remediation goal for drinking water
SVOC = semivolatile organic compound
VOC = volatile organic compound
µg/L = micrograms per liter

TABLE 4-1

Monitor Well Sampling Summary
Sampling Summary for OU1 Groundwater Monitor Well Programs

Program	Number of Wells	Monitor Well Location	Sample Frequency
ISCO Waste Discharge Requirements Permit[a]	10 monitor wells[b]	MW-2, EW-1 (63' & 85') EW-2 (63'&78'), MW-20, MW-20B, MW-21, MW-33A, MW-33B, MW-39A, MW-39B	Baseline and monthly for 6 months, quarterly for remaining 2.5 years
Bioremediation Permeable Barrier Waste Discharge Requirements Permit[c]	10 monitor wells[d]	MW-24, MW-25, MW-25B, MW-27, MW-28, MW-29, MW-30, MW31, MW-31B, MW-38A	Quarterly for 5 years
Long Term Performance Monitoring[e]	24 monitor wells quarterly; 8 wells annually	24 quarterly wells-EW-1, EW-2, MW-10, MW-15, MW-17 MW-20, MW-20B, MW-21, MW-22, MW-23, MW-24, MW-27, MW-28, MW-29, MW-30, MW-31, MW-31B, MW-34A, MW-34B, MW35A, MW-35B, MW36A, MW-36B,MW-39A; 8 annual wells MW-2, MW-3, MW-16, MW-18, MW-19, MW-26, MW-32, MW-33A	Quarterly/Semiannually/ Annually (up to 23 years or less)[f]

[a] Per Los Angeles Regional Water Quality Control Board (LARWQCB) Wastewater Discharge Requirements (WDR) permit analyzed quarterly for VOCs, 1,4-dioxane, chloride, nitrate, sulfate, bromide, alkalinity, TSS, TDS, TOC, cations, hexavalent chromium, priority pollutant metals. VOCs and 1,4 dioxane only for more frequent than quarterly sampling. Cations include barium, boron, calcium, iron, magnesium, manganese, potassium, and sodium. Priority pollutant metals and hexavalent chromium will be analyzed during the initial sampling round and annually thereafter. All sampling events will include field parameters (ferrous iron, pH, DO, ORP, temperature, turbidity, and conductivity).

[b] After three years some wells EW-1, EW-2, MW-20, MW-20B, MW-21, MW-39A will continue to be sampled under long term performance monitoring.

[c] Per LARWQCB permit analyzed quarterly for VOCs; 1,4-dioxane; chloride; nitrate; sulfate; bromide; alkalinity; TDS; TOC; sulfide; ethane/ methane; $CO_{2;}$ VFAs (volatile fatty acids, not required by WDR); and cations (include calcium, iron, magnesium, manganese, potassium, and sodium); plus field parameters (see No. 1 above).

[d] After five years it is anticipated that only six wells (to be determined) will continue to be sampled under long term performance monitoring.

[e] Wells will be analyzed quarterly for VOCs; semiannually for 1,4-dioxane. Analysis for MNA parameters will be performed during the annual sampling event, and will include alkalinity chloride, nitrate, sulfate, sulfide, ethene/ethane/methane, and field parameters (see No.1 above).

[f] Initially all groundwater monitoring wells will be sampled quarterly. As concentrations decline, the sampling frequency shall decline as follows:

- Quarterly – groundwater concentration greater than cleanup goals;
- Semiannual – groundwater concentrations less than cleanup goals during the previous sample event; or
- Annual – groundwater concentrations less than cleanup goal for two consecutive sample events.
- Stop sampling a well, until confirmation sampling, if groundwater concentrations less than cleanup goal for three consecutive sample events.
- If concentrations increase above cleanup goals at any time, the well shall resume the quarterly sampling frequency and follow the process listed above.

TABLE 4-2

Treatment System Sampling Summary
Sampling Summary for OU1 Groundwater Extraction and Treatment System Sampling

Program	Sample Location	Sample Frequency	
		Initial Operations[a]	Long-Term Operations
Source area Extraction Well and Injection wells[b]	SEW-1, IW-1, IW-2	Weekly	Quarterly for 3 years
Downgradient Containment Extraction Wells[c]	DEW-1 and DEW-2	Weekly	Quarterly for 20 years
Treatment System[d]	Influent and effluent; and intermediate locations	Weekly	Monthly for 20 years
Treatment System POTW[e]	Effluent to POTW[c,e]	N/A	Bi-monthly

[a] Initial operations typically last one to four weeks. During this time, the remediation process is being fine tuned to operate at maximum efficiency given the Site conditions.

[b] It is assumed that only one WDR permit will be required for the ISCO and groundwater injection wells (see Table 4-1). Injection wells and extraction wells will be sampled for the same parameters under the WDR permit for ISCO (see Table 4-1, footnote #1).

[c] Extraction wells will be sampled for the same parameters under the LARWQCB WDR permit for the bioremediation barrier (see Table 4-1, footnote #3).

[d] Treatment system influent and effluent analyzed for VOCs and 1,4-dioxane only. Two intermediate sample locations (prior to LGAC and between LGAC vessels) will be analyzed monthly for VOCs only.

[e] Per the Los Angeles County Sanitation District (LASCD), self-monitoring at the location of the discharge to the sewer lateral will be required as a permit condition. It is expected the permit requirement will require semimonthly sampling for chemical oxygen demand (COD) and suspend solids (SS), and quarterly for VOCs.

N/A = not applicable

TABLE 4-3

Design Assumptions for OU 1 (Groundwater Remedial Action)

Contaminants of Concern (COC): 1,2,3-TCP; TCE; 1,2-DCA; vinyl chloride; 1,2-DCP; 1,1-DCA; cis-1,2-DCE; PCE; trans-1,2-DCE; 1,1-DCE; benzene; and 1,4-dioxane.
Contaminant source area (i.e., 100 ppb plume) delineated during previous site investigations.
Site consists largely of sandy silts, silty sands, sand interspersed with minor layers of silts and clay.
Remedial Action includes installation of the following key elements.
Ozone/Hydrogen Peroxide (Peroxone) Injection Wells: – Number: 12 new and 3 existing wells. – Location: To be installed in the source area (i.e., 100 ppb plume) to form a double “V” shaped pattern in conjunction with the three existing peroxone injection wells. – Well design: Pre-fabricated injection assemblies, each completed with 1-inch outer diameter (OD) casing, 0.02-inch, V-slotted screens, 0.5-inch OD tubing, and check valves. – Total well depth: 100 ft bgs. – Injection intervals: 2 per location at 75 and 95 ft bgs (approximately). – Injection depth: 10 ft below the target groundwater contamination. – Radius of influence: 25 ft (minimum). – Oxidant: Ozone and hydrogen peroxide. – Ozone injection rate: Up do 2 lbs/day per injection well (<1.0 molar ratio of H_20_2/O_3). – System design treatment concentration: > 50 µg/L.
Ozone/Hydrogen Peroxide Conduits: – 1-1/2” diameter PVC Schedule 40 conduit to contain 1 each 3/8” Teflon tubing and 1/4” polyethylene tubing. Notes: Teflon tubing for ozone; polyethylene tubing for hydrogen peroxide
In Situ Chemical Oxidation (ISCO) Trailers: – Number: 2 – Size: Approximately 21′ × 7′ – Location: Inside warehouse on site – Components: ▪ ozone generation system—up to 15 lbs/day ▪ oxygen generation system—up to 130 lbs/day (up to 95% concentration) ▪ reagent distribution capacity—up to 10 ozone and 10 hydrogen peroxide injection points ▪ hydrogen peroxide system—150-gal tank (up to 35% solution) 75 gal/day at 25 psig injection capacity ▪ compressed air system—up to 120 psig pressure, up to 18 scfm injection capacity
Permeable Bioremediation Barrier: – Reductive dechlorination enhancing substrate. – Number injection points: 180. – Location: To be installed downgradient of the source area, along Southern Avenue. – Length of barrier: 350 ft. – Total boring depth: 100 ft bgs. – Injection intervals: 80 to 100 ft bgs. – Injection depth: 100 ft bgs (approximately).
Groundwater Extraction Wells: – Number: 3. – Location: One well to be installed downgradient of the source area to address groundwater containing contaminants at concentrations less than the ISCO design concentration (i.e., 50 µg/L) but greater than cleanup goals. Two wells to be installed downgradient near the 5 ppb plume boundary to contain the contaminant plume. – Total well depth: 105 ft bgs (for source area well); 115 ft bgs (for downgradient extraction wells). – Screen depth: 60 to 100 ft bgs for source area wells; 65 to 112 ft bgs for downgradient wells. – Extraction Rate: 25 gpm for source area; 20 gpm each for downgradient wells.

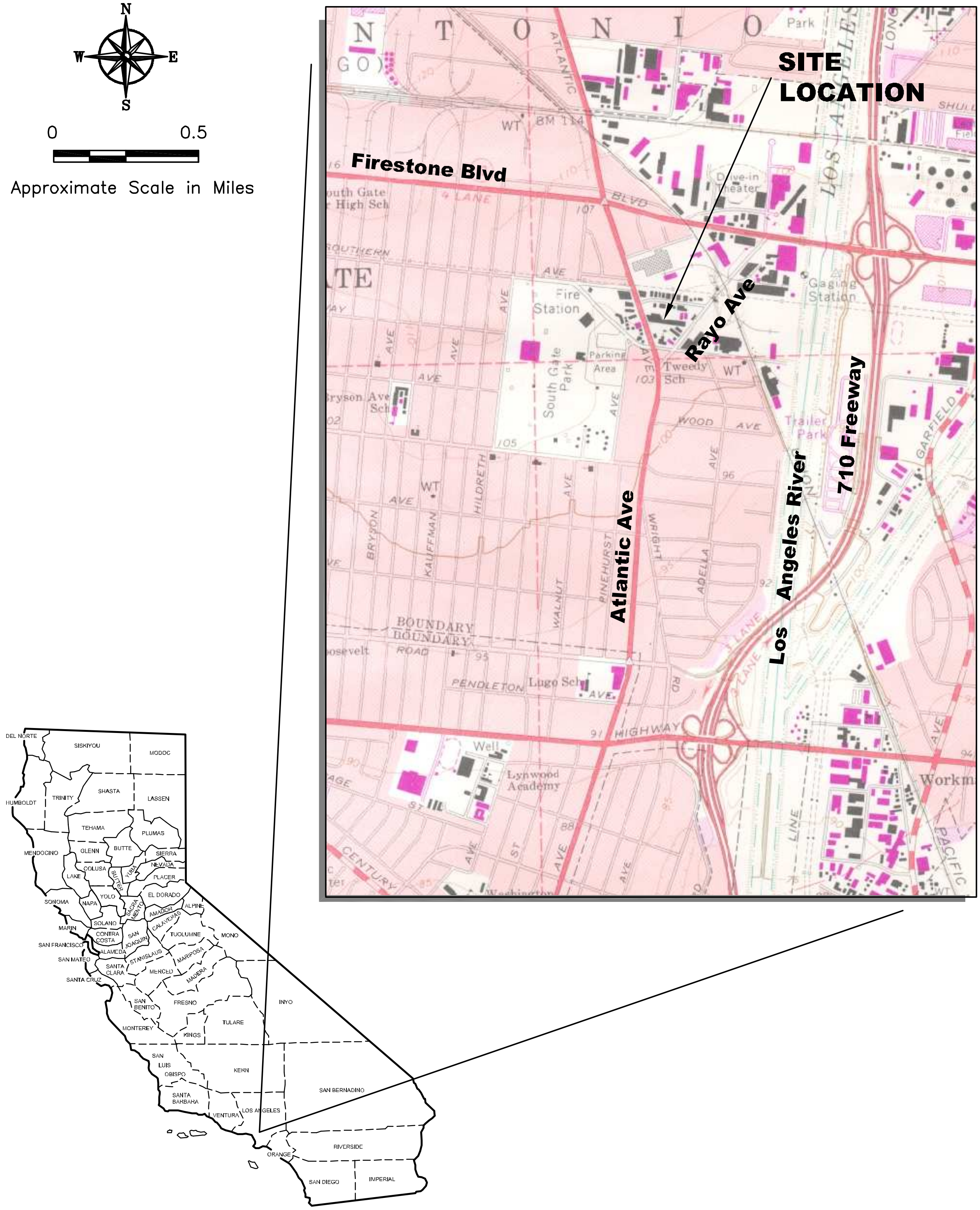
TABLE 4-3

(Continued)

Groundwater Injection Wells: – Number: 2. – Location: To be installed upgradient of the Peroxone Injection Well field. – Total well depth: 90 ft bgs. – Injection depth: 55 to 85 ft. – Groundwater injection rate: 15 gpm each.
Groundwater Extraction and Injection Well Piping: – Piping diameter: 2" HDPE SDR-11. – Length of pipe: Approximately 1,800′ (extraction wells) and 600′ (injection wells). – Buried at a depth of 2′ in sand layer, with magnetic tape.
Groundwater Treatment System: – Location: On site, next to warehouse. – Components: (a) Ex situ advanced oxidation process (also to be used for cleanup of perched aquifer groundwater as part of soil remedial action) and (b) two liquid-phase granular activated carbon (LGAC) vessels. – Compound dimensions: 32′ × 40′, 6" thick concrete slab with 6" berm, chain-link fence all around with one man-gate and one equipment gate. – Treatment water: All extraction wells and 5 gpm of perched aquifer. – Fate of treated water: Groundwater injection wells (as discussed above) and release to on-site sanitary sewer location under a LACSD permit. – Water treatment rate: 70 gpm (including 2 downgradient wells, 1 source area extraction well, and 5 gpm for perched aquifer).

bgs = below ground surface
COC = constituent of concern
ft = feet
gpm = gallons per minute
HRC = hydrogen release compound
ISCO = in-situ chemical oxidation
LACSD = Los Angeles County Sanitation District
lbs = pounds
LGAC = liquid granular activated carbon
OD = outer diameter
OU = operable unit
ppb = parts per billion
psig = pounds per square inch gauge
PVC = polyvinyl chloride
scfm = standard cubic feet per minute
μg/L = micrograms per liter

FIGURES



Cooper Drum Superfund Site South Gate, CA	Figure 1-1 Site Location Map

URS
2870 GATEWAY OAKS DRIVE, SUITE 300
SACRAMENTO, CA 95833

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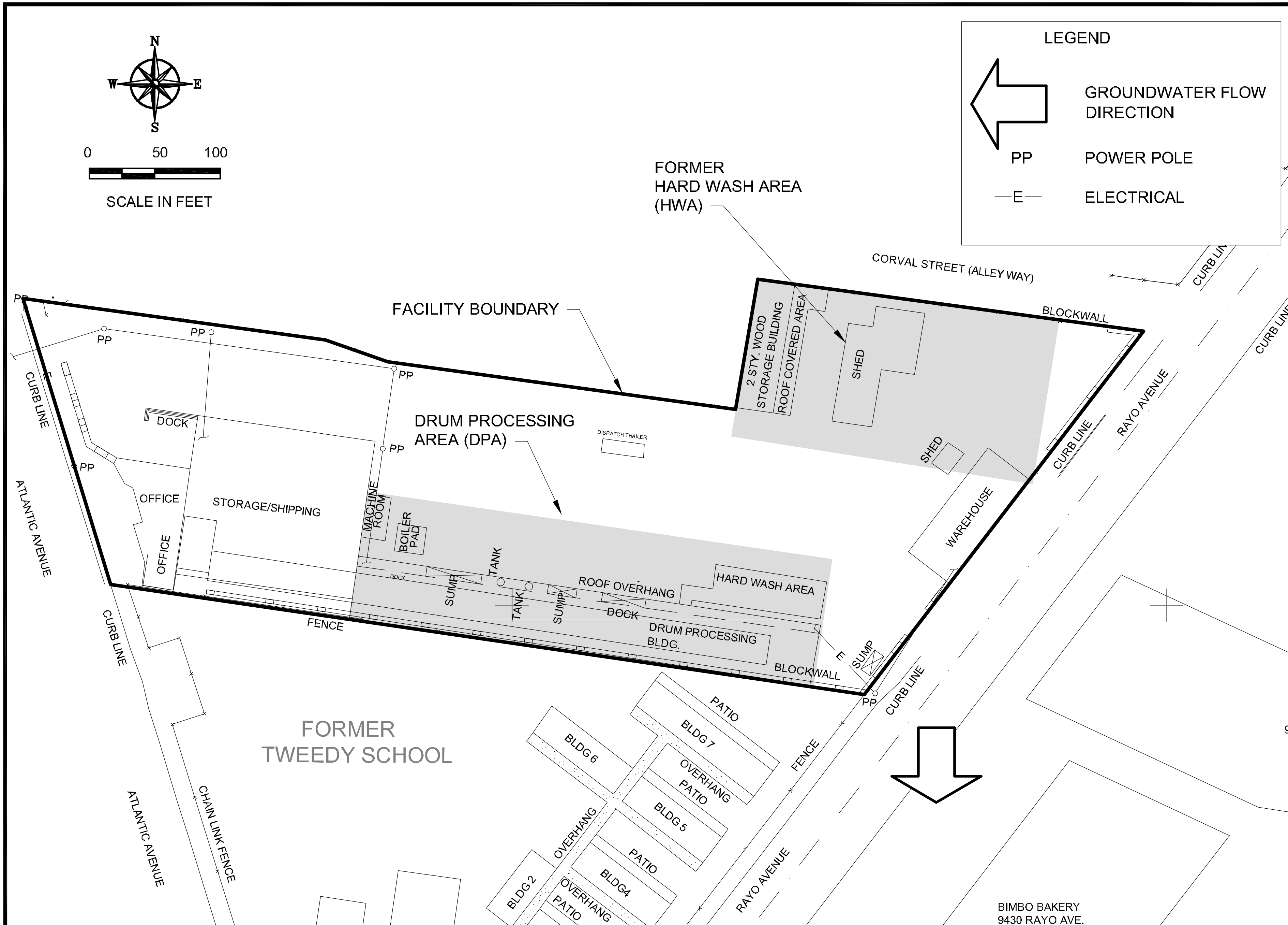

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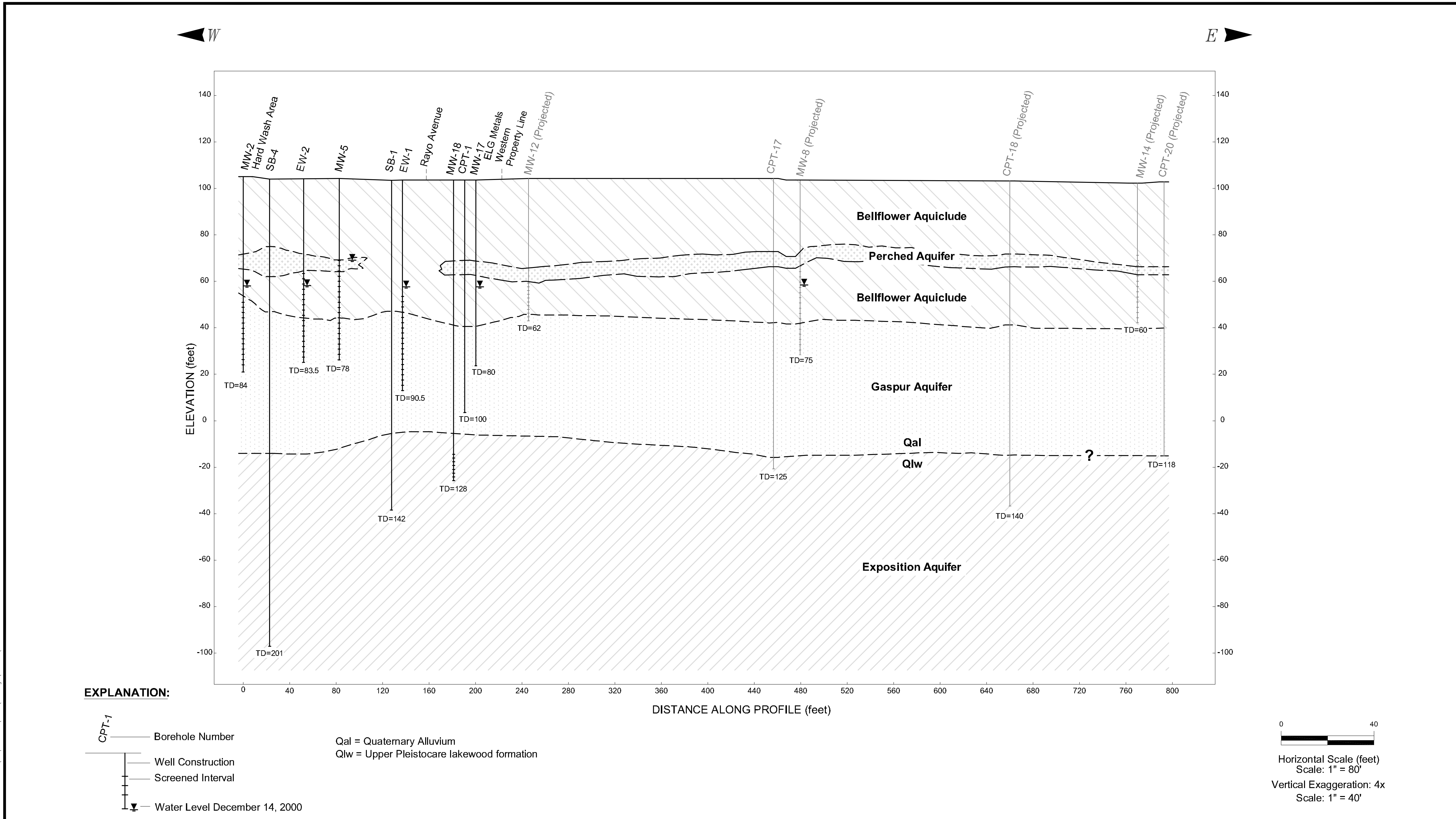
2870 GATEWAY OAKS DRIVE, SUITE 300
SACRAMENTO, CA 95833

Cooper Drum Superfund Site
South Gate, CA

Figure 1-2
Site Layout Map



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Generalized Geologic Cross Section

Figure 2-1

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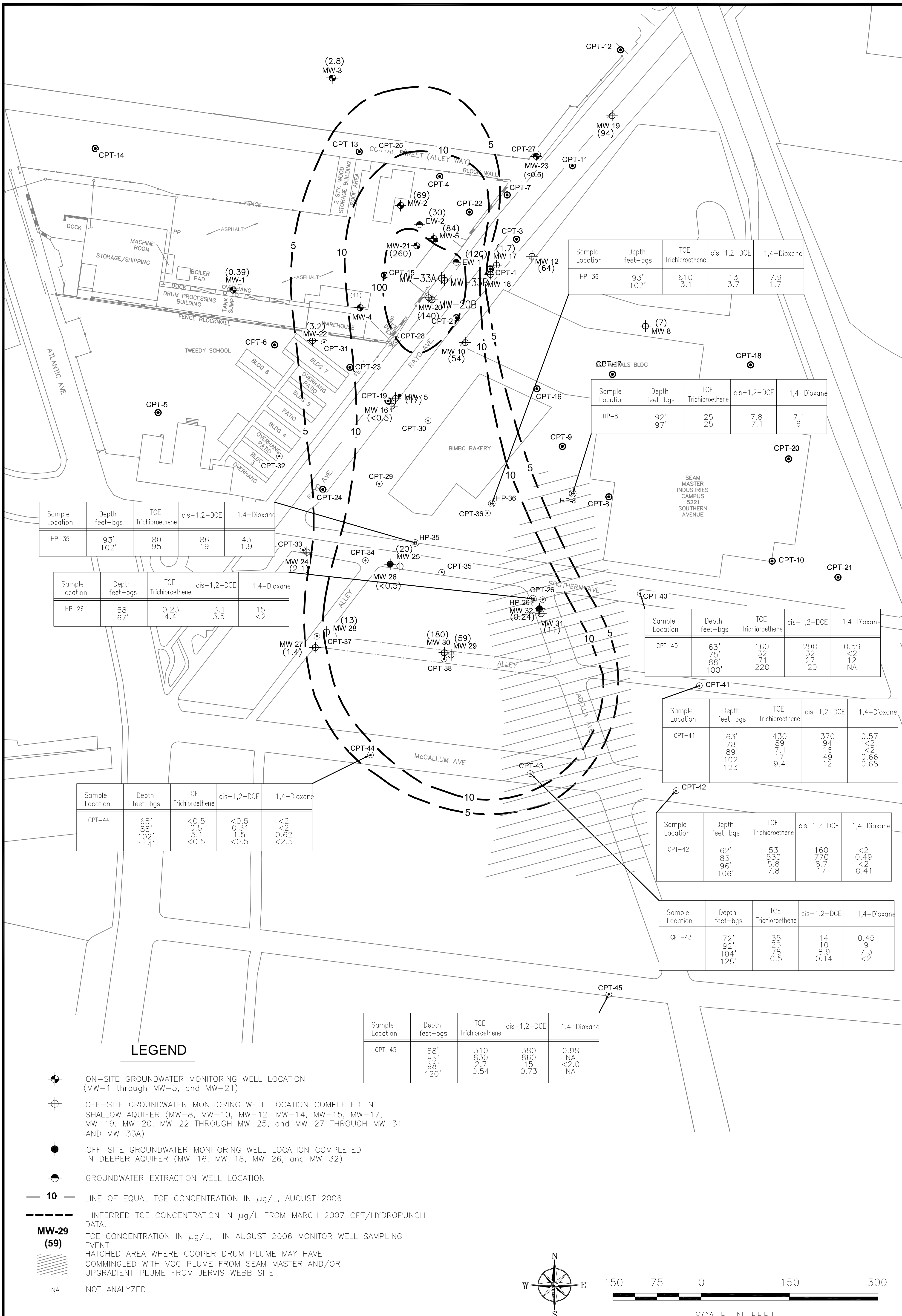

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
HP-36	93'	610	13	7.9
	102'	3.1	3.7	1.7

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
HP-8	92'	25	7.8	7.1
	97'	25	7.1	6

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
HP-35	93'	80	86	43
	102'	95	19	1.9

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
HP-26	58'	0.23	3.1	15
	67'	4.4	3.5	<2

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-40	63'	160	290	0.59
	75'	32	32	<2
	88'	71	27	12
	100'	220	120	NA

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-41	63'	430	370	0.57
	78'	89	94	<2
	89'	7.1	16	<2
	102'	17	49	0.66
	123'	9.4	12	0.68

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-44	65'	<0.5	<0.5	<2
	88'	0.5	0.31	<2
	102'	5.1	1.5	0.62
	114'	<0.5	<0.5	<2.5

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-42	62'	53	160	<2
	83'	530	770	0.49
	96'	5.8	8.7	<2
	106'	7.8	17	0.41

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-43	72'	35	14	0.45
	92'	23	10	9
	104'	78	8.9	7.3
	128'	0.5	0.14	<2

Sample Location	Depth feet-bgs	TCE Trichloroethene	cis-1,2-DCE	1,4-Dioxane
CPT-45	68'	310	380	0.98
	85'	830	860	NA
	98'	2.7	15	<2.0
	120'	0.54	0.73	NA

LEGEND

- ON-SITE GROUNDWATER MONITORING WELL LOCATION (MW-1 through MW-5, and MW-21)
- OFF-SITE GROUNDWATER MONITORING WELL LOCATION COMPLETED IN SHALLOW AQUIFER (MW-8, MW-10, MW-12, MW-14, MW-15, MW-17, MW-19, MW-20, MW-22 THROUGH MW-25, and MW-27 THROUGH MW-31 AND MW-33A)
- OFF-SITE GROUNDWATER MONITORING WELL LOCATION COMPLETED IN DEEPER AQUIFER (MW-16, MW-18, MW-26, and MW-32)
- GROUNDWATER EXTRACTION WELL LOCATION
- — 10 — LINE OF EQUAL TCE CONCENTRATION IN µg/L, AUGUST 2006
- – – – – INFERRED TCE CONCENTRATION IN µg/L FROM MARCH 2007 CPT/HYDROPUNCH DATA.
- MW-29 (59) TCE CONCENTRATION IN µg/L, IN AUGUST 2006 MONITOR WELL SAMPLING EVENT
- HATCHED AREA WHERE COOPER DRUM PLUME MAY HAVE COMMINGLED WITH VOC PLUME FROM SEAM MASTER AND/OR UPGRADIENT PLUME FROM JERVIS WEBB SITE.
- NA NOT ANALYZED

N W E S

150 75 0 150 300
SCALE IN FEET

URS
2870 Gateway Oaks Dr., Ste. 150
Sacramento, CA 95833-3200
TEL: (916) 679-2000
FAX: (916) 679-2900

Cooper Drum Company
South Gate, California

FIGURE 2-2
EXISTING WELL LOCATIONS AND 2007 CPT HYDROPUNCH RESULTS

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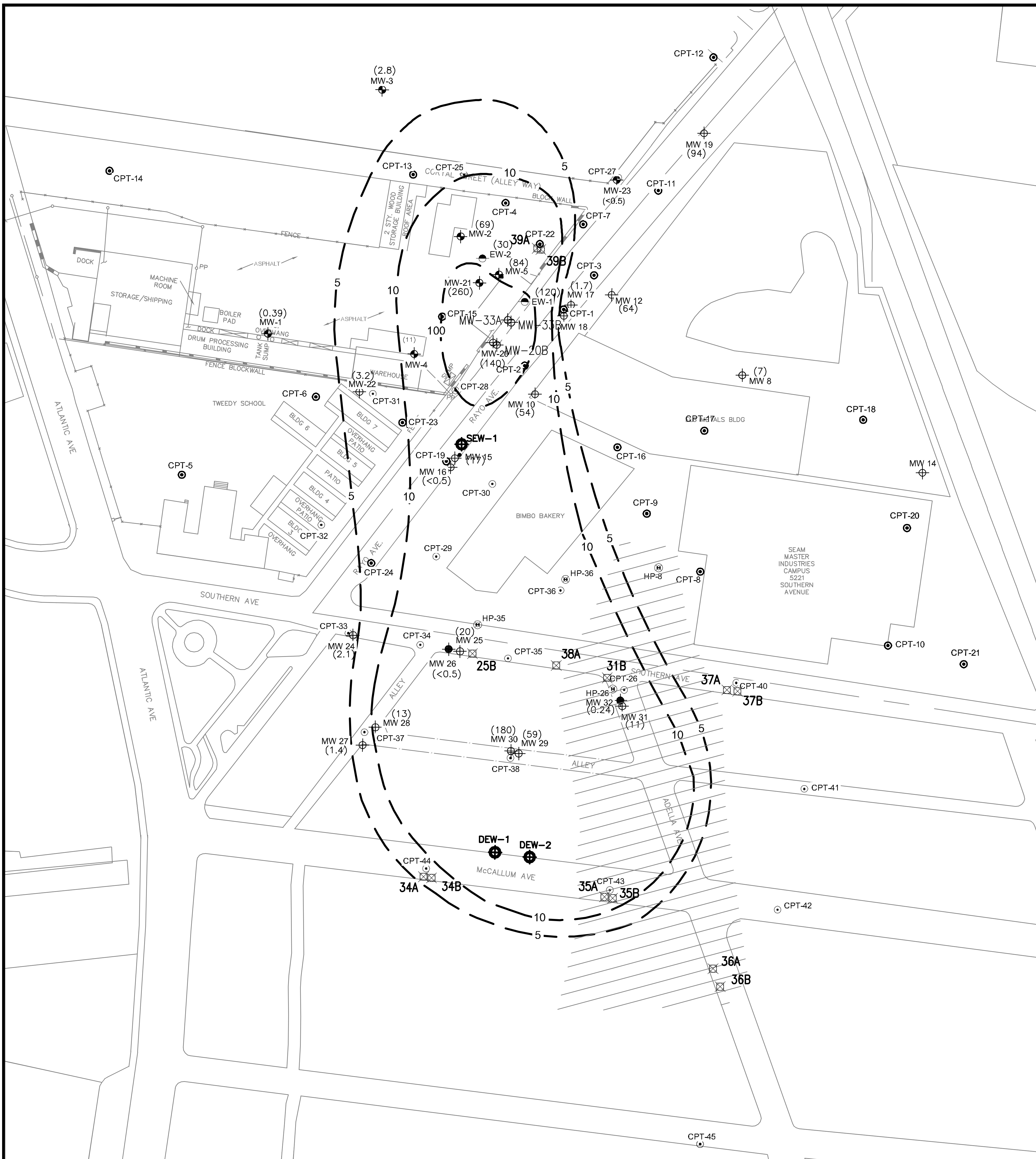

LEGEND

- ON-SITE GROUNDWATER MONITORING WELL LOCATION (MW-1 through MW-5, and MW-21)
- OFF-SITE GROUNDWATER MONITORING WELL LOCATION COMPLETED IN SHALLOW AQUIFER (MW-8, MW-10, MW-12, MW-14, MW-15, MW-17, MW-19, MW-20, MW-22 THROUGH MW-25, and MW-27 THROUGH MW-31 AND MW-33A)
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- — 10 — LINE OF EQUAL TCE CONCENTRATION IN μg/L, AUGUST 2006
- — — — INFERRED TCE CONCENTRATION IN μg/L FROM MARCH 2007 CPT/HYDROPUNCH DATA.
- MW-29 (59) TCE CONCENTRATION IN μg/L, IN AUGUST 2006 MONITOR WELL SAMPLING EVENT
- HATCHED AREA WHERE COOPER DRUM PLUME MAY HAVE COMMINGLED WITH VOC PLUME FROM SEAM MASTER AND/OR UPGRADIENT PLUME FROM JERVIS WEBB SITE.
- NA NOT ANALYZED
- 36A PROPOSED WELL LOCATIONS FOR REMEDIAL ACTION
- DEW-1 PROPOSED EXTRACTION WELL LOCATIONS FOR REMEDIAL ACTION.

N W E S

150 75 0 150 300

SCALE IN FEET

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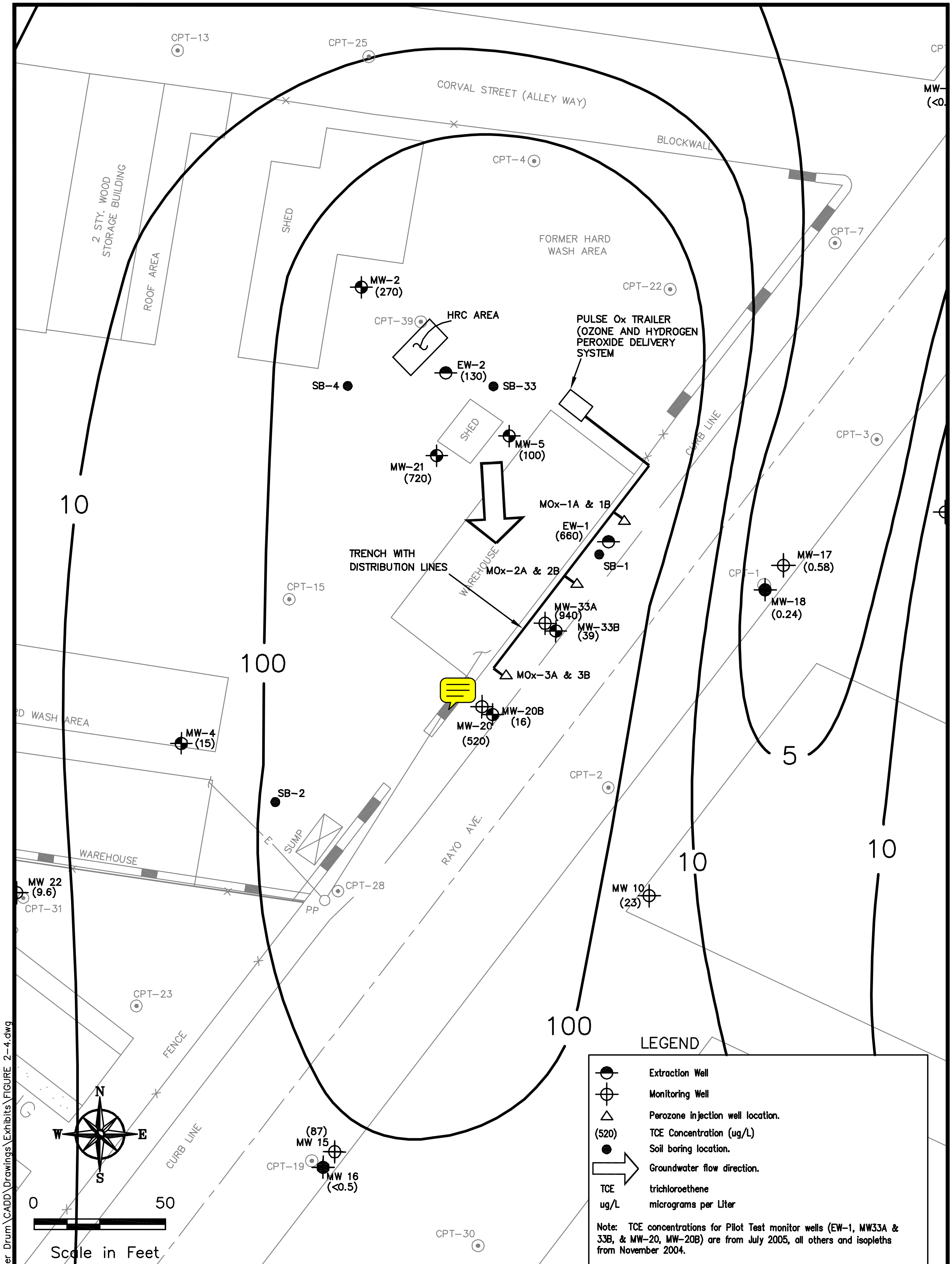
Cooper Drum Company
South Gate, California

FIGURE 2-3
PROPOSED MONITOR WELL AND EXTRACTION WELL LOCATIONS FOR REMEDIAL ACTION



URS
2870 GATEWAY OAKS DRIVE, SUITE 300
SACRAMENTO, CA 95833

Cooper Drum Superfund Site
South Gate, CA

Figure 2-4
ISCO Field Pilot Test Layout w/ Baseline (November 2004) TCE Concentrations

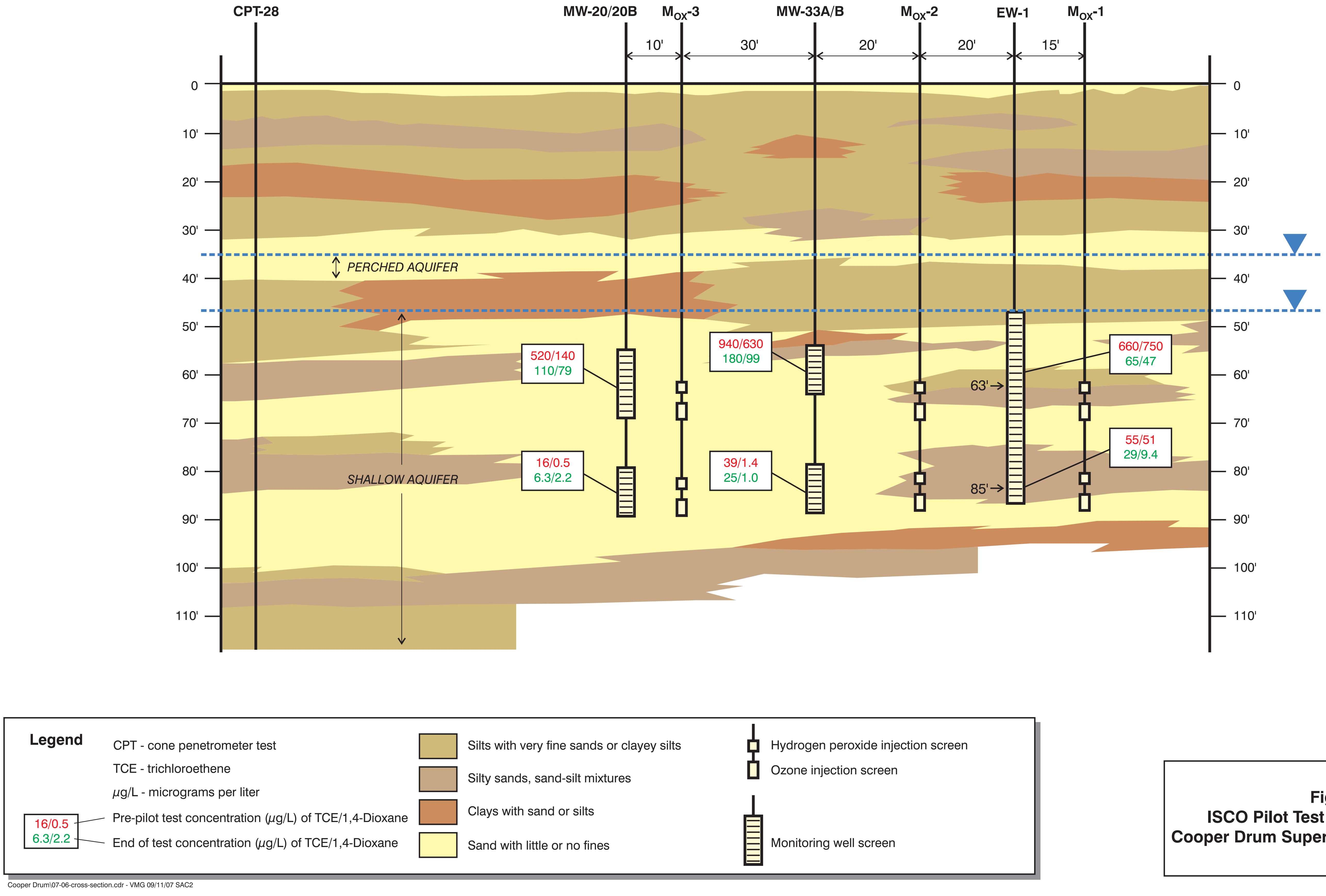
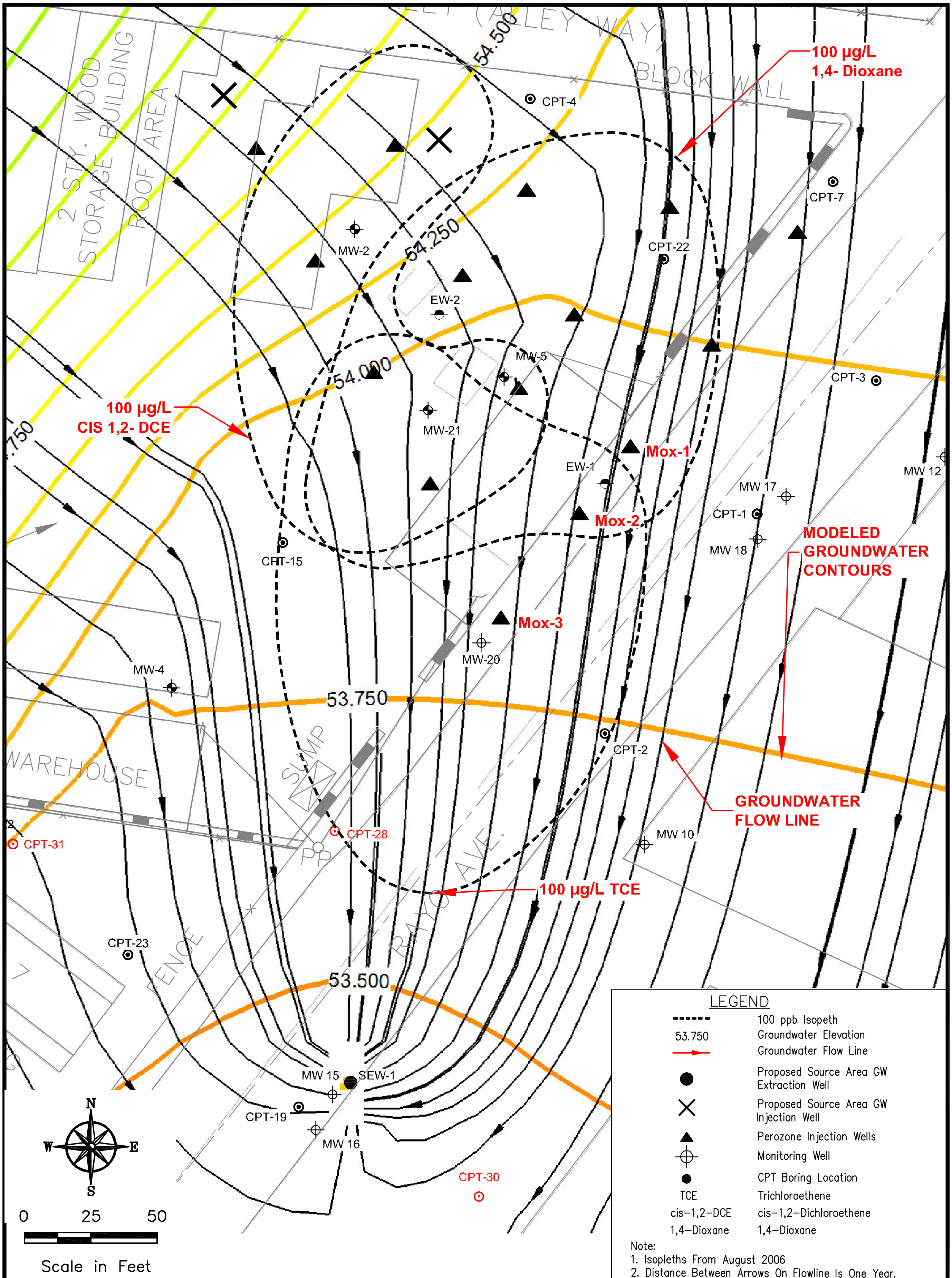


Figure 2-5
ISCO Pilot Test Injection Well Layout
Cooper Drum Superfund Site, South Gate, CA

PLOT BY: DAVID_LARSON - Sep 13, 2007 - 3:04:50pm

XREFS: J:\Cooper Drum\CADD\Drawings\XR-NEW-BACKGRD2.dwg J:\Cooper Drum\CADD\Drawings\xref_base.dwg

IMAGES: Figure 6.jpg Figure-6.jpg



URS
2870 GATEWAY OAKS DRIVE, SUITE 150
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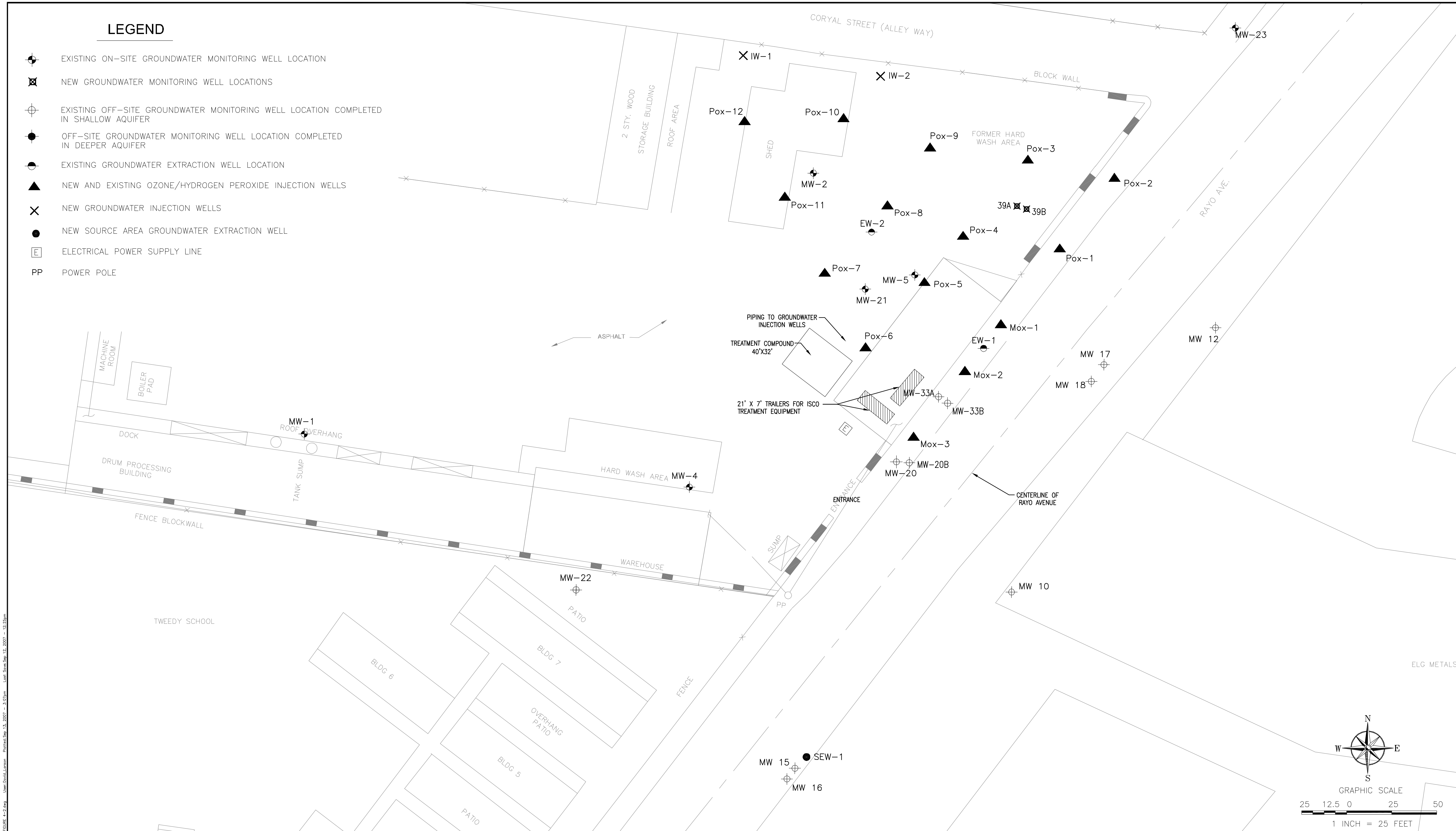
Cooper Drum Superfund Site
South Gate, CA

Figure 4-1
SOURCE AREA REMEDIATION SYSTEM
15 PEROZONE INJECTION WELLS WITH A SINGLE
GROUNDWATER EXTRACTION WELL PUMPING AT 25 GPM

DRAWING: FIGURE 4-1.dwg

DRAWING: J:\Cooper Drum\CADD\Drawings\Exhibits\



NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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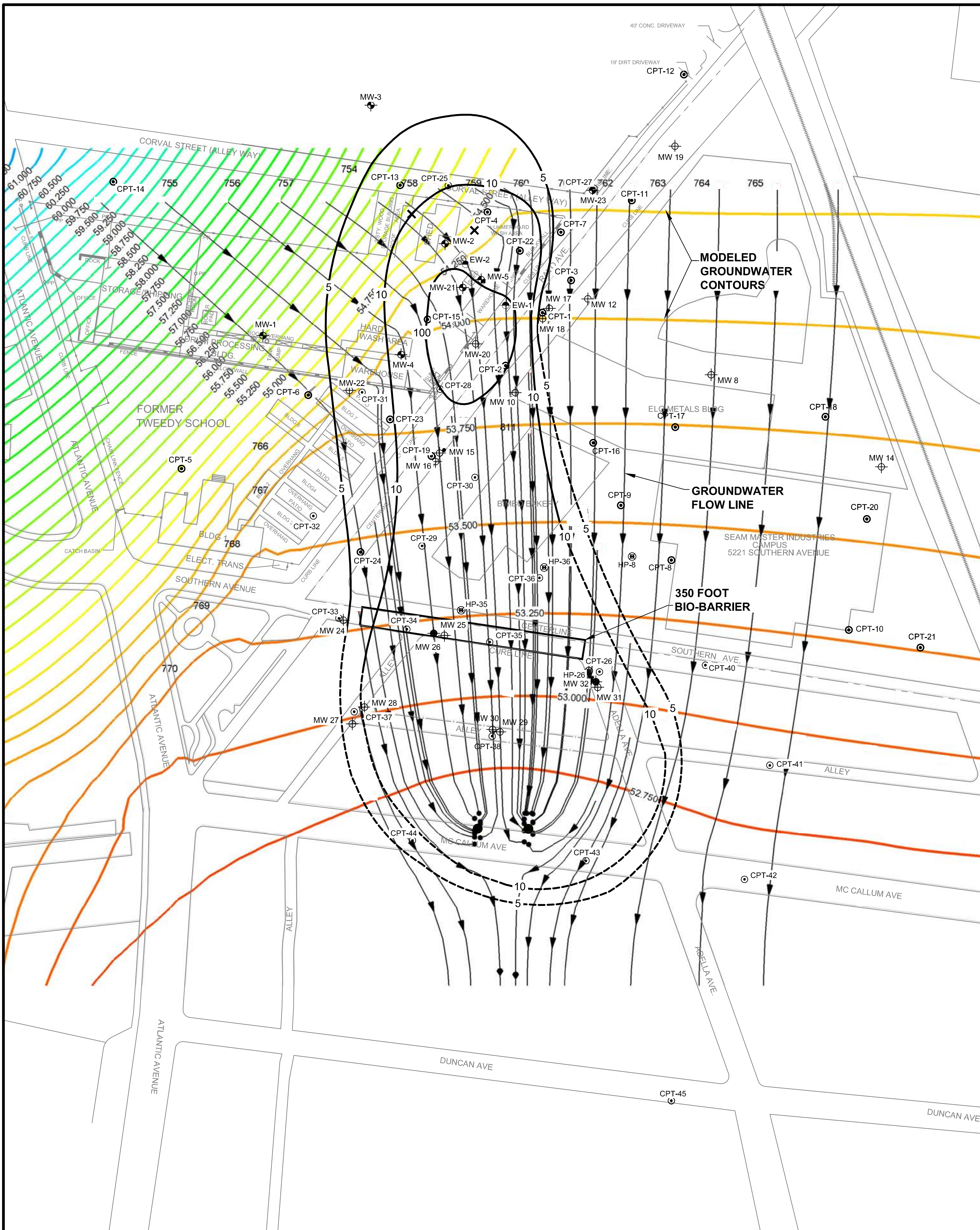
OU1 SOURCE AREA REMEDIATION SYSTEM MAP

SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=25'-0"	8/23/2007	FIGURE 4-2.dwg	**FIGURE 4-2**

DRAWING: Don-071907-FIG-3-3-DWN-GRD-CONT.dwg
DRAWING: C:\Documents and Settings\rptaylor\Desktop\
XREFS: C:\Documents and Settings\rptaylor\Desktop\NEW-BACKGRD2.dwg
PLOT BY: ROBERT_P_TAYLOR - Sep 12, 2007 - 3:16:23pm
IMAGES: Figure 9.jpg



LEGEND

- - - -	100 ppb Isopeth
–56.75–	Groundwater Elevation
—►—	Groundwater Flow Line
●	Proposed Downgradient Groundwater Extraction Well
✕	Proposed Source Area Groundwater Injection Well
⊕	Monitoring Well
⦿	CPT Boring Location
TCE	Trichloroethene
cis–1,2–DCE	cis–1,2–Dichloroethene
1,4–Dioxane	1,4–Dioxane

Note:
1. Isopleths From August 2006 and 2007 CPT investigation.
2. Distance Between Arrows On Flowline Is One Year.

150 75 0 150 300
SCALE IN FEET

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South Gate, CA

Figure 4-3
DOWNGRADIENT CONTAINMENT REMEDATION SYSTEM
TWO GROUNDWATER EXTRACTION WELLS (20 gpm each)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX

GROUNDWATER REMEDIAL DESIGN

OPERABLE UNIT 1
COOPER DRUM COMPANY SUPERFUND SITE

PREPARED BY
URS GROUP, INC.

SEPTEMBER 2007

VICINITY MAP

LOCATION MAP

N
W E
S

SHEET INDEX

G–1	TITLE SHEET
G–2	SITE LOCATION MAP, SHEET INDEX, AND GENERAL NOTES
P–1	OZONE/HYDROGEN PEROXIDE INJECTION SYSTEM SIMPLIFIED PROCESS FLOW DIAGRAM
P–2	SIMPLIFIED GROUNDWATER AND SOIL GAS REMEDIATION SYSTEM PROCESS FLOW DIAGRAM
C–1	TREATMENT COMPOUND LOCATION AND SITE PLAN
C–2	DOWNGRADIENT CONTAINMENT AND TREATMENT SYSTEM
C–3	TRENCH DETAILS
C–4	SAMPLING BOX DETAIL
C–5	FENCE DETAILS
C–6	WELL CONSTRUCTION DETAILS
S–0	STRUCTURAL GENERAL NOTES
S–1	SOURCE AREA TREATMENT COMPOUND PLAN
S–2	CONCRETE DETAILS
M–1	TYPICAL WELL HEAD DETAILS
E–1	ELECTRICAL GENERAL NOTES AND SYMBOLS
E–2	ELECTRICAL SITE PLAN
E–3	ELECTRICAL SITE PLAN DOWNGRADIENT EXTRACTION WELLS
E–4	SINGLE LINE DIAGRAM

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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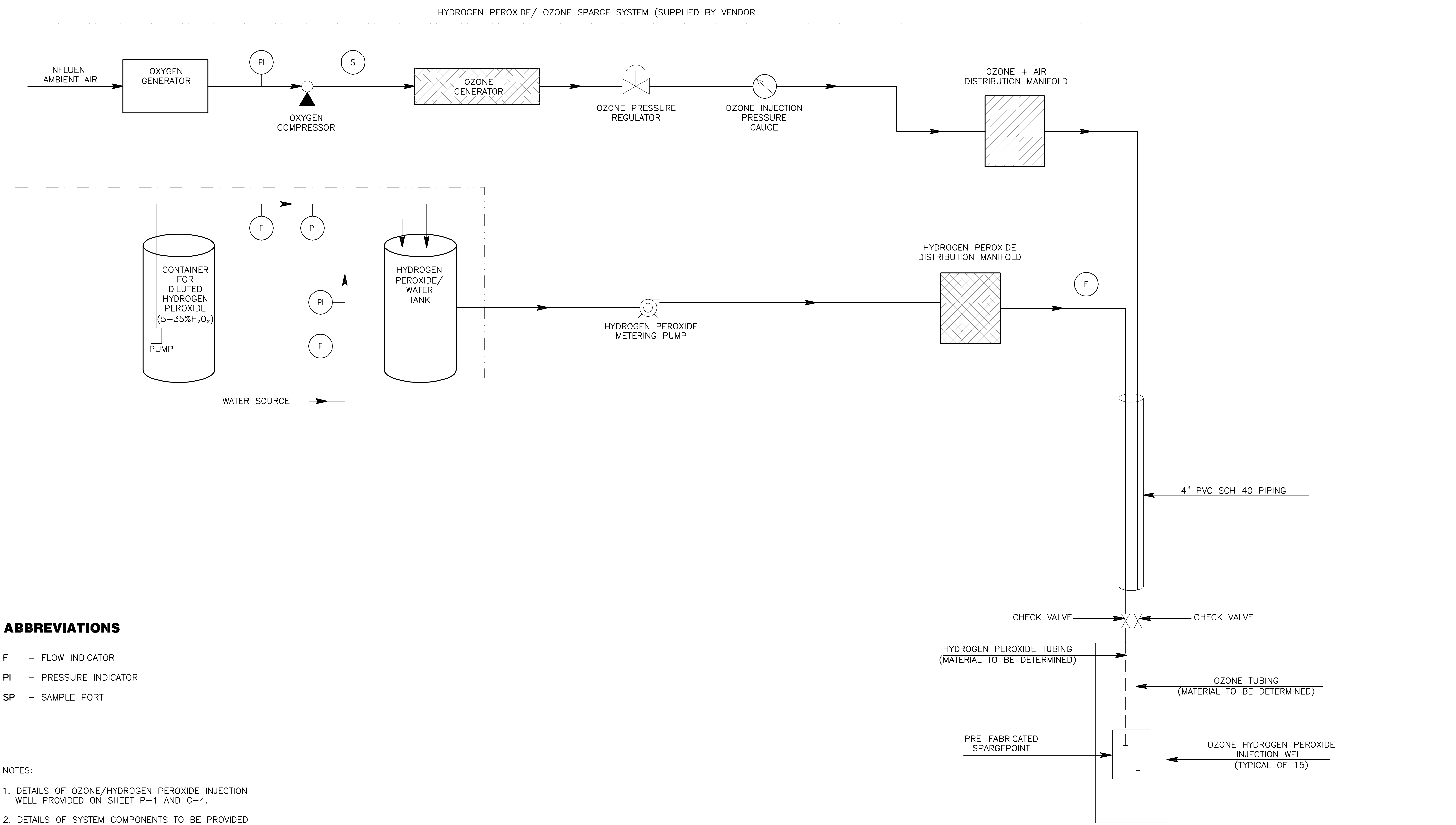
SHEET LOCATION MAP, SHEET INDEX AND GENERAL NOTES

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	G–2.dwg	G-2



ABBREVIATIONS

F – FLOW INDICATOR

PI – PRESSURE INDICATOR

SP – SAMPLE PORT

NOTES:

1. DETAILS OF OZONE/HYDROGEN PEROXIDE INJECTION WELL PROVIDED ON SHEET P–1 AND C–4.
2. DETAILS OF SYSTEM COMPONENTS TO BE PROVIDED BY SELECTED VENDOR PRIOR TO INSTALLATION.

(FIGURE NOT TO SCALE)

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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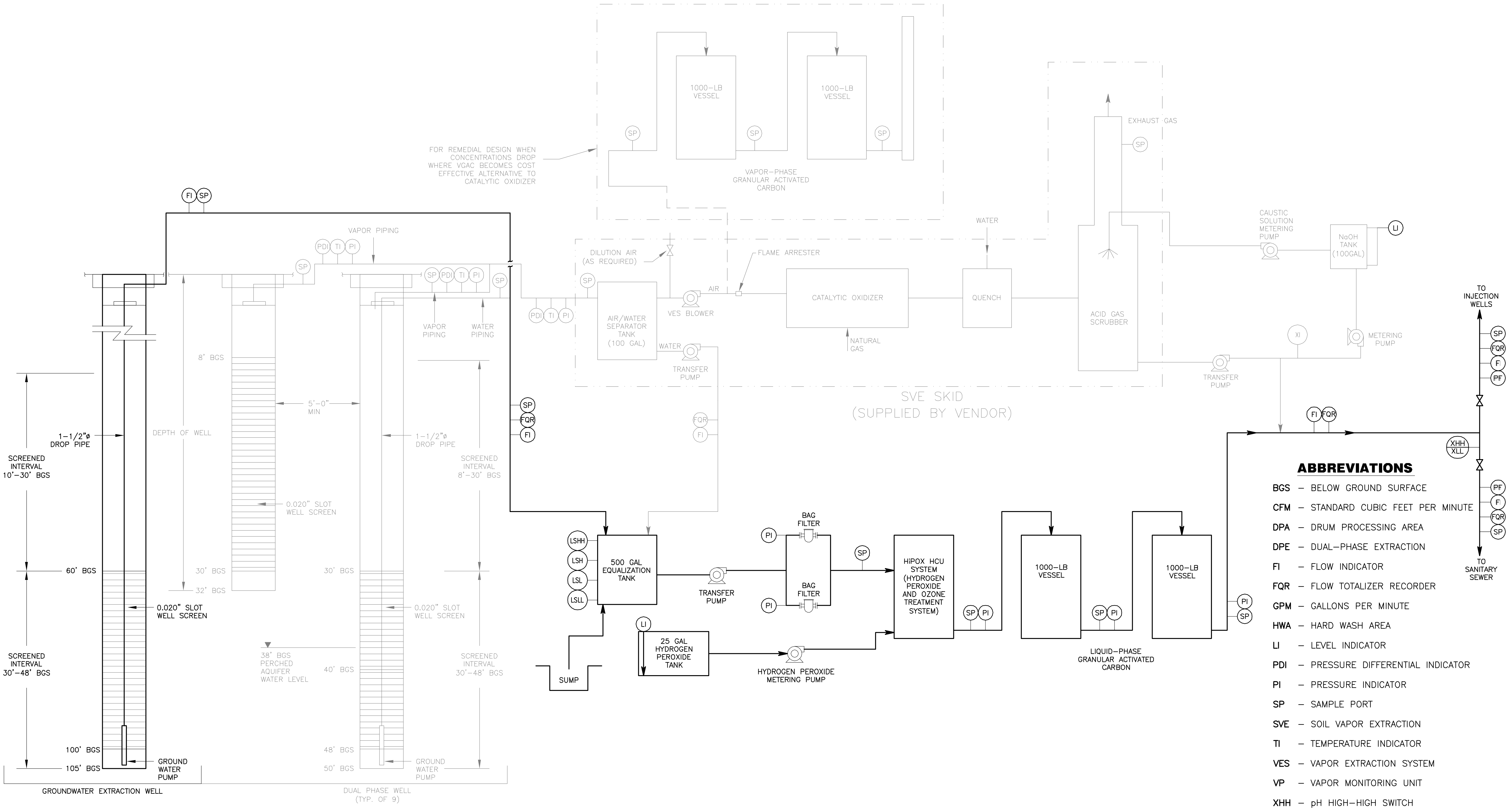
OZONE/HYDROGEN PEROXIDE INJECTION SYSTEM SIMPLIFIED PROCESS FLOW DIAGRAM

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	P–1.dwg	P-1



ABBREVIATIONS

BGS – BELOW GROUND SURFACE
CFM – STANDARD CUBIC FEET PER MINUTE
DPA – DRUM PROCESSING AREA
DPE – DUAL-PHASE EXTRACTION
FI – FLOW INDICATOR
FQR – FLOW TOTALIZER RECORDER
GPM – GALLONS PER MINUTE
HWA – HARD WASH AREA
LI – LEVEL INDICATOR
PDI – PRESSURE DIFFERENTIAL INDICATOR
PI – PRESSURE INDICATOR
SP – SAMPLE PORT
SVE – SOIL VAPOR EXTRACTION
TI – TEMPERATURE INDICATOR
VES – VAPOR EXTRACTION SYSTEM
VP – VAPOR MONITORING UNIT
XHH – pH HIGH-HIGH SWITCH
XLL – pH LOW-LOW SWITCH
XI – pH INDICATOR

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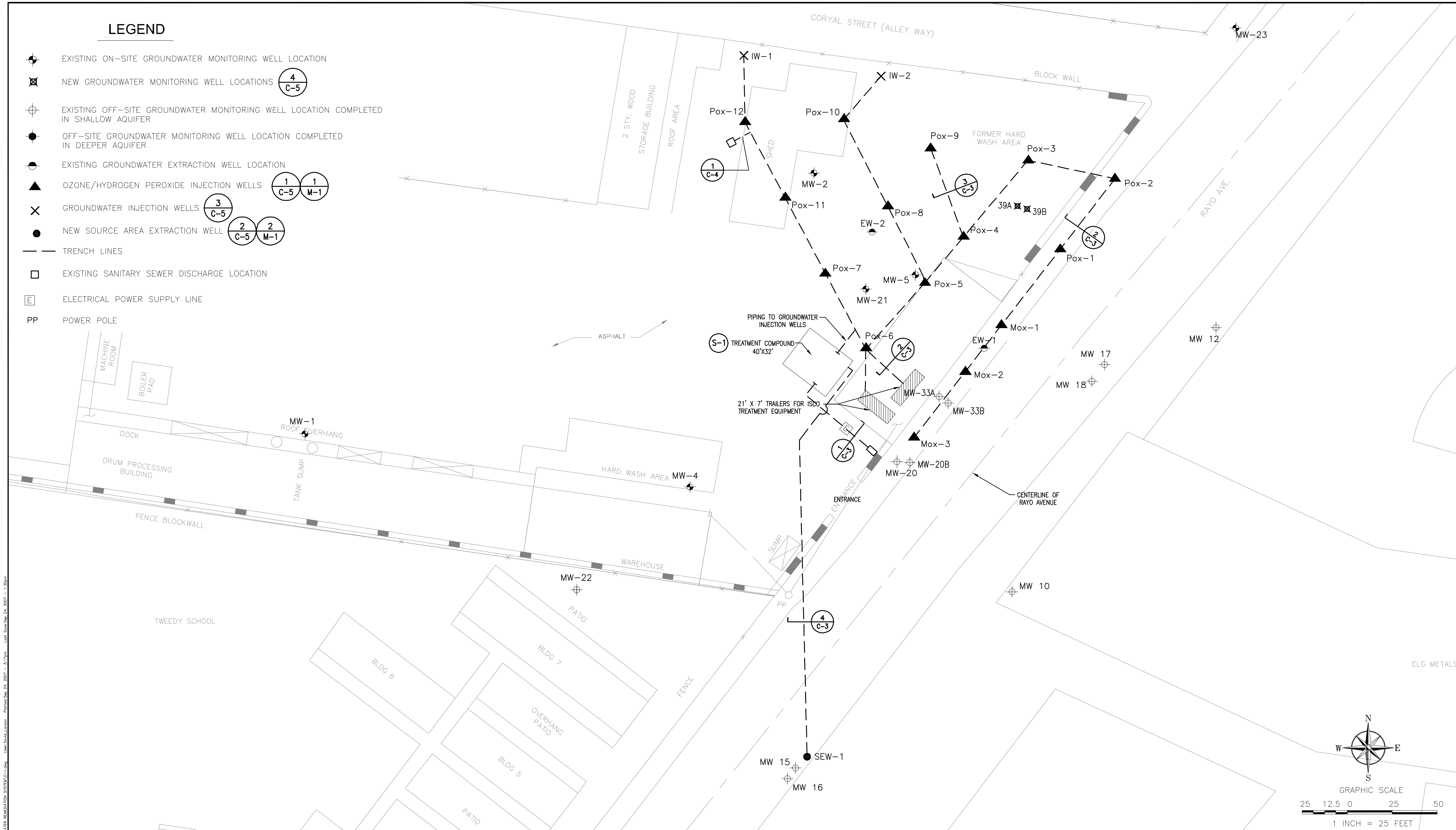
SIMPLIED GROUNDWATER AND SOIL GAS REMEDIATION SYSTEM PROCESS FLOW DIAGRAM

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/22/2007	P-2.dwg	P-2



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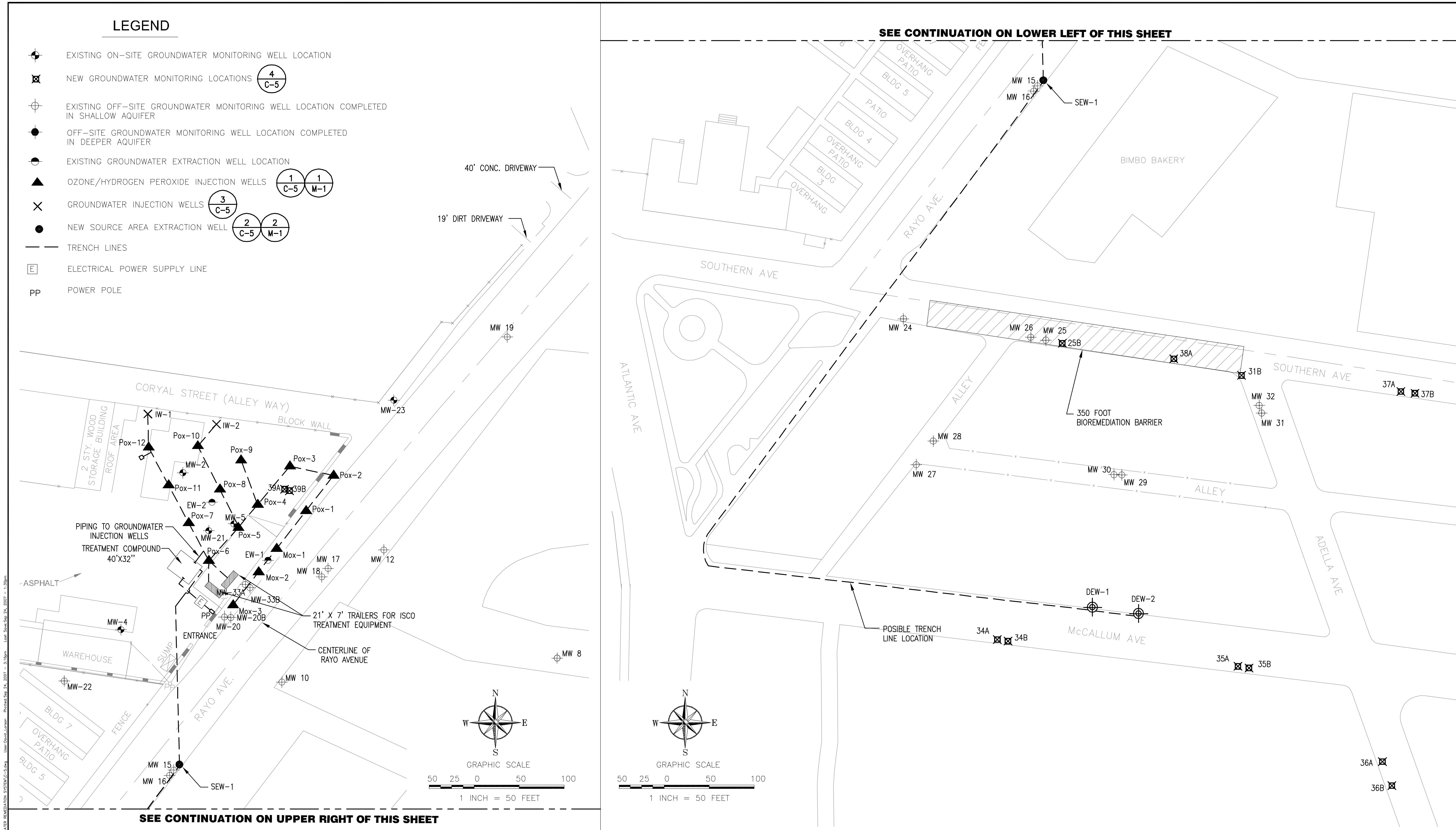
TREATMENT COMPOUND LOCATION AND SITE PLAN

SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=25'-0"	8/23/2007	C-1.dwg	C-1



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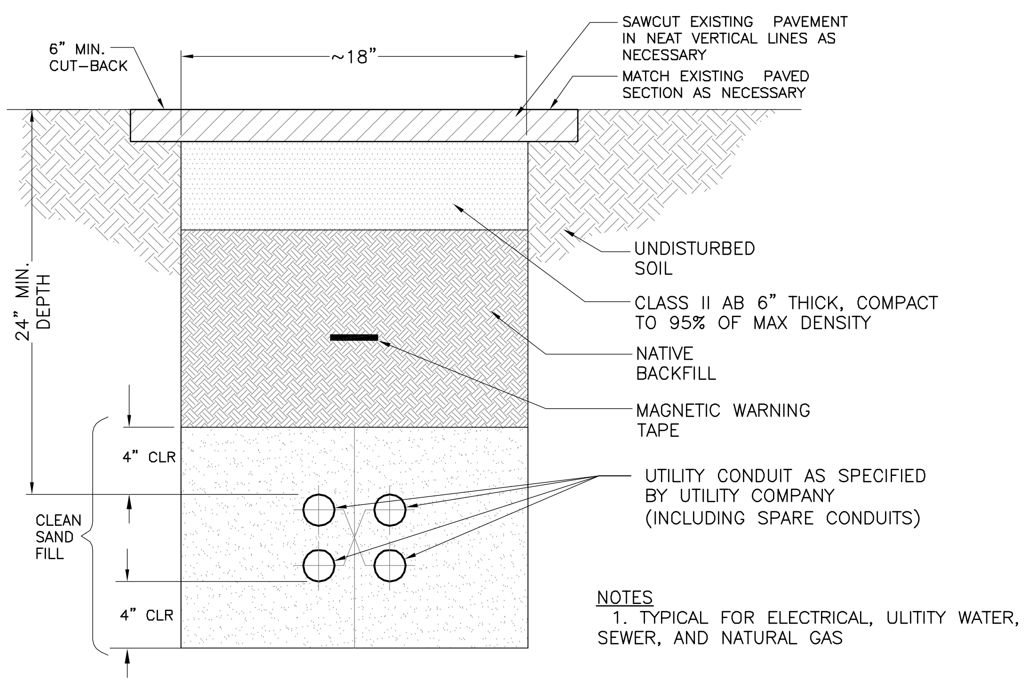
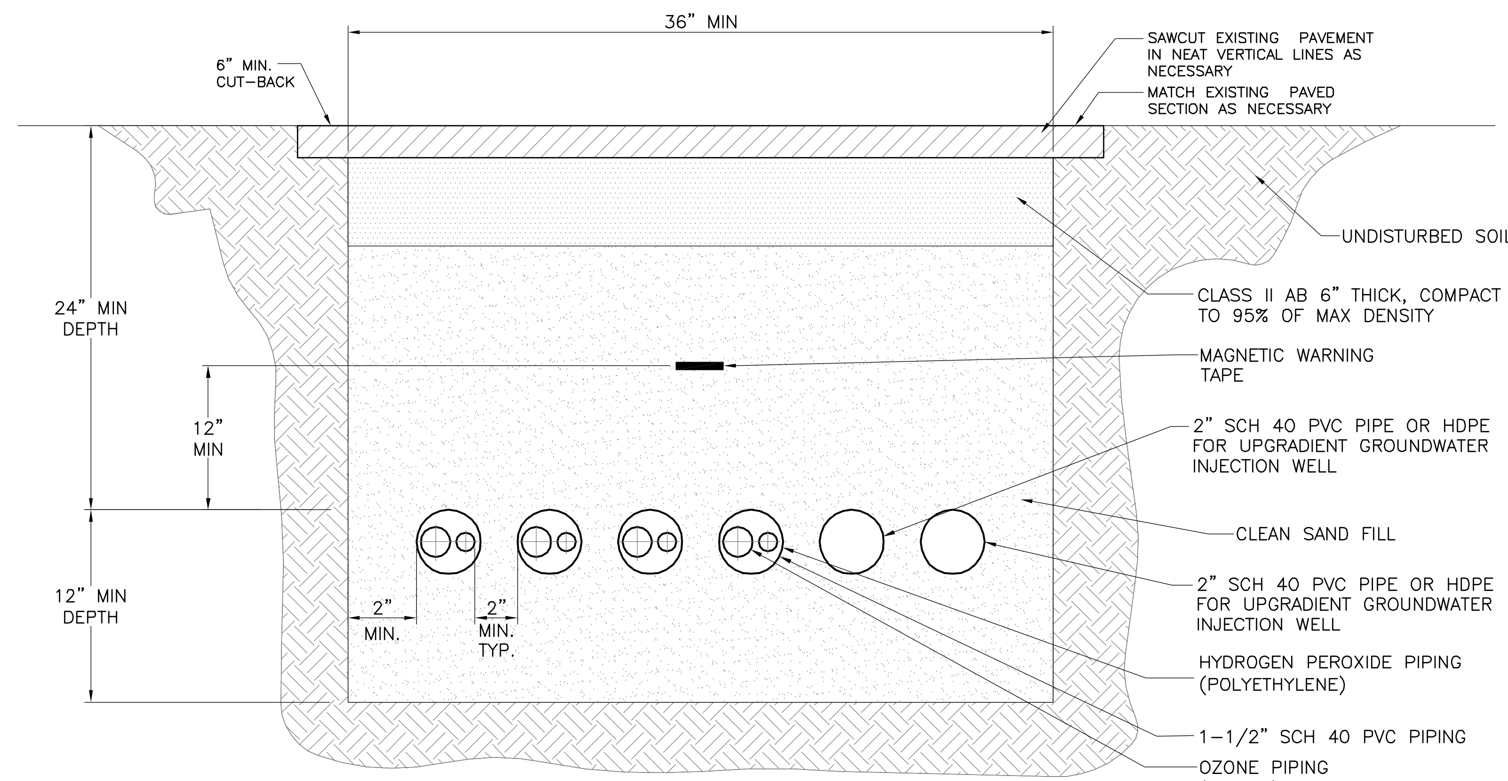
DOWNGRADIENT EXTRACTION WELLS

SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=50'-0"	8/23/2007	C-5.dwg	C-2

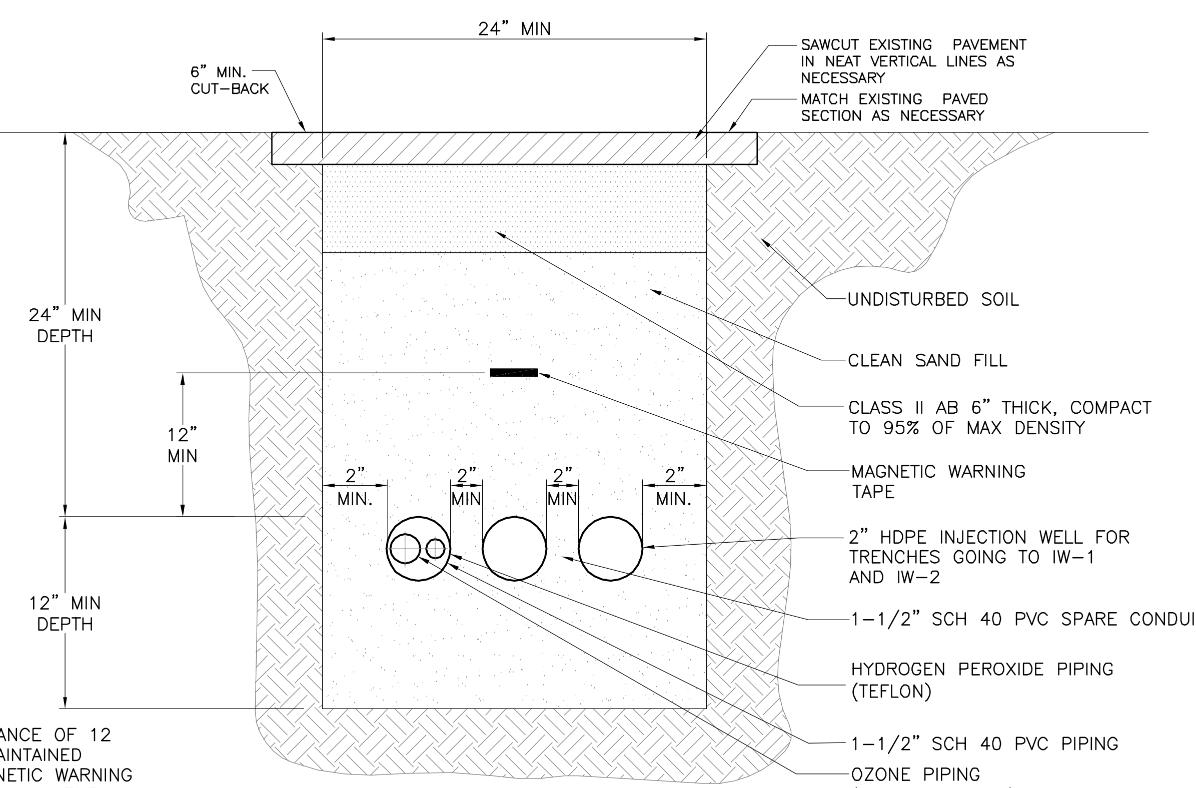


NOTES
1. TYPICAL FOR ELECTRICAL, ULITITY WATER, SEWER, AND NATURAL GAS

1/C-1 UTILITY TRENCH DETAIL (TYPICAL)
(NOT TO SCALE)

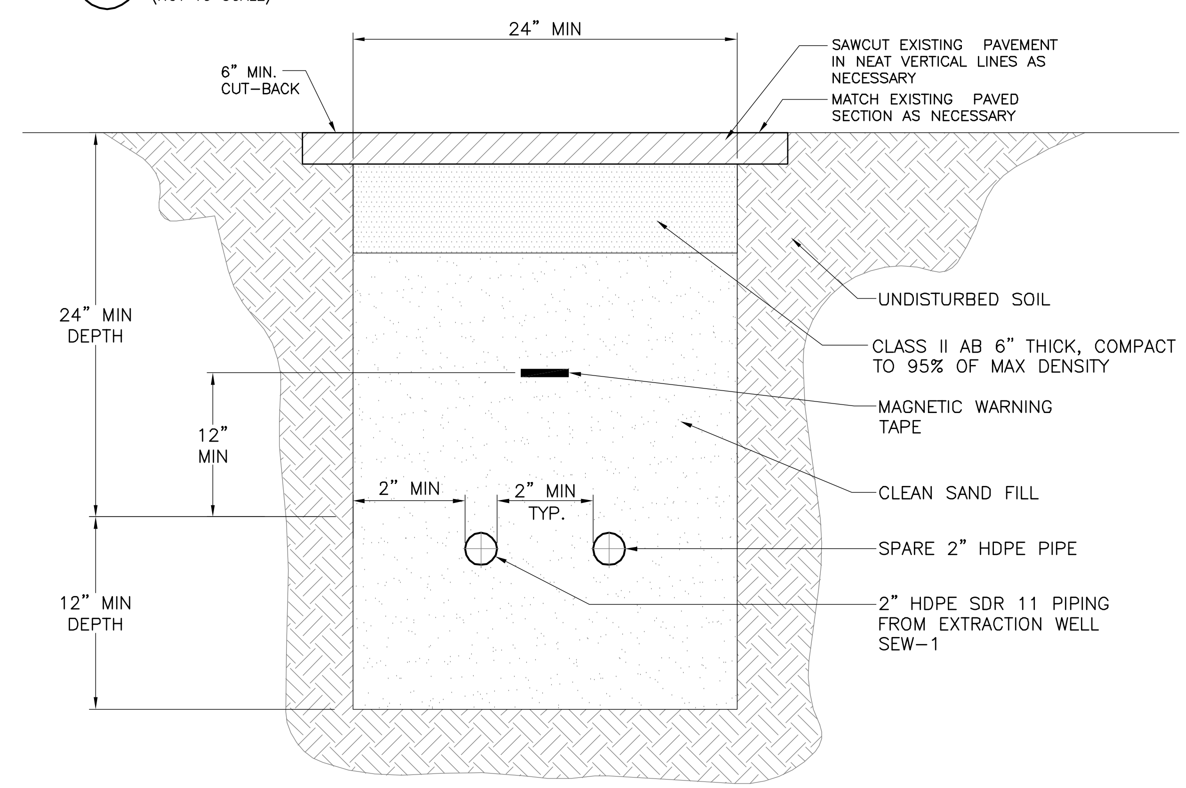


2/C-1 TRENCH DETAIL- OZONE/ HYDROGEN PEROXIDE WELLS PIPING (TYPICAL)
(NOT TO SCALE)



NOTES
1. A MINIMUM DISTANCE OF 12 INCHES WILL BE MAINTAINED BETWEEN THE MAGNETIC WARNING TAPE AND PIPING IN ALL THE TRENCHES SHOWN.

3/C-1 TRENCH DETAIL - OZONE/HYDROGEN PEROXIDE WELL PIPING
(NOT TO SCALE)



4/C-1 TRENCH DETAIL - EXTRACTION WELL PIPING
(NOT TO SCALE)

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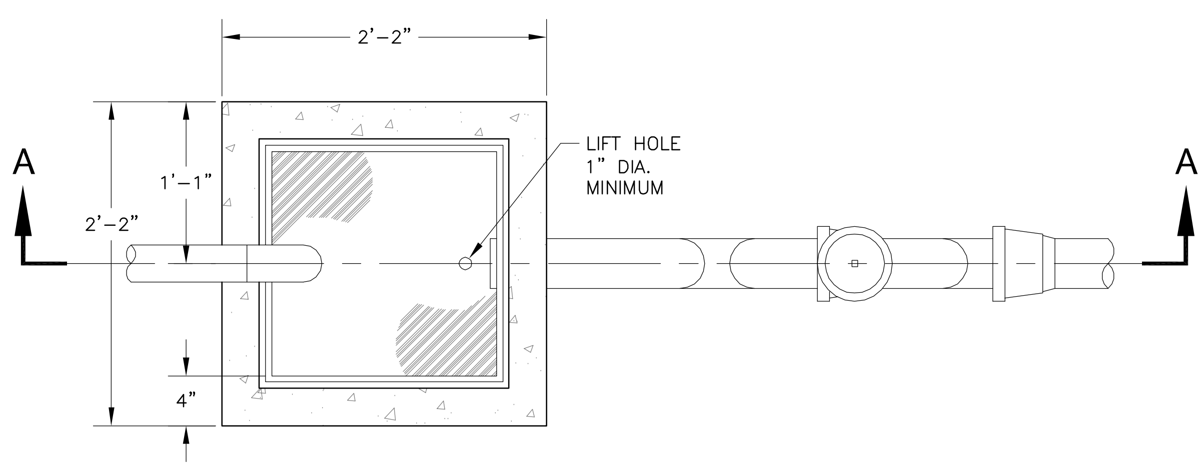
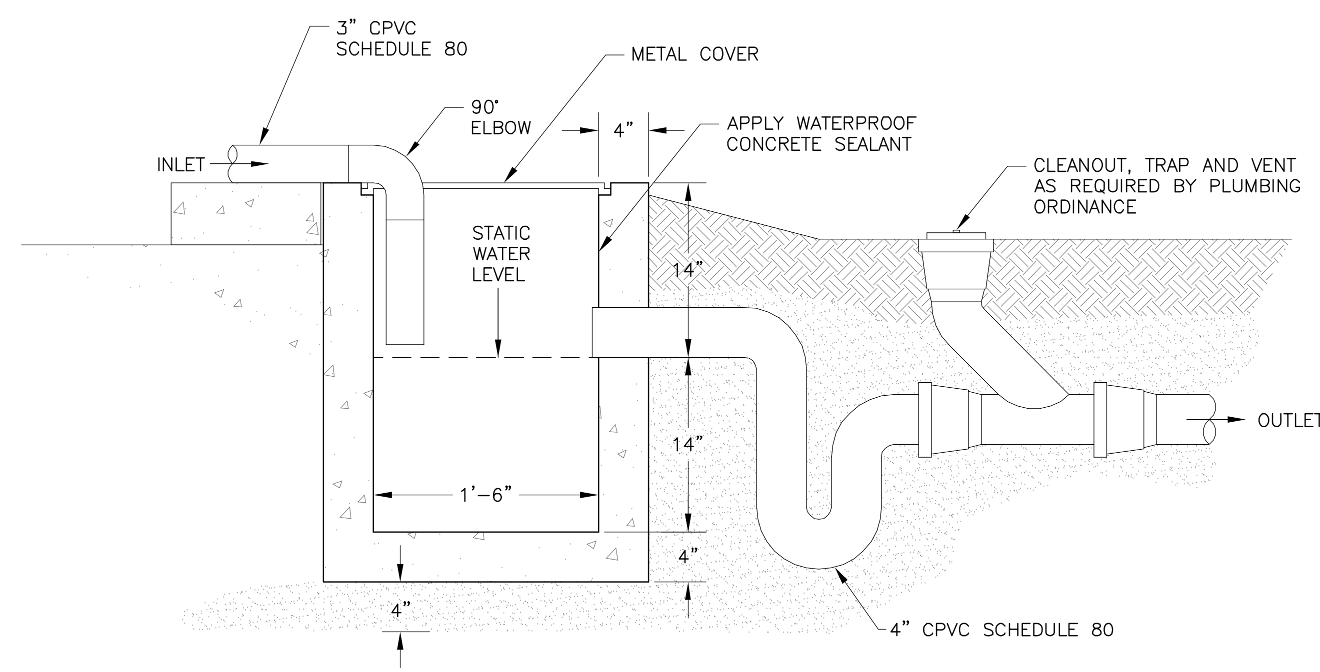
TRENCH DETAILS

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	C-2.dwg	C-3



1 / C-1 **SAMPLING BOX PLAN**
(NOT TO SCALE)



SECTION A-A
(NOT TO SCALE)

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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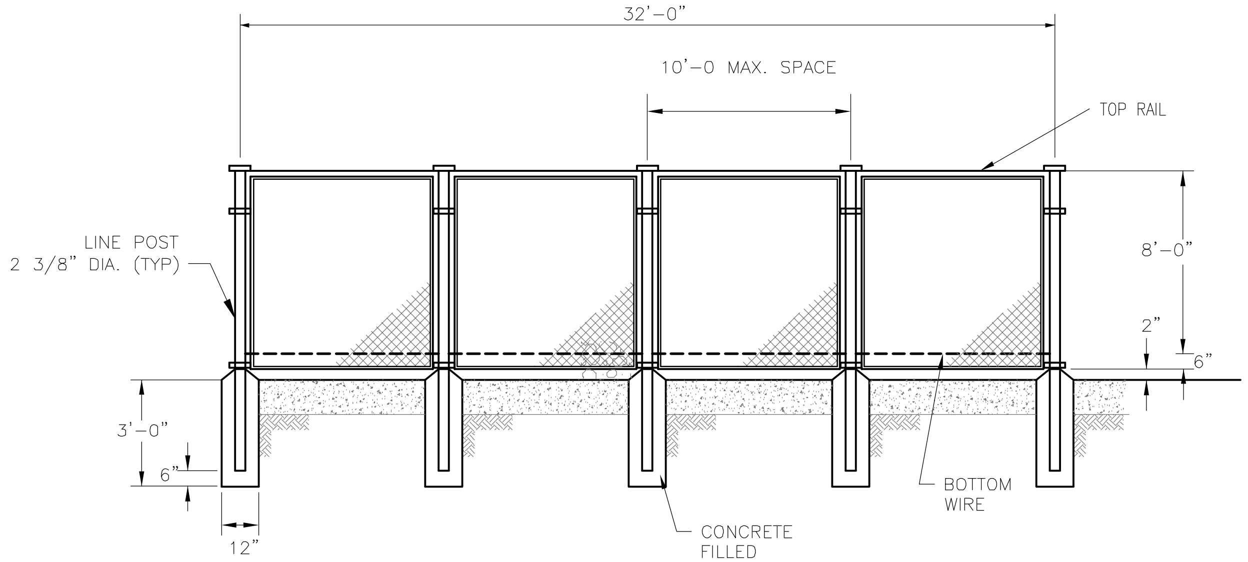
SAMPLING BOX DETAIL

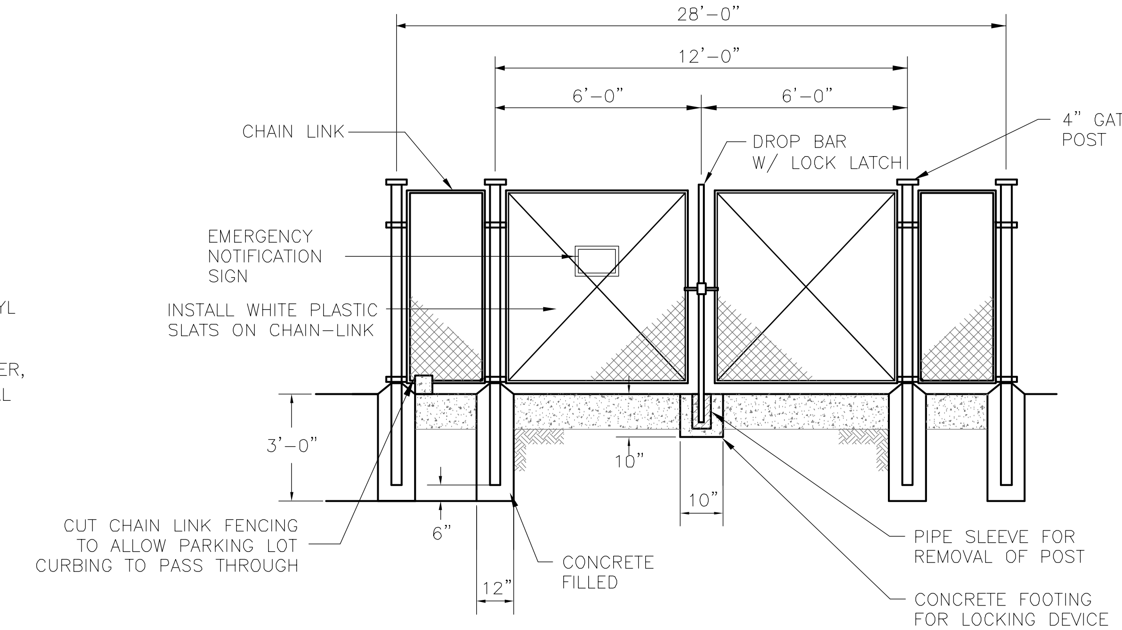
SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	C-2a.dwg	C-4



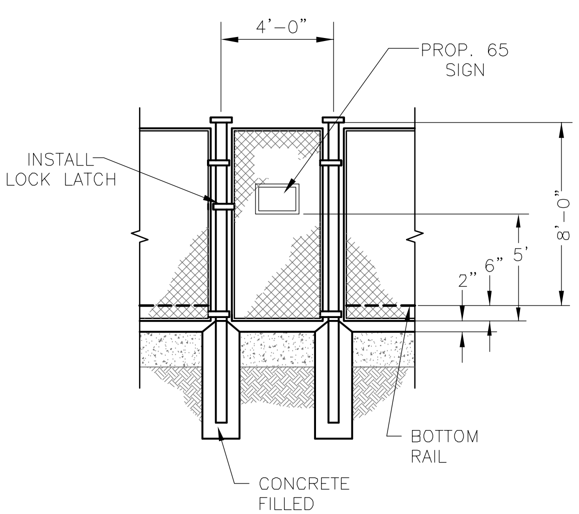
1 S-1 CHAIN LINK FENCE DETAIL
NOT TO SCALE

NOTES:

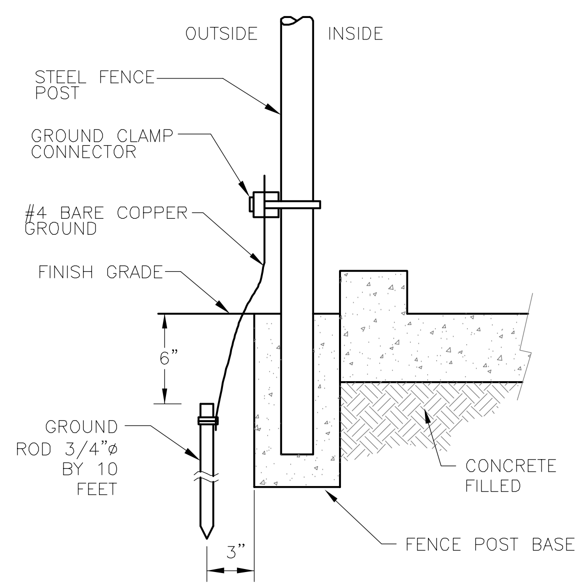
1. PROVIDE POST CAP FOR GATE POSTS, CORNER POSTS AND LINE POSTS.
2. PROVIDE 12'-0" GATE AS SPECIFIED BY PLAN, DETAIL 5.
3. FENCING AND GATE SHALL BE 8 FEET HIGH, 9 GAUGE GALVANIZED, CHAIN-LINK, PERMANENT CONSTRUCTION WITH PRE INSTALLED WHITE VINYL SECURITY SLOTS.
4. LINE POSTS SHALL BE 2" NOMINAL DIA., CORNER, END AND BRACE POSTS SHALL BE 2½" NOMINAL DIA., GATE POST SHALL BE 4" NOMINAL DIA.
5. SEE SHEET S-1 FOR SITE LAYOUT AND FENCE POSITION.



3 S-1 TYPICAL GATE DETAIL
NOT TO SCALE



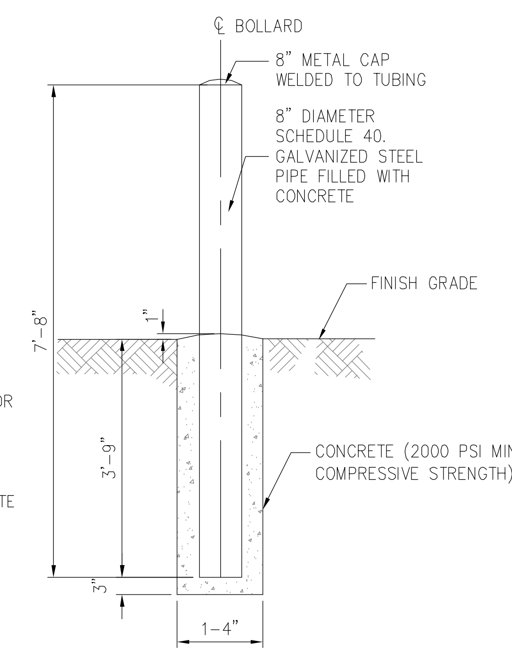
2 S-1 PERSONNEL GATE
NOT TO SCALE



4 S-1 FENCE GROUNDING DETAIL
NOT TO SCALE

NOTES:

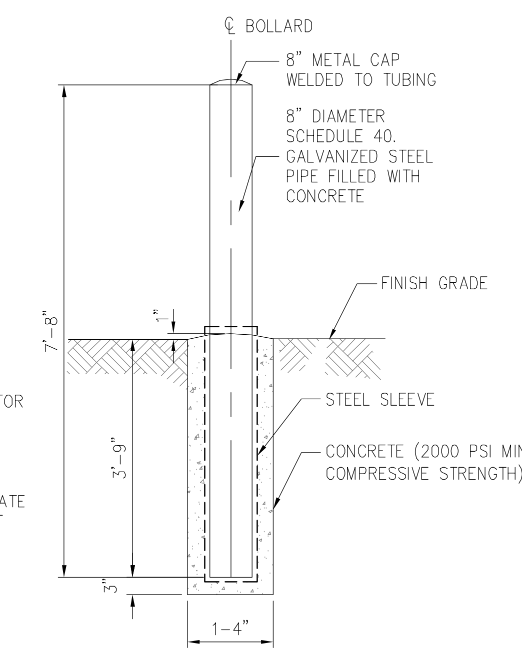
1. SEE S-1 FOR NUMBER OF GUARD POST TO BE USED.
2. THE EXACT LOCATION OF BOLLARD MAY BE CHANGED BY THE INSPECTOR IN THE FIELD.
3. THE STEEL PIPE ABOVE GROUND SHALL BE PAINTED A MINIMUM OF TWO FIELD COATS OF ZINC CHROMATE PRIMER, AND YELLOW COLOR PAINT COVER.



5 S-1 TYPICAL BOLLARD DETAIL
NOT TO SCALE

NOTES:

1. SEE S-1 FOR NUMBER OF GUARD POST TO BE USED.
2. THE EXACT LOCATION OF BOLLARD MAY BE CHANGED BY THE INSPECTOR IN THE FIELD.
3. THE STEEL PIPE ABOVE GROUND SHALL BE PAINTED A MINIMUM OF TWO FIELD COATS OF ZINC CHROMATE PRIMER, AND YELLOW COLOR PAINT COVER.



6 S-1 TYPICAL REMOVABLE BOLLARD DETAIL
NOT TO SCALE

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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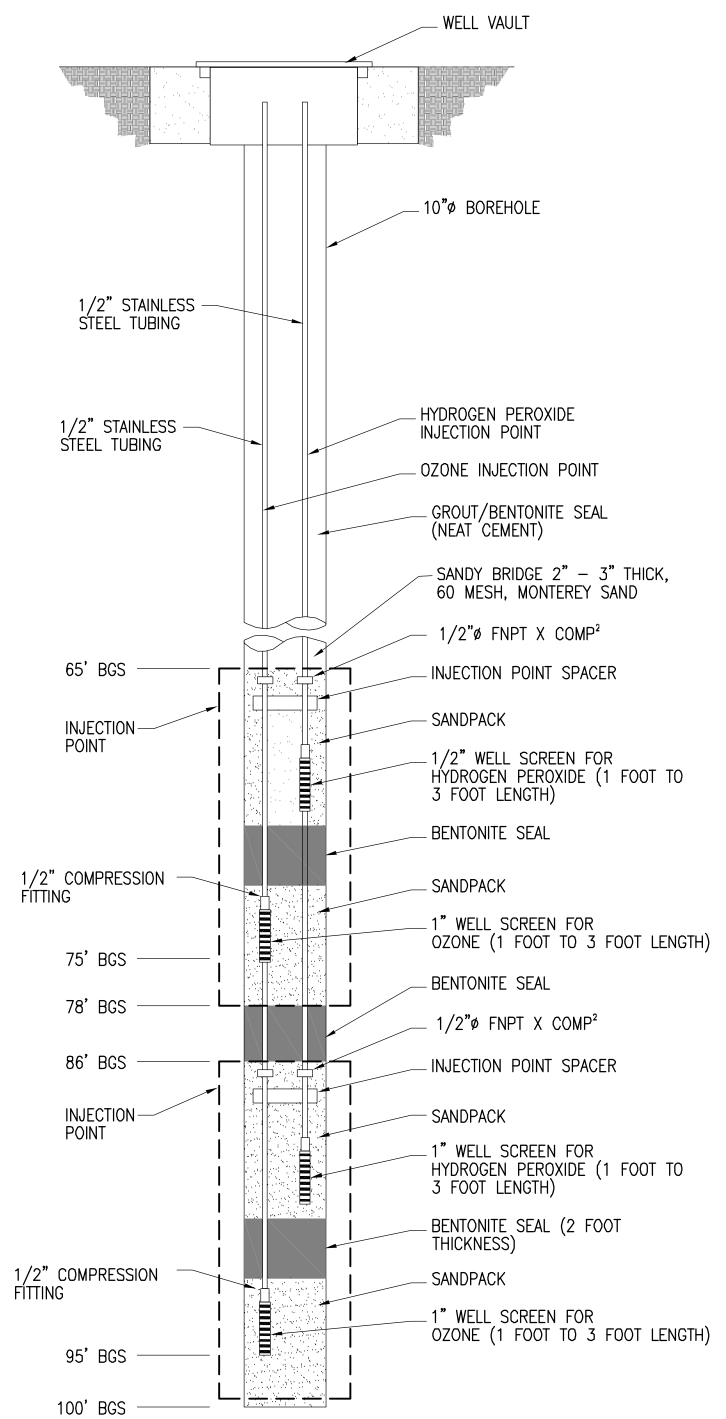
FENCE DETAILS

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	C-3.dwg	C-5



NOTES:

1. SPACERS MUST BE INSTALLED WITHIN GROUT SEAL. SPACERS SHOULD BE APPROX. EVERY FIVE FEET.

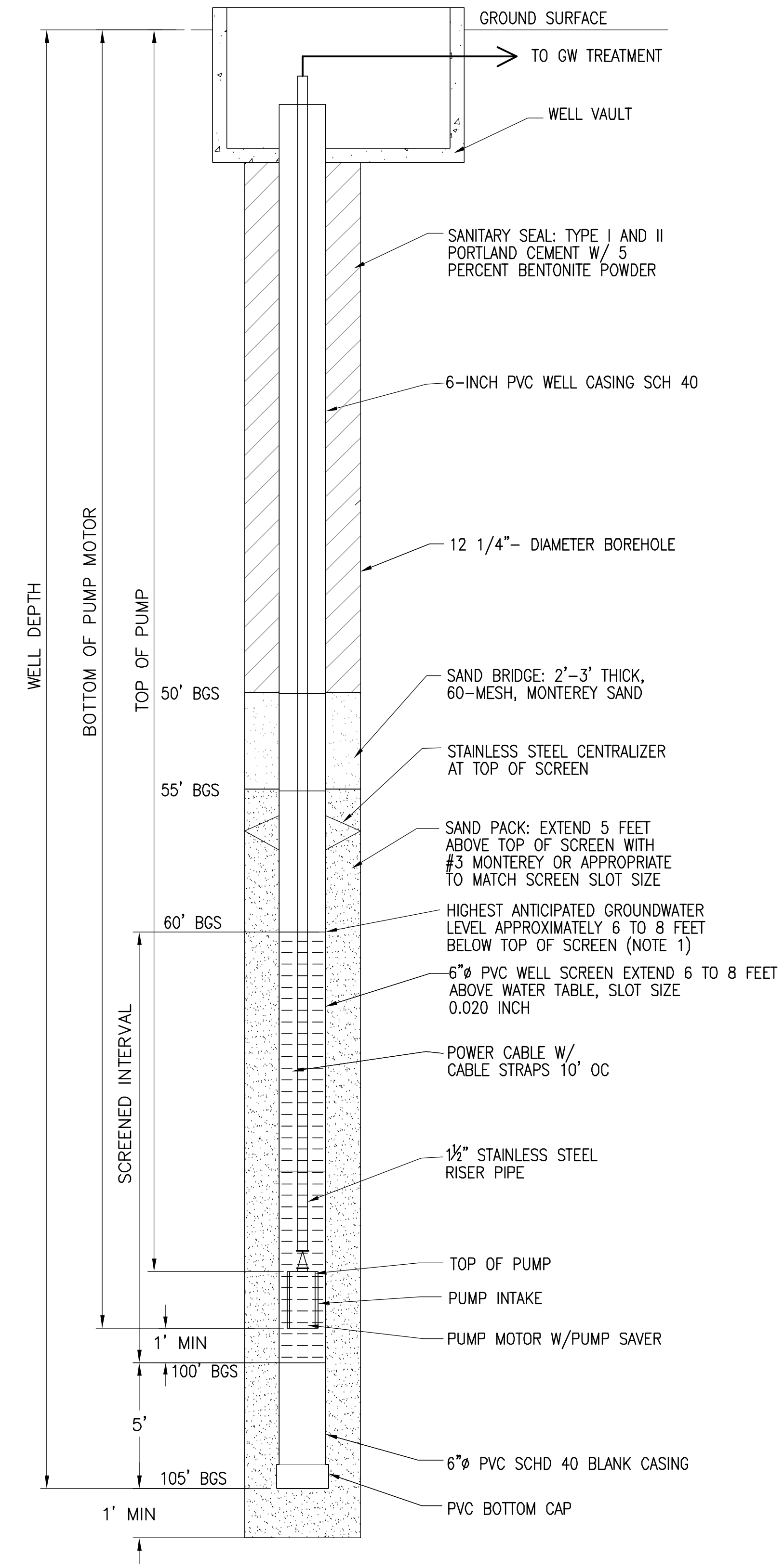
2. EACH INJECTION WELL WILL BE SUPPLIED WITH A SS COMPRESSION BY EITHER COMPRESSION OR FNPT FITTING ON EACH POINT AS APPROPRIATE. (APPROXIMATELY 1 FOOT ABOVE TOP OF WELL SCREEN)

3. TUBING/PIPING/FITTING MATERIAL TO BE DETERMINED.

4. DEPTH OF OZONE/PEROXIDE INJECTION INTERVALS IS BETWEEN 70 TO 95 FEET bgs.

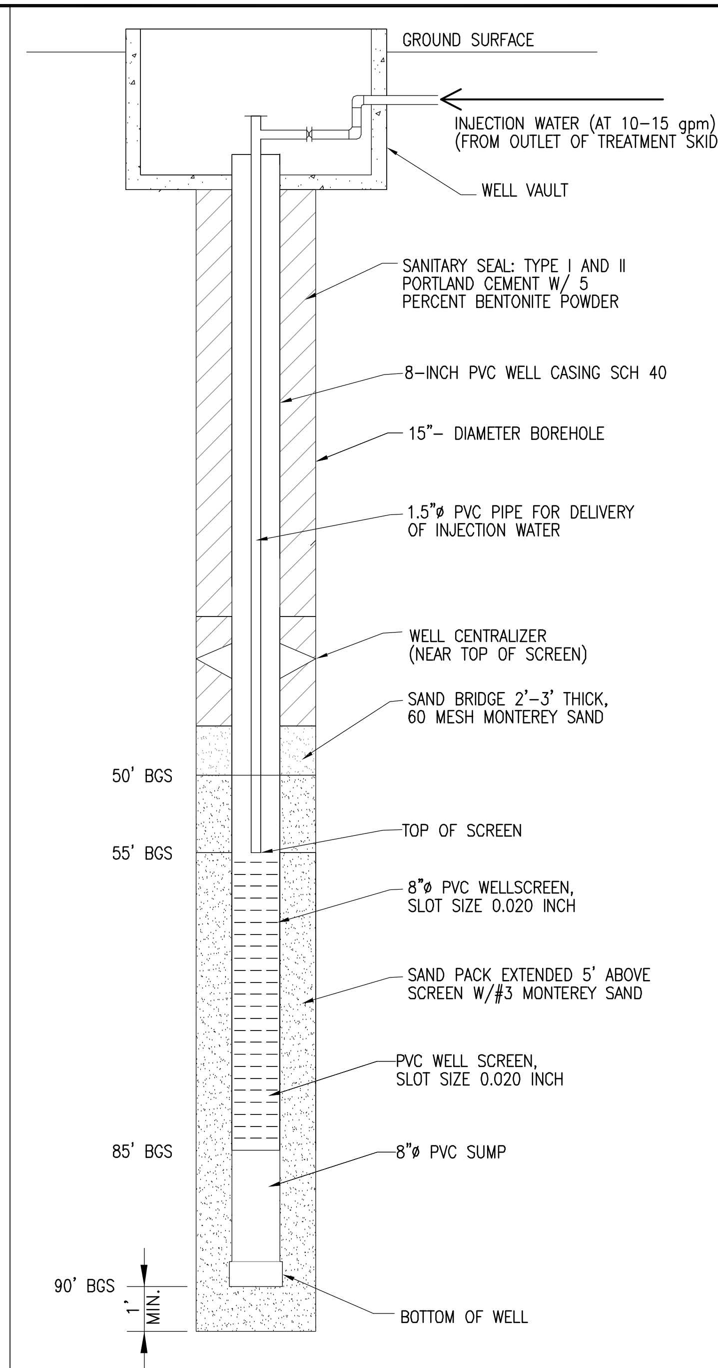
1 (C-1 | C-2) OZONE/HYDROGEN PEROXIDE INJECTION WELL CONSTRUCTION DETAIL

(NOT TO SCALE)



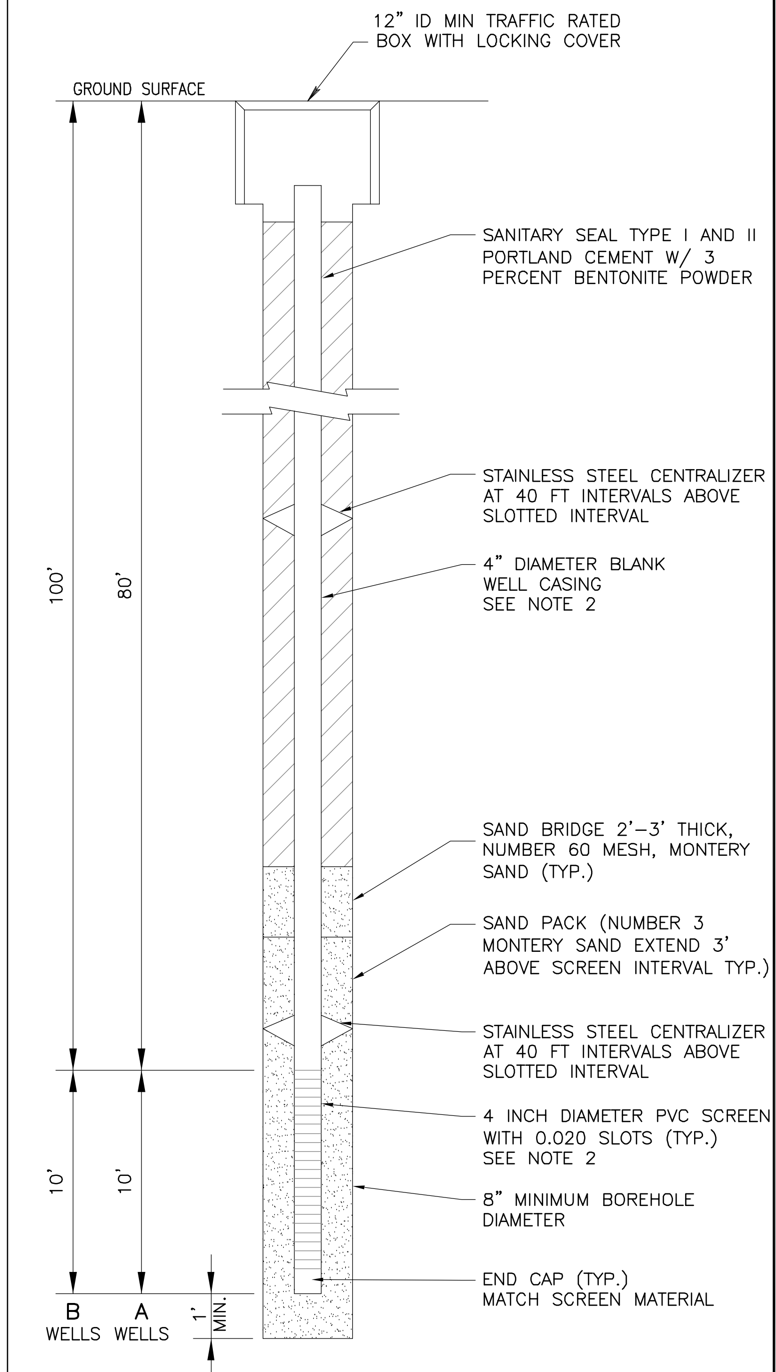
2 (C-1 | C-2) SOURCE AREA GROUNDWATER EXTRACTION WELL CONSTRUCTION DETAIL

(NOT TO SCALE)



3 (C-1 | C-2) GROUNDWATER INJECTION WELL CONSTRUCTION DETAIL

(NOT TO SCALE)



NOTES:

1. ACTUAL CONSTRUCTION MAY VARY DEPENDING ON TOTAL DEPTH OF WELL.
2. CASING AND SCREEN MATERIAL MAY BE SCHEDULE 40 LOW CARBON STEEL OR SCHEDULE 40 PVC.
3. DIELECTRIC INSULATING MATERIAL SHALL BE PROVIDED BEFORE THE LCS CASING AND SS BLANK CASING.

4 (C-1 | C-2) MONITORING WELL DETAIL (A AND B ZONES)

(NOT TO SCALE)

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

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WELL CONSTRUCTION DETAIL

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	C-4.dwg	C-6

STRUCTURAL ABBREVIATIONS

@	AT	HORZ	HORIZONTAL
ABV	ABOVE	HT	HEIGHT
AB	ANCHOR BOLTS	HB	HIGH STRENGTH BOLT (A325)
ACI	AMERICAN CONCRETE INSTITUTE	ICBO	INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS
ADDNL	ADDITIONAL		
AFF	ABOVE FINISH FLOOR	ID	INSIDE DIAMETER
AGG	AGGREGATE	IN (")	INCH
AISC	AMERICAN INSTITUTE FOR STEEL CONSTRUCTION	INTR	INTERIOR
		INFO	INFORMATION
ALT	ALTERNATE	JT	JOINT
APPROX	APPROXIMATE	LL	LIVE LOAD
ARCH	ARCHITECT/ ARCHITECTURAL	LGTH	LENGTH
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	LONG	LONGITUDINAL
		LT WT	LIGHT WEIGHT
AWS	AMERICAN WELDING SOCIETY	LWC	LIGHT WEIGHT CONCRETE
BLW	BELOW	MAX	MAXIMUM
BLDG	BUILDING BLDG	MB	MACHINE BOLT
BLK	BLOCK BLOCKING BLKG	MCJ	MASONRY CONTROL JOINT
BOC	BOTTOM OF CONCRETE	MECH	MECHANICAL
BOF	BOTTOM OF FOOTING	MFR	MANUFACTURER
BOTT	BOTTOM	MIN	MINIMUM
BRG	BEARING	MISC	MISCELLANEOUS MISC
BTW	BETWEEN	MTL	METAL
CBC	CALIFORNIA BUILDING CODE	NIC	NOT IN CONTRACT
CC	CENTER TO CENTER	NO (#)	NUMBER OR POUNDS
CE	CIVIL ENGINEER	NOM	NOMINAL
CIP	CAST IN PLACE	NSG	NON SHRINK GROUT
CJ	CONSTRUCTION	NTS	NOT TO SCALE NTS
CMU	MCONCRETE MASONRY UNIT	OC	CENTER
CONC	CONCRETE	OD	OUTSIDE DIAMETER
CONN	CONNECTION	OPG	OPENING
CONT	CONTINUOUS	PC	PIECE
CTR	CENTER CTR CENTERED	PCC	PRECAST CONCRETE
DIA (ø)	DIAMETER	PERP	PERPENDICULAR
DL	DEAD LOAD	PSI	POUNDS PER SQUARE INCH
DN	DOWN	PT	POINT
DSA	DIVIDION OF STATE ARCHITECTS	R	RADIUS
DTL	DETAIL	REINF	REINFORCING
DWG	DRAWING	REQ	REQUIRED
EA	EACH	SAD	SEE ARCHITECTURAL DRAWINGS
EF	EACH FACE	SCHED	SCHEDULE
EJ	EXPANSION JOINT	SE	STRUCTURAL ENGINEER
ELV	ELEVATION ELEV	SEIS	SEISMIC
EOS	EDGE OF SLAB	JT	JOINT
EOR	ENGINEER OF RECORD	SHRWL	SHEARWALL
EQ (=)	EQUAL	SIM	SIMILAR
EW EF	EACH WAY EACH FACE	SJ	SHRINKAGE JOINT
EW	EACH WAY	SOG	SLAB ON GRADE
EXTR	EXTERIOR	SPEC	SPECIFICATION
f'c	MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE	SQ	SQUARE
		STD	STANDARD
FD	FLOOR DRAIN	STL	STEEL
FF	FINISH FLOOR	STRUC	STRUCTURAL
FFE	FINISH FLOOR ELEVATION	SYM	SYMMETRICAL
FG	FINISH GRADE	T24	TITLE 24 CALIFORNIA CODE
f'm	MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF MASONRY	THK	THICK/THICKNESS
		TOC	TOP OF CONCRETE TOC
FNDN	FOUNDATION	TOF	TOP OF FOOTING/TOP OF FRAMING
FOC	FACE OF CONCRETE FOC		
FOM	FACE OF MASONRY	T.O. SLAB	TOP OF SLAB
FRMG	FRAMING FRMG	TOS	TOP OF STEEL
FT (')	FOOT/FEET	TOT	TOTAL
FTG	FOOTING	TOW	TOP OF WALL
Fy	SPECIFIED YIELD STRENGTH OF REIFORCING, PSI OR SPECIFIED MINIMUM	TRAN	TRANSVERSE
		TYP	TYPICAL
		T&B	TOP AND BOTTOM
KSI	YIELD STRESS OF STEEL	UBC	UNIFORM BUILDING CODE
GRD	GRADE	UNO	UNLESS NOTED OTHERWISE
GT	GROUT	VERT	VERTICAL
HC	HANDICAP	VIF	VERIFIY IN FIELD
HD	HOLD DOWN	w/	WITH
HDR	HEADER	WT	WEIGHT
HK	HOOK	WWF	WELDED WIRE FABRIC

INSPECTION NOTES:

1. GENERAL: IN ADDITION TO THE INSPECTIONS REQUIRED BY SECTION 108 OF THE 2006 IBC, THE GOVERNMENT SHALL EMPLOY AN IBC APPROVED SPECIAL INSPECTOR TO PERFORM SPECIAL INSPECTIONS AND TESTS AS INDICATED IN THE SCHEDULE BELOW.
2. INSPECTORS: ALL TESTS AND INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT INSPECTION AGENCY WHICH IS IN THE EMPLOYMENT OF THE GOVERNMENT.
3. ALL SPECIAL INSPECTION AND TESTING AGENCIES SHALL BE QUALIFIED PER ASTM E329 AND APPROVED BY THE GOVERNMENT.
4. PROVIDE INSPECTION REPORTS TO BUILDING DEPARTMENT, GOVERNMENT, ARCHITECT AND
ENGINEER WITHIN TWO WEEKS OF PERFORMANCE INSPECTION OR TEST.
5. REFER TO CHAPTER 17 OF THE CODE FOR OTHER REQUIRED SPECIAL INSPECTIONS
6. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO SEE THAT THE TESTS AND INSPECTIONS ARE PERFORMED. JOB SITE VISITS BY THE STRUCTURAL ENGINEER DO NOT CONSTITUTE AND ARE NOT A SUBSTITUTE FOR INSPECTIONS.
7. WHERE THE CONTRACTOR CHOOSES TO USE OPTIONAL OR ALTERNATIVE MEANS OF FASTENING OR ANCHORING MATERIALS AS SHOWN ON THE PLANS AND DETAILS AND REQUIRES SPECIAL FIELD INSPECTION, SUCH AS FIELD WELDING, ADHESIVE OR EXPANSION ANCHORS, ETC. ALL ADDITIONAL SPECIAL INSPECTION AND TESTING COSTS SHALL BE PAID FOR BY THE GOVERNMENT AND REIMBURSED BY THE CONTRACTOR.

FOUNDATIONS:

1. REFER TO RECOMMENDATIONS IN SOILS REPORT, FILE NO. __N/A__ BY __N/A__ DATED __N/A_______. ALLOWABLE SOIL BEARING PRESSURE FOR FOUNDATION IS 1,500 PSF (DL + LL) AND 2,000 PSF (DL + LL + SEISMIC OR WIND).
   1.1 SOIL CLASSIFICATION IS CL FOR TRACY SITE.
2. ALL SITEWORK AND GRADING SHALL BE DONE IN COMPLIANCE WITH THE SOILS REPORT AND SPECIFICATIONS OR ENGINEER'S RECOMMENDATIONS.
3. SOILS ENGINEER SHALL VERIFY CONDITION AND/OR ADEQUACY OF ALL FOUNDATION EXCAVATIONS PRIOR TO PLACEMENT OF CONCRETE.
4. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO SHORE AND BRACE ALL EXCAVATIONS AS REQUIRED.
5. ALL FOUNDATIONS ARE SHOWN AND DIMENSIONED AS BEING FORMED. FOUNDATIONS MAY BE PLACED IN NEAT EXCAVATIONS PROVIDED FOOTINGS ARE INCREASED 2" IN WIDTH, SEE TYPICAL EXCAVATION DETAIL.
6. EXCAVATIONS SHALL BE CLEANED OF ALL DEBRIS AND LOOSE SOIL. STANDING WATER SHALL BE REMOVED PRIOR TO CONCRETE PLACEMENT.
7. FOUNDATION DEPTHS INDICATED ON PLANS ARE MINIMUMS. ACTUAL DEPTHS ARE TO BE CONFIRMED BY SOILS ENGINEER ON THE JOB SITE.
8. BOTTOMS OF ALL FOUNDATIONS SHALL BE LEVEL. CHANGES IN BOTTOM OF FOUNDATION ELEVATION SHALL BE MADE ACCORDING TO STEPPED FOOTING DETAILS.
9. FOOTINGS SHALL BE CENTERED UNDER WALLS AND/OR COLUMNS UNLESS OTHERWISE INDICATED ON DRAWINGS.
10. CONTRACTOR SHALL CHECK FOOTING FORMS TO VERIFY THAT THEY ARE SQUARE & PLUMB. THE CONTRACTOR SHALL ALSO VERIFY THAT ALL INSERTS & EMBEDS ARE IN THEIR CORRECT LOCATION & ORIENTATION PRIOR TO PLACING CONCRETE.
11. NOTIFY THE STRUCTURAL ENGINEER 48 HOURS IN ADVANCE OF PLACING CONCRETE.

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1. CONTRACTOR SHALL BE RESPONSIBLE FOR ARRANGING SPECIAL INSPECTION.

DUTIES & RESPONSIBILITIES OF THE INSPECTOR ARE COVERED IN SECTION 1704.1 OF IBC.

	ITEM	CONTINUOUS INSPECTION	PERIODIC INSPECTION	REMARKS
CONCRETE	SLAB ON GRADE (f'c = 4000 PSI)	— —	YES	PRIOR TO POURING OF CONCRETE & DURING THE TAKING OF TEST SPECIMENS
CONCRETE	WALL (f'c = 4000 PSI)	— —	YES	PRIOR TO POURING OF CONCRETE & DURING THE TAKING OF TEST SPECIMENS
CONCRETE	GRADE BEAM AND FOUNDATION (f'c = 3000 PSI)	— —	YES	PRIOR TO POURING OF CONCRETE & DURING THE TAKING OF TEST SPECIMENS & PLACING OF REINF'D CONCRETE
CONCRETE	STRUCTURAL CONCRETE CONC. ON METAL DECK (f'c = 3000 PSI) (SECTION 1704.4)	YES	— —	PRIOR TO POURING OF CONCRETE DURING THE TAKING OF TEST SPECIMENS CHECK REINFORCEMENT LOCATION
BOLTS IN CONCRETE (SECTION 1704.4)		— —	YES	PRIOR TO AND DURING THE PLACEMENT OF CONCRETE AROUND BOLTS
FIELD WELDING	STRUCTURAL STEEL (ELECTRODE = E70XX)	YES	— —	DURING THE WELDING
FIELD WELDING	REINFORCING STEEL (ELECTRODE = E90XX) (SECTION 1704.4)	YES	— —	DURING THE WELDING
FIELD WELDING	METAL ROOF DECK WELDING	— —	YES	DURING THE WELDING
STRUCTURAL WELDING (INCLUDING HSA WELDING) (SECTION 1704.3)		YES	— —	EXCEPT FOR WELDING PERFORMED IN THE SHOP OF AN APPROVED FABRICATOR
REINFORCING STEEL (SECTION 1704.4)		— —	YES	PRIOR TO COVER UP
HIGH STRENGTH BOLTS (A325 & A490) (SECTION 1704.3)		— —	YES	DURING INSTALLATION OF BOLTS & TIGHTENING
SPRAY APPLIED FIREPROOFING (SECTION 1704.11)		— —	YES	DURING THE SPRAYING

2. A CERTIFICATE OF SATISFACTORY COMPLETION OF WORK REQUIRING SPECIAL INSPECTION MUST BE COMPLETED AND SUBMITTED TO THE FIELD INSPECTION DIVISION.
3. AN APPLICATION FOR OFF-SITE FABRICATION MUST BE SUBMITTED TO THE FIELD INSPECTION DIVISION FOR APPROVAL PRIOR TO FABRICATION.
4. A CERTIFICATE OF COMPLIANCE FOR OFF-SITE FABRICATION MUST BE COMPLETED AND SUBMITTED TO THE FIELD INSPECTION DIVISION PRIOR TO ERECTION OF PREFABRICATED COMPONENTS.

DESIGN CRITERIA (2006 IBC & UFC 1-200-01):

2.0 REFERENCED STRUCTURAL STANDARDS IN THE 2006 IBC
- 2.01 DESIGN LOADS............................ASCE 7-05
- 2.02 CONCRETE...................................ACI 318-05
- 2.03 MASONRY....................................ACI 530-05/ASCE 5-05/TMS 402-05
- 2.04 STEEL (ASD) ....AISC 360-05
- 2.05 STEEL (SEISMIC)...........................AISC 341-05
- 2.06 STEEL (COLD-FORMED LGS)........NAS 01 INCL. 2004 SUPPLEMENT
  - 2.06.1 GENERAL............................AISI GENERAL-04
  - 2.06.2 HEADER..............................AISI HEADER-04
  - 2.06.3 TRUSS ....AISI TRUSS-04
  - 2.06.4 WALL STUD.........................AISI WSD-04
  - 2.06.5 LATERAL.............................AISI LATERAL-04
- 2.07 WOOD (ASD)..................................AF&PA NDS-05

1. BUILDING CODE: 2006 IBC & UFC 1-200-01
2. GRAVITY LOADS:
   (DL):
   ROOF 20 psf
   EXTERIOR WALLS 15 psf
   INTERIOR WALLS 10 psf
   (LL):
   ROOF (REDUCIBLE): 20 psf
   GROUND SNOW, Po (BASE): 0 psf
3. WIND LOADS:
   BASIC WIND SPEED = 85 MPH (3 SECOND GUST)
   EXPOSURE = C
   IMPORTANCE = 1.0
4. Earthquake:
   Ss = 0.61
   S1 = 0.18
   SEISMIC USE GROUP = I
   IMPORTANCE FACTOR = 1.0
   SITE CLASS = D
   SEISMIC DESIGN CATEGORY = D
   RESPONSE COEEFICIENT, R = 5.5
   OVERSTRENGTH FACTOR, Wo = 2.5

GENERAL:
1. ALL DESIGN AND CONSTRUCTION SHALL COMPLY WITH THE 2006 INTERNATIONAL BUILDING CODE AND ALL APPLICABLE LOCAL ORDINANCES.

CONCRETE NOTES

1. THE EXTENT OF THE CONCRETE WORK IS SHOWN ON THE DRAWINGS.
2. SUBMITTALS ARE REQUIRED FOR REINFORCEMENT, CONCRETE MIXES, ADMIXTURES, CURING COMPOUNDS AND ANY OTHER ITEM AS REQUESTED BY THE C.Q.C.
3. CONCRETE TESTING SHALL BE PERFORMED PER ACI REQUIREMENTS:
   3.1) A MINIMUM OF ONE SAMPLE A DAY WITH NO LESS THAN 5 SAMPLES FOR A GIVEN CLASS OF CONCRETE, TAKEN FROM 5 RANDOMLY SELECTED BATCHES, OR FROM EACH BATCH IF LESS THAN 5 BATCHES ARE USED.
   3.2) A MINIMUM OF ONE SAMPLE PER 150 CUBIC YARDS.
   3.3) A MINIMUM OF ONE SAMPLE FOR EACH 5,000 SQUARE FEET OF SLAB OR WALL.
   3.4) IF LESS THAN 50 CUBIC YARDS OF A GIVEN CLASS OF CONCRETE IS NEEDED, THE NEED FOR STRENGTH TESTS MAY BE WAIVED WITH THE APPROVAL OF THE ENGINEER.
4. MATERIALS SHALL COMPLY WITH ACI 318-02. PORTLAND CEMENT SHALL BE PER ASTM C 150, TYPE I WITH NORMAL WEIGHT AGGREGATE PER ASTM C33. A 5% (±1.5) AIR ENTRAINING AGENT MAY BE USED IN ALL EXTERIOR CONCRETE. THIS AGENT SHALL BE PER ASTM C 260.
5. COMPRESSIVE STRENGTH OF CONCRETE (28 DAY STRENGTH) AS FOLLOWS:
   5.1) FOOTINGS: 3,000 PSI
   5.2) SLAB-ON-GRADE: 4,000 PSI
   5.3) LEAN CONC. 2,500 PSI
6. PROPORTION ALL MIX DESIGNS TO HAVE A MAXIMUM SLUMP OF 4 INCHES UNLESS SPECIFICALLY APPROVED BY THE ENGINEER.
7. THE MAXIMUM WATER/CEMENT RATIO SHALL BE LIMITED TO 0.45 UNLESS SPECIFICALLY APPROVED BY THE ENGINEER.
8. REINFORCEMENT STEEL: GRADE 60 FY = 60,000 PSI MIN. (ASTM A 615) WELDED WIRE FABRIC SHALL CONFORM TO ASTM A 185
9. ANCHOR BOLTS SHALL BE F1554-36 MATERIAL AND SHALL HAVE A MINIMUM EMBEDMENT OF THE GREATER OF 7 INCHES OR 12 DIAMETERS INTO THE CONCRETE UNLESS CALLED FOR OTHERWISE ON THE DRAWINGS. ALL THREADS SHALL BE CUT AND NOT ROLLED. THE EMBEDDED END SHALL CONSIST OF A HEAVY HEX NUT OR OTHER MECHANICAL ANCHOR. HOOK BOLTS ARE NOT ACCEPTABLE. ALL ANCHOR BOLTS MUST BE CLEANED OF OIL, RUST AND OTHER DELETERIOUS COATINGS PRIOR TO PLACEMENT. SET ALL EMBEDMENTS BY MEANS OF A TEMPLATE WHERE POSSIBLE.
10. DETAILING: ALL REINFORCING SHALL BE DETAILED, BOLSTERED AND SUPPORTED WITH ACI STANDARDS #315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCING CONCRETE STRUCTURES." NO LAP SPLICES SHALL BE USED IN VERTICAL PIER STEEL. STAGGER ALL SPLICES OF ALL HORIZONTAL REINFORCING.
11. CARE SHALL BE TAKEN TO PREVENT CURLING IN THE SLAB DURING CURING. BURLAP CURING OR OTHER MOISTURE CURE METHOD AS DESCRIBED IN SPECS SHALL BE UTILIZED.
12. PROVIDE CORNER REINFORCING TO MATCH CONTINOUS REINFORCMENT SIZE AND QUANITY AT INTERSECTIONS AND CORNERS OF WALLS AND FOOTINGS.
13. WALL, PIER AND COLUMN DOWELS SHALL BE THE SAME SIZE AND SPACING AS WALL, PIER AND COLUMN REINFORCING, UNLESS NOTED OTHERWISE.

EXECUTION:

14. THE CONCRETE FOUNDATIONS AND SLAB-ON-GRADE MUST BE PLACED ON ENGINEERED FILL, REFER TO SOILS REPORT OR ENGINEER'S RECOMMENDATIONS AS APPROPRIATE.
15. PLACEMENT OF CONCRETE SHALL BE PER ACI 318-05. CONCRETE SHALL BE DEPOSITED AS NEAR TO ITS FINAL POSITION AS POSSIBLE. ALL CONCRETE SHALL BE THOROUGHLY CONSOLIDATED AROUND REINFORCEMENT AND EMBEDDED ITEMS. ALL REINFORCING STEEL MUST BE FREE FROM DIRT, RUST AND OTHER DELETERIOUS MATERIAL PRIOR TO PLACEMENT. DOWELS, ANCHOR BOLTS, INSERTS, ETC. SHALL BE SECURELY TIED IN PLACE PRIOR TO POURING OF CONCRETE OR GROUT.
16. MINIMUM CONCRETE COVERS AS FOLLOWS:
    16.1) CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH: 3"
    CONCRETE PERMANENTLY EXPOSED TO EARTH OR WEATHER:
    16.2) NO. 5 BAR OR SMALLER: 1-1/2"
    16.3) NO. 6 BAR OR LARGER: 2"
    CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT
    16.4) WITH GROUND (TO NO. 11 BARS): 3/4"
17. PROVIDE CONTINUOUS 2" X 4" KEY-WAY IN ALL HORIZONTAL AND VERTICAL CONSTRUCTION JOINTS. OTHERWISE, ROUGHEN AND CLEAN ALL CONSTRUCTION JOINTS.
18. NO PIPES, DUCTS OR CONDUIT SHALL BE PLACED IN CONCRETE UNLESS SPECIFICALLY DETAILED OR NOTED.
19. NO ADMIXTURES SHALL BE USED WITHOUT THE APPROVAL OF THE ENGINEER. NO CALCIUM CHLORIDE SHALL BE USED.
20. PROVIDE CURING AND SEALING COMPOUND TO ALL EXPOSED INTERIOR SLABS AND TO ALL EXTERIOR SLABS, WALKS AND CURBS AS SOON AS FINAL FINISHING IS COMPLETE.
21. NOTIFY THE EOR AND THE BUILDING OFFICIAL WHEN REQ'D AT LEAST 48 HOURS PRIOR TO PLACING CONCRETE.

GENERAL NOTES:

1. ALL DRAWINGS ARE CONSIDERED TO BE A PART OF THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REVIEW AND COORDINATION OF ALL DRAWINGS AND SPECIFICATIONS PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE START OF CONSTRUCTION SO THAT A CLARIFICATION CAN BE ISSUED. ANY WORK PERFORMED IN CONFLICT WITH THE CONTRACT DOCUMENTS OR CODE REQUIREMENTS SHALL BE CORRECTED BY THE CONTRACTOR AT CONTRACTOR'S EXPENSE AND AT NO EXPENSE TO THE GOVERNMENT.
2. TYPICAL NOTES AND DETAILS SHALL APPLY UNLESS OTHERWISE SHOWN OR NOTED ON DRAWINGS.
3. DETAILS OF CONSTRUCTION NOT FULLY SHOWN SHALL BE OF THE SAME NATURE AS SHOWN FOR SIMILAR CONDITION.
4. ALL WORK SHALL CONFORM TO THE MINIMUM STANDARDS OF THE FOLLOWING CODES: 2006 INTERNATIONAL BUILDING CODE (IBC), AND LATEST REVISIONS REFERRED TO HERE AS "THE CODE", AND OTHER REGULATING AGENCIES WHICH HAVE AUTHORITY OVER ANY PORTION OF THE WORK, INCLUDING THE STATE OF CALIFORNIA DIVISION OF INDUSTRIAL SAFETY, AND THOSE CODES AND STANDARDS LISTED IN THESE NOTES AND SPECIFICATIONS.
5. NOTES AND DETAILS ON DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE GIVEN, CONSTRUCTION SHALL BE AS SHOWN FOR SIMILAR WORK. IF CONFLICTS OCCUR BETWEEN DRAWINGS AND SPECIFICATIONS, THE MORE RESTRICTIVE REQUIREMENT SHALL GOVERN. STRUCTURAL ENGINEER SHALL BE NOTIFIED OF CONFLICTS AND THAT PORTION OF WORK SHOULD NOT PROCEED UNTIL THE CONFLICT IS RESOLVED.
6. SEE ARCHITECTURAL DRAWINGS FOR THE FOLLOWING:
   6.1. SIZE AND LOCATION OF ALL DOOR AND WINDOW OPENINGS.
   6.2. SIZE AND LOCATIONS OF ALL INTERIOR AND EXTERIOR NON-BEARING PARTITIONS.
   6.3. SIZE AND LOCATION OF ALL CONCRETE CURBS, EQUIPMENT PADS, PITS, FLOOR DRAINS, SLOPES, DEPRESSED AREAS, CHANGE IN LEVEL, CHAMFERS, GROOVES, INSERTS, ETC.
   6.4. SIZE AND LOCATION OF ALL FLOOR AND ROOF OPENINGS EXCEPT AS SHOWN.
   6.5. FLOOR AND ROOF FINISHES.
   6.6. DIMENSIONS NOT SHOWN ON STRUCTURAL DRAWINGS.
7. SEE MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR THE FOLLOWING:
   7.1. PIPE RUNS, SLEEVES, HANGERS, TRENCHES, WALL AND SLAB OPENINGS, ETC. EXCEPT AS SHOWN OR NOTED.
   7.2. ELECTRICAL CONDUIT RUNS, BOXES, OUTLETS IN WALL OR SLABS.
   7.3. CONCRETE INSERTS FOR ELECTRICAL, MECHANICAL OR PLUMBING FIXTURES.
   7.4. SIZE AND LOCATION OF MACHINE OR EQUIPMENT BASES AND ANCHOR BOLTS FOR MOTOR MOUNTS.
8. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION.
9. ASTM SPECIFICATIONS ON THE DRAWINGS SHALL BE OF THE LATEST REVISION.
10. CONSTRUCTION MATERIAL SHALL BE SPREAD OUT IF PLACED ON FRAMED ROOF OR FLOOR. LOAD SHALL NOT EXCEED DESIGN LIVE LOAD PER SQUARE FOOT. PROVIDE ADEQUATE SHORING AND/OR BRACING WHERE STRUCTURE HAS NOT ATTAINED DESIGN STRENGTH.
11. HEAVY EQUIPMENT, CRANES AND MATERIAL STOCKPILES SHALL NOT BE LOCATED ON OR ADJACENT TO SHORING.
12. SUBSTITUTIONS FOR STRUCTURAL MEMBERS, HARDWARE, OR DETAILS SHALL BE REVIEWED BY THE ARCHITECT AND STRUCTURAL ENGINEER AND APPROVED BY THE APPROPRIATE AGENCY. FOR A SUBSTITUTION TO BE REVIEWED THE CONTRACTOR SHALL AGREE AND COMPLY WITH THE FOLLOWING:
    12.1. THE CONTRACTOR SHALL BE BILLED ON A TIME AND MATERIALS BASIS FOR THE REVIEW OF THE SUBSTITUTION WITH NO GUARANTEE OF APPROVAL.
    12.2. VERIFY THAT THE SUBSTITUTION DOES NOT AFFECT DIMENSIONS SHOWN ON DRAWINGS.
    12.3. THE CONTRACTOR SHALL ALSO PAY FOR CHANGES TO THE BUILDING DESIGN, WHICH INCLUDES BUT IS NOT LIMITED TO; ENGINEERING DESIGN, DETAILING, APPROVAL AGENCY PROCESS AND CONSTRUCTION COSTS CAUSED BY THE REQUESTED SUBSTITUTION.
    12.4. THE PROPOSED SUBSTITUTION IS TO HAVE NO ADVERSE AFFECT ON OTHER TRADES, THE CONSTRUCTION SCHEDULE, OR THE SPECIFIED WARRANTY REQUIREMENTS.
13. NO STRUCTURAL MEMBERS SHALL BE CUT, NOTCHED OR OTHERWISE PENETRATED UNLESS SPECIFICALLY APPROVED BY THE STRUCTURAL ENGINEER IN ADVANCE OR SHOWN ON THESE DRAWINGS.
14. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO STARTING CONSTRUCTION. DIMENSIONS AND ELEVATIONS MUST BE VERIFIED WITH ARCHITECTURAL DRAWINGS. IN THE EVENT OF A CONFLICT, THE STRUCTURAL ENGINEER AND ARCHITECT ARE TO BE NOTIFIED IMMEDIATELY. DRAWING SCALES GIVEN ARE APPROXIMATE- DO NOT SCALE PLANS OR DETAILS.
15. SITE VISITS BY STRUCTURAL ENGINEER SHALL NOT BE IN LIEU OF INSPECTIONS.
16. LAP SPLICES SHALL BE IN ACCORDANCE WITH THE FOLLOWING TABLE, UNLESS NOTED OTHERWISE. WHERE CLASSES ARE NOT CALLED OUT ON THE DRAWINGS, USE CLASS "B" SPLICES.

BAR SIZE	TENSION SPLICES (INCHES) TOP BARS "A"	"B"	OTHER BARS "A"	"B"	COMPRESSION SPLICES (INCHES)
#3	16	21	12	16	12
#4	21	28	16	21	15
#5	27	35	21	27	19
#6	35	46	27	35	23
#7	48	62	37	48	26
#8	63	82	48	63	30
#9	80	104	61	80	34
#10	101	131	78	101	38
#11	125	162	96	125	42

COMPRESSION DOWEL EMBEDMENT: 22 BAR DIAMETERS. LAP WELDED FABRIC ONE SPACING OF CROSS WIRES PLUS 2 INCHES.

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

DESIGNED BY: M. WIDMANN
DRAWN BY: D. LARSON
CHECKED BY: N/A

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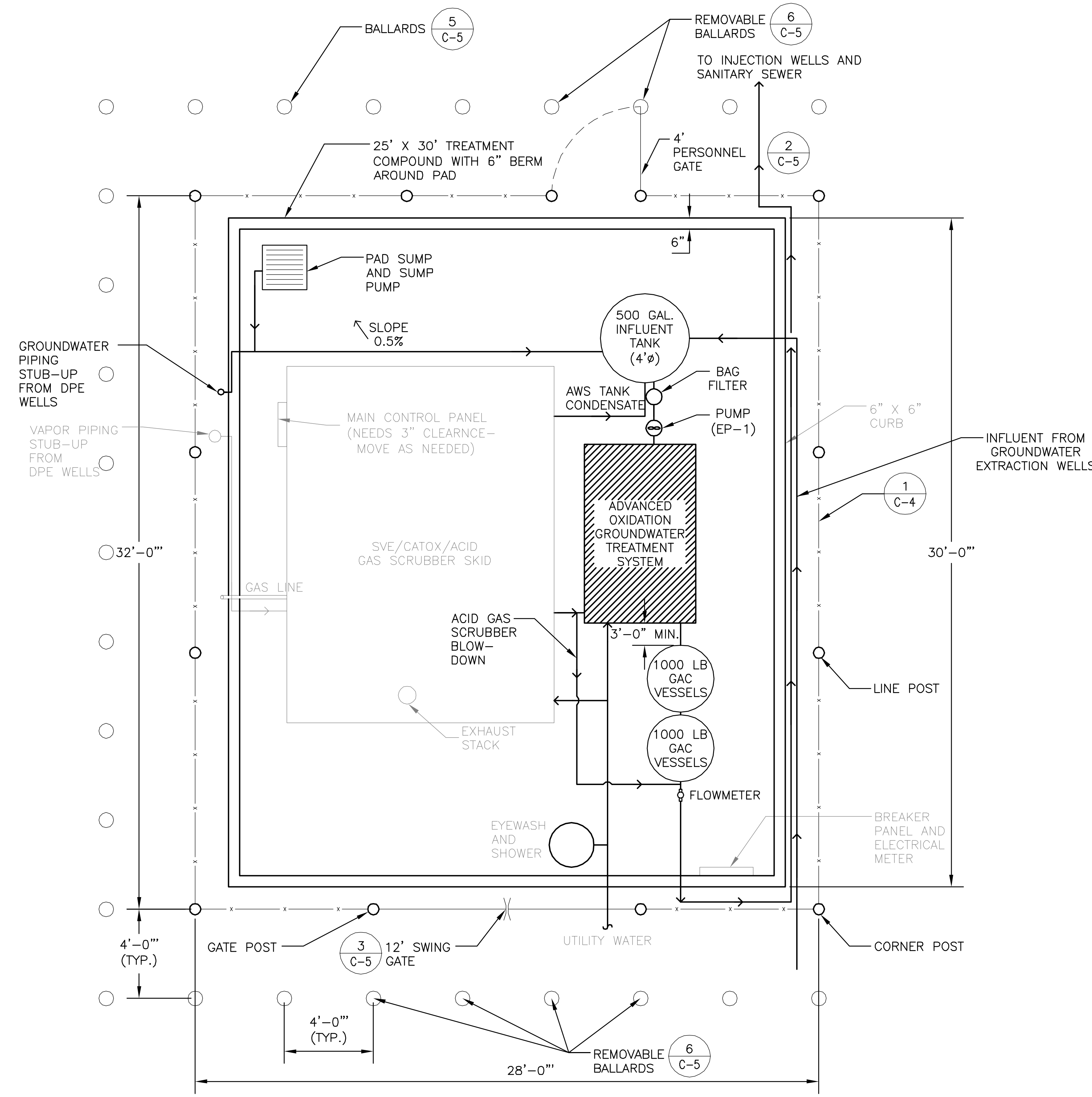
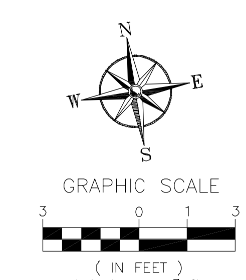
REGISTERED PROFESSIONAL ENGINEER
M. Klsabull
No. S-4087
EXP. 09-30-07
STRUCTURAL
STATE OF CALIFORNIA

SOIL REMEDIAL DESIGN
COOPER DRUM COMPANY SUPERFUND SITE
9316 SOUTH ATLANTIC AVE, SOUTH GATE
LOS ANGELES COUNTY , CALIFORNIA 90280

ABBREVIATIONS, GENERAL NOTES,DESIGN CRITERIA FOUNDATION, CONCRETE AND REBAR NOTES

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/30/2007	S-3.dwg	S-0





NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

DESIGNED BY: M.WIDMANN
DRAWN BY: D. LARSON
CHECKED BY: N/A

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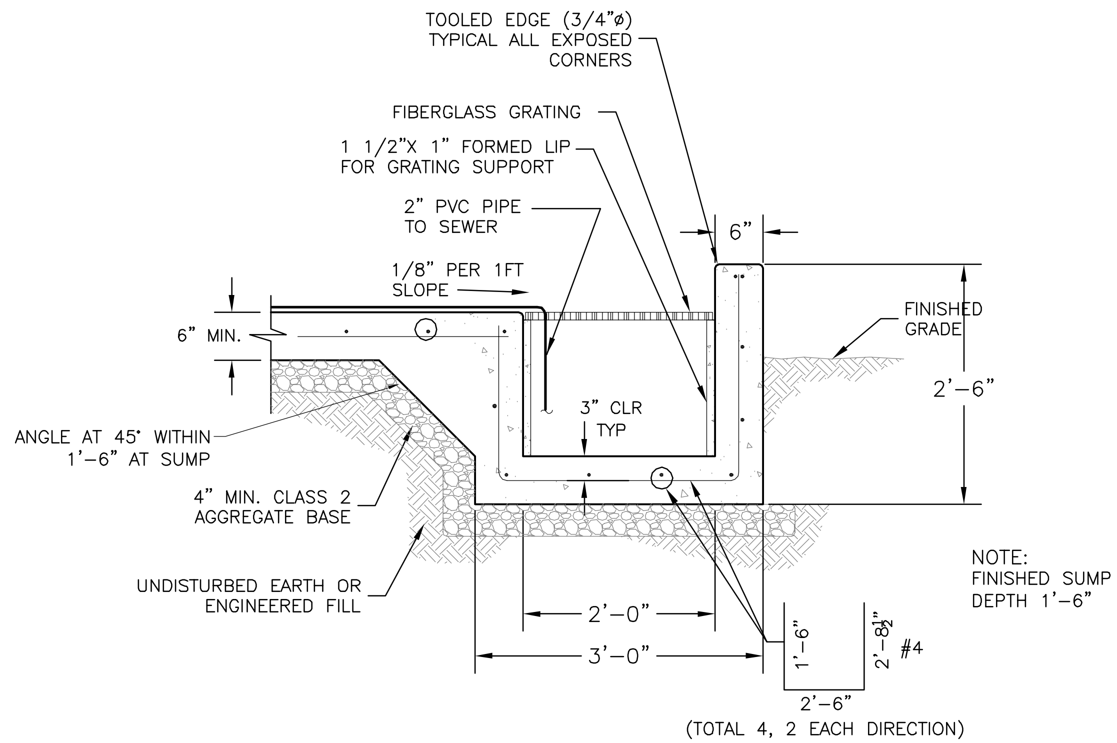
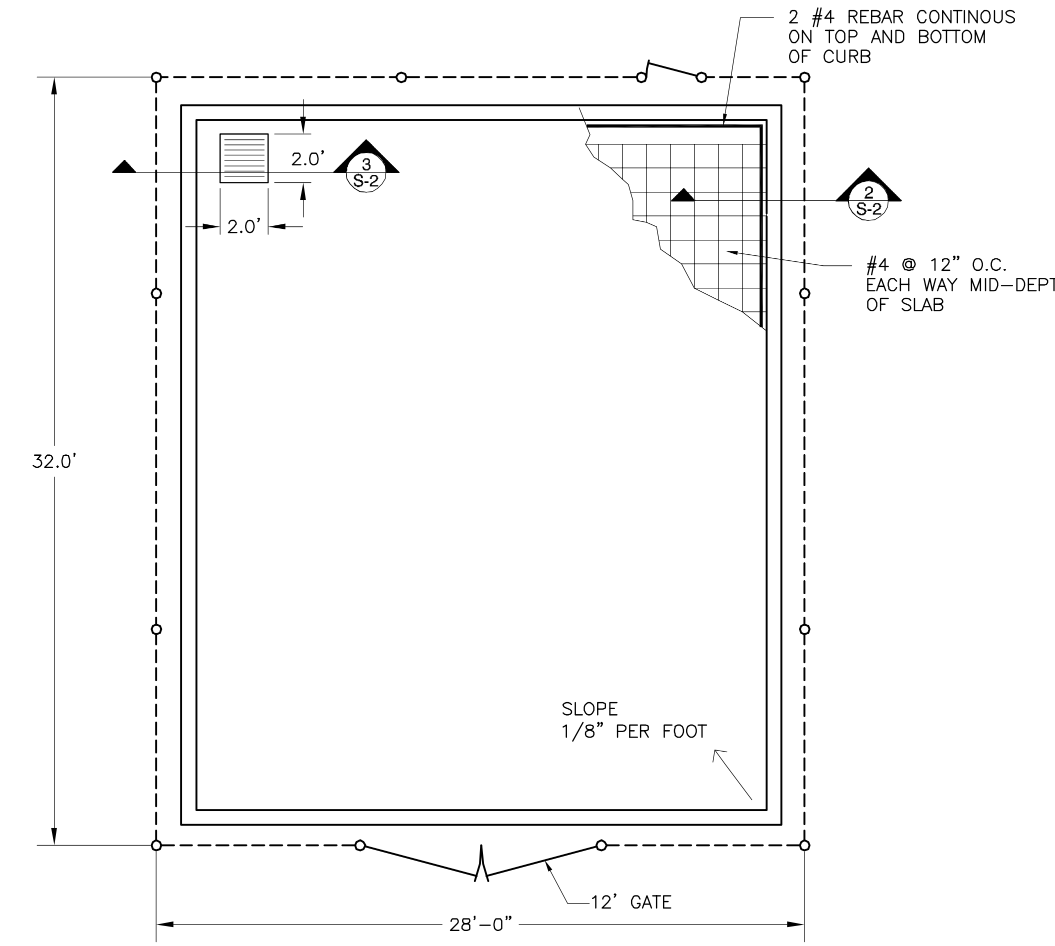
TREATMENT COMPOUND PLAN

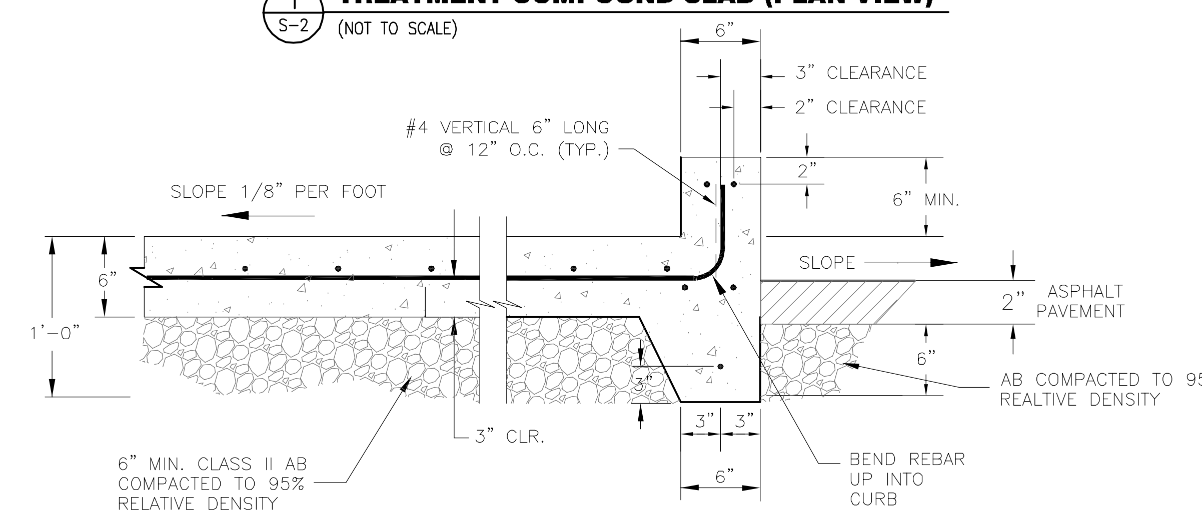
SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=3'-0"	8/23/2007	S-1.dwg	S-1



3/S-2 **SUMP DETAIL**
(NOT TO SCALE)



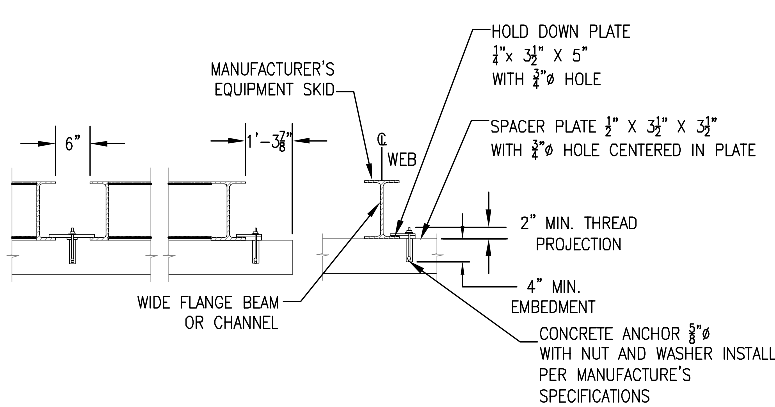
1/S-2 **TREATMENT COMPOUND SLAB (PLAN VIEW)**
(NOT TO SCALE)



NOTES:

1) USE 2,500 PSI CONCRETE @ 28 DAYS

2/– **FOOTING AND SLAB (CROSS-SECTION)**
(NOT TO SCALE)



4/S-2 **PROPOSED EQUIPMENT SKID HOLD DOWN PLATE DETAIL**
(NOT TO SCALE)

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

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CHECKED BY: N/A

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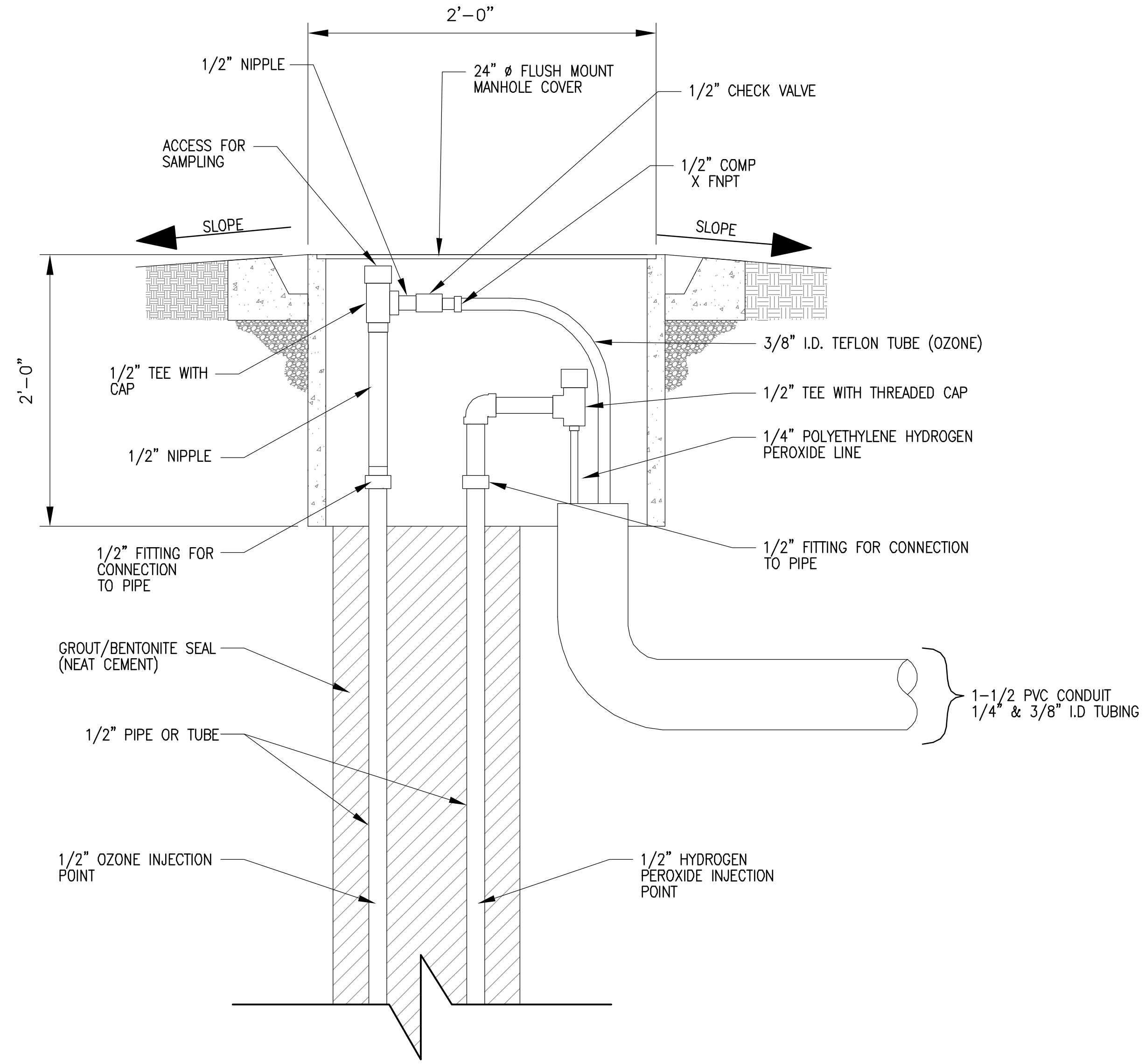
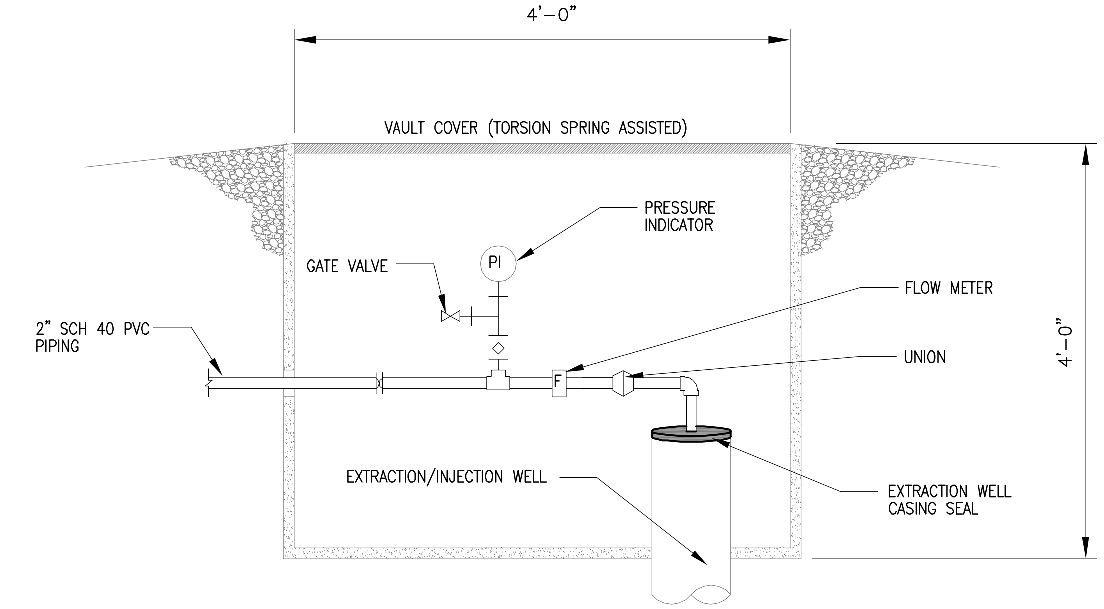
CONCRETE DETAILS

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/22/2007	S-2.dwg	S-2

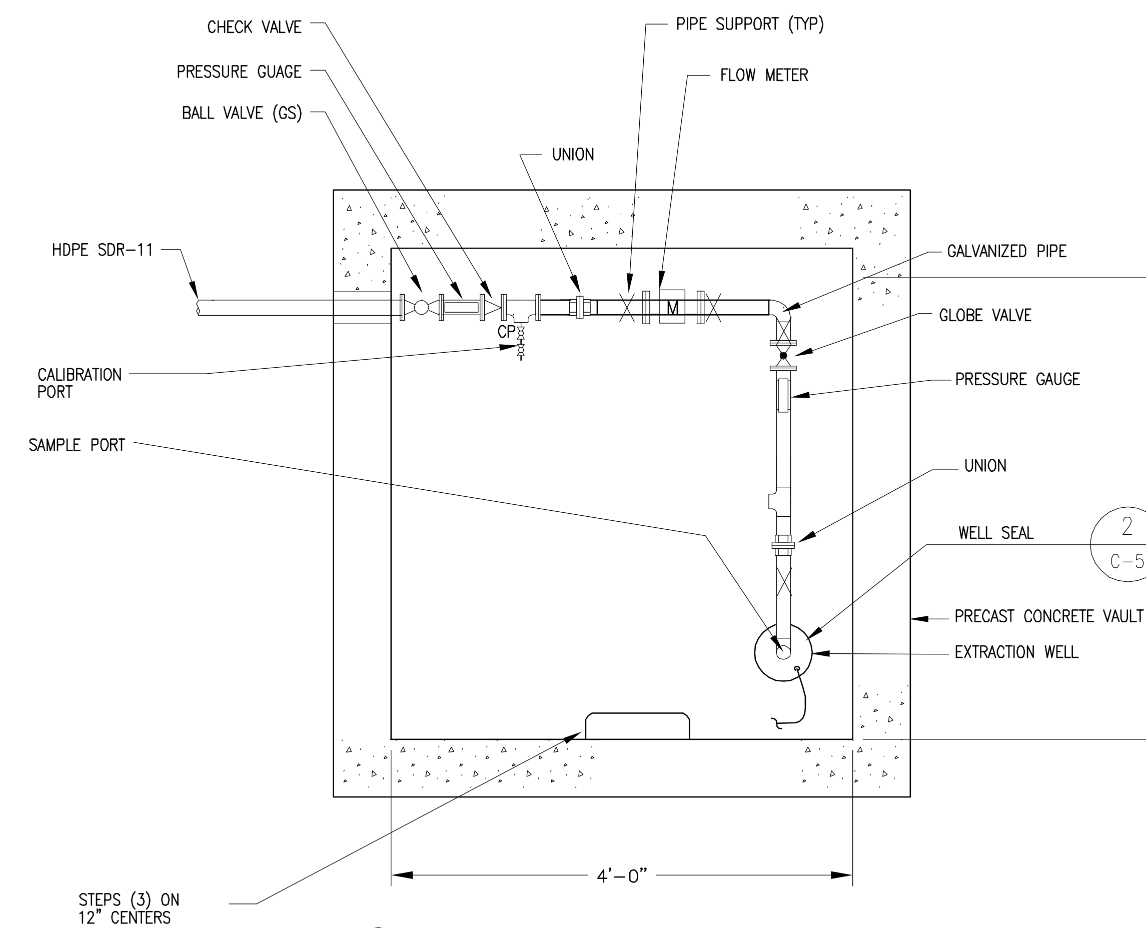


1 / C-1 TYPICAL OZONE/PEROXIDE INJECTION WELL HEAD DETAILS
NTS

NOTE:
1. ALL PIPING/TUBING DIMENSIONS SHOWN ARE TYPICAL FOR OZONE/PERIXIDE INJECTION.
2. ACTUAL DIMENSIONS MAY VARY DEPENDING ON THE VENDOR SELECTED AND OTHER ENGINEERING FACTORS.



3 / M-1 TYPICAL EXTRACTION WELL VAULT DETAIL PROFILE
NTS



2 / C-1 C-2 TYPICAL EXTRACTION WELL VAULT DETAIL PLAN
NTS

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

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TYPICAL WELL HEAD DEATILS - OZONE/PEROXIDE WELL AND EXTRACTION/INJECTION WELL

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/23/2007	M-1.dwg	M-1

GENERAL NOTES:

1. FURNISH AND INSTALL ALL NECESSARY LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS REQUIRED TO INSTALL COMPLETE AND OPERATIONAL ELECTRICAL SYSTEMS ACCORDING TO THE INTENT OF THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WHETHER ITEMIZED OR NOT.
2. EXAMINE THE DRAWINGS FOR MECHANICAL EQUIPMENT AND PROVIDE STARTERS, CIRCUIT BREAKERS, SWITCHES, PUSHBUTTONS AND APPURTENANCES WHICH ARE NOT SPECIFIED TO BE WITH THE MECHANICAL EQUIPMENT. ERECT ALL ELECTRICAL EQUIPMENT NOT DEFINITELY STATED TO BE ERECTED BY OTHERS, FURNISH AND INSTALL CONDUIT WIRE AND CABLE AND MAKE CONNECTIONS REQUIRED TO PLACE ALL EQUIPMENT IN COMPLETE OPERATION.
3. THE ELECTRICAL CONTRACTOR SHALL HAVE THOROUGHLY EXAMINED THE SITE AND FAMILIARIZED HIMSELF WITH THE EXISTING CONDITIONS, AND SHALL HAVE MADE ALLOWANCE THEREFORE IN PREPARING HIS PROPOSAL . HE SHALL VERIFY EXISTING CONDITIONS, PULLBOXES, ELECTRICAL DISTRIBUTION SYSTEMS AND DEMOLITION REQUIREMENTS PRIOR TO SUBMITTING A BID.
4. IN THE EVENT OF DISCREPENCIES BETWEEN EXISTING CONDITIONS AND THE DRAWINGS, THE ELECTRICAL CONTRACTOR SHALL BID NEW CONDITIONS, WIRES AND NECESSARY EQUIPMENT IN ORDER TO COMPLETE THE JOB AND PROVIDE A FULLY OPERABLE AND AND ACCEPTABLE SYSTEMS. EXTRAS WILL NOT BE ALLOWED FOR WORK NOT INDICATED OR NOTED ON THE DRAWINGS WHEN SUCH WORK IS APPARENT FROM AN INSPECTION OF THE PREMISES AT THAT TIME .
5. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING CONTINUITY OF EXISTING ELECTRICAL CIRCUITS BEING USED FOR EXISTING LIGHTING AND RECEPTACLES TO REMAIN WHETHER INDICATED OR NOT. VERIFY USAGE FOR ALL BRANCH CIRCUITS IN EXISTING PANELBOARDS AND ADJUST CIRCUITS AS NECESSARY. DOCUMENT PANEL CIRCUIT DIRECTORIES ON AS BUILT DRAWINGS AND PROVIED TYPE WRITTEN DIRECTORY CARDS FOR ALL PANELBOARDS.
6. ALL MATERIALS USED ON THIS PROJECT SHALL BE LISTED AND BEAR THE LABEL OF UNDERWRITERS LABORTORIES. AND APPROVED FOR ITS INTENDED USE .
7. ELECTRICAL WORK SHALL CONFORM TO THE 2004 CALIFORNIA ELECTRICAL CODE AND COUNTY OF LOS ANGELES CODES.
8. FIRE SEAL AROUND ALL CONDUITS PENETRATIONS THROUGH FIRE BARRIERS WITH AN APPROVED FIRE SEALANT EQUAL TO THE RATING OF THE SURFACE PENETRATED. FIRE SEAL INSIDE OF CONDUIT AFTER CONDUCTOR INSTALLATION .

ABBREVIATIONS:

120V	120 VOLTS
C O	CONDUIT ONLY
C	CONDUIT
CONT	CONTROLS
(E)	EXISTING
EL	EMERGENCY LIGHT
EOL	INDICATES DEVICE w/ END-OF-LINE RESISTOR
FACP	FIRE ALARM CONTROL PANEL
MT	EMPTY CONDUIT WITH PULLSTRING
(N)	NEW
NIES	NOT INCLUDED ELECTRICAL SCOPE
NL	NIGHT LIGHT
PFB	PROVIDE FOR FUTURE BREAKER
(R)	REMOVE
(RE)	RELOCATE EXISTING
UNO	UNLESS NOTED OTHERWISE
WP	WEATHERPROOF

LEGEND:

- FLUORESCENT LIGHT FIXTURE – RECESSED WITH INTEGRAL BATTERY PACK FOR EMERGENCY OPERATION
- 2g FLUORESCENT LIGHT FIXTURE – RECESSED, NUMBER DENOTES CIRCUIT, LETTER DENOTES SWITCH DESIGNATION
- FLUORESCENT HID LIGHT FIXTURE – RECESSED
- HID LIGHT FIXTURE – WALL MOUNTED
- SINGLE POLE TOGGLE SWITCH, @ +46" UNO
- 2 TWO POLE TOGGLE SWITCH, @ +46" UNO
- 3 THREE-WAY TOGGLE SWITCH, @ +46" UNO
- M MOTOR RATED SINGLE POLE SWITCH, @ UNIT UNO
- (A) FIXTURE TAG: LETTER INDICATES TYPE
- JUNCTION BOX, SIZE & TYPE AS INDICATED OR AS REQUIRED
- 20 AMP 125V 3W DUPLEX RECEPTACLE, @ +18" UNO
- 20 AMP 125V 3W DUPLEX RECEPTACLE WITH GFCI, ABOVE COUNTER SPLASH
- DEDICATED CIRCUIT RECEPTACLE, 20 AMP 125V 3W DUPLEX, @ +18" UNO
- 20 AMP 125V 3W DOUBLE DUPLEX RECEPTACLE, @ +18" UNO
- NON-FUSED DISCONNECT SWITCH
- CIRCUIT BREAKER DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH, SIZE PER UNIT LABEL
- MOTOR, N.I.E.S. CONNECT AS REQUIRED, NUMBER INDICATES HP
- CONTROL EQUIPMENT. CONNECT AS REQUIRED
- PANELBOARD – SURFACE MOUNTED – SEE SCHEDULE
- TELEPHONE OUTLET, 4" SQ. BOX w/ SINGLE DEVICE RING & PLATE @ +18" UNO
- DATA OUTLET, 4" SQ. BOX w/ SINGLE DEVICE RING & PLATE @ +18" UNO
- CONDUIT CONCEALED IN CEILING OR WALL
- HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET – OVERHEAD
- HOMERUN TO RESPECTIVE PANEL OR TERMINAL CABINET – UNDERGROUND
- CONDUIT RISER – UP
- CONDUIT RISER – DOWN

BRANCH CIRCUIT WITHOUT FURTHER DESIGNATION INDICATES A 2 #12 WIRE CIRCUIT AND 1#12 GROUND WIRE. ALL CONDUITS AND RACEWAY MUST HAVE AN INSULATED GROUND WIRE SIZED PER NEC 250.122, CONDUIT SIZE SHALL BE 3/4" UNO.

- UNDERGROUND CONDUIT OU1 RA
- UNDERGROUND CONDUIT OU2 RA
- FLAG NOTE SHOWN ON SAME SHEET
- A / E1.0 SECTION DESIGNATION; TOP LETTER INDICATES SECTION, BOTTOM LETTER/NUMBER INDICATES SHEET
- 1 / E1.0 DETAIL DESIGNATION; TOP NUMBER INDICATES DETAIL, BOTTOM LETTER/NUMBER INDICATES SHEET
- MECHANICAL & PLUMBING EQUIPMENT DESIGNATION
- LINE VOLTAGE THERMOSTAT, NIES, INSTALL & CONNECT AS REQUIRED
- TELEVISION OUTLET
- EMERGENCY CALL OUTLET
- P PUBLIC TELEPHONE OUTLET
- SPECIAL OUTLET. SEE PLANS FOR SPECIFICATION
- SEALING FITTING WITH SEALING COMPOUND FOR CLASS 1, DIV. 1

NOTE: SYMBOLS INDICATED ABOVE MAY NOT NECESSARILY APPEAR AS PART OF THESE DRAWINGS IF NOT REQUIRED.

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

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Exp. 12-31-06
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STATE OF CALIFORNIA

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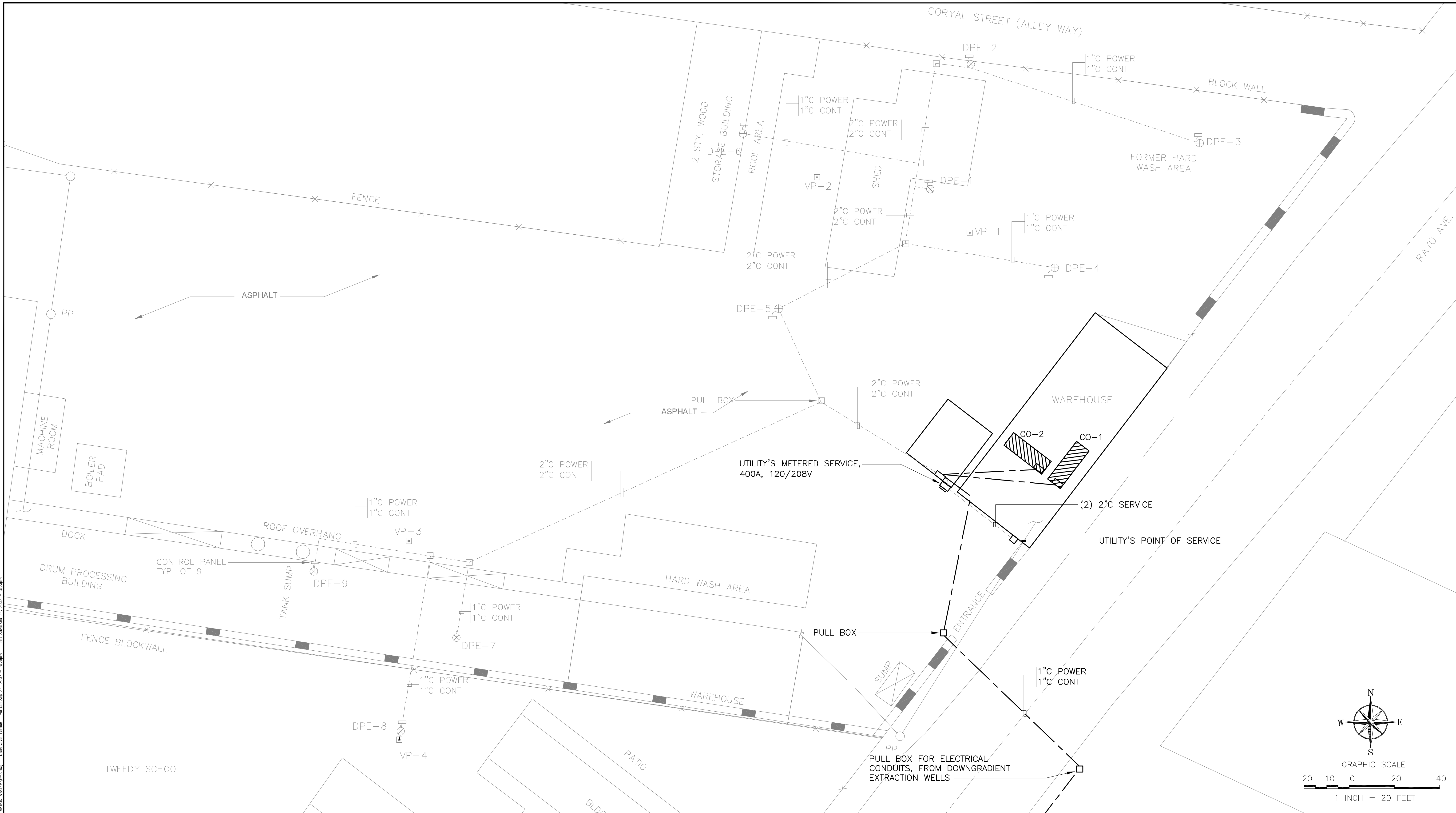
ELECTRICAL GENERAL NOTES AND SYMBOLS

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/22/2007	E-1.dwg	E-1



SEE CONTINUATION ON SHEET E-3

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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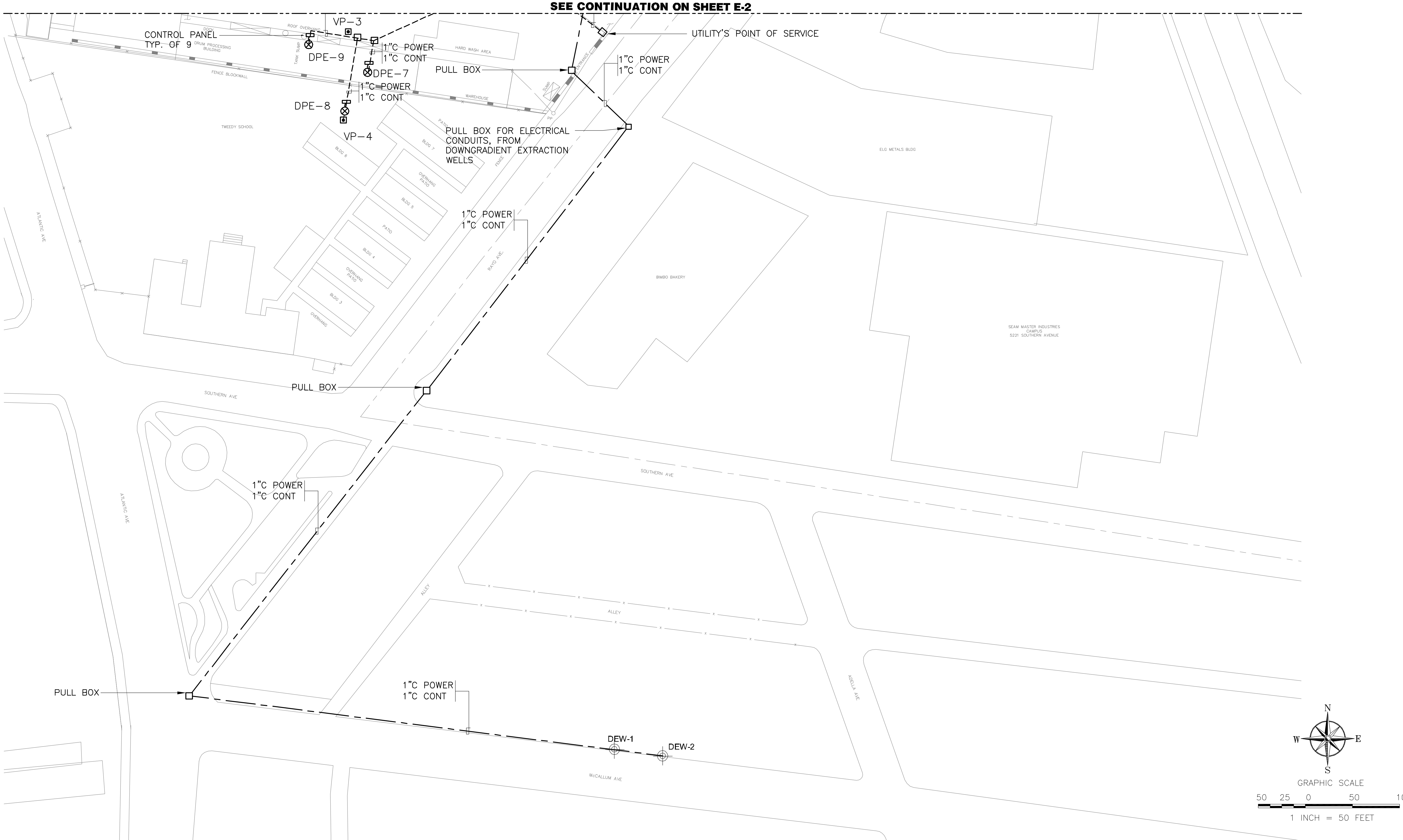
ELECTRICAL SITE PLAN

SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=20'-0"	8/22/2007	E-2.dwg	E-2

SEE CONTINUATION ON SHEET E-2



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LOS ANGELES COUNTY , CALIFORNIA 90280

ELECTRICAL SITE PLAN
DOWN GRADIENT EXTRACTION WELLS

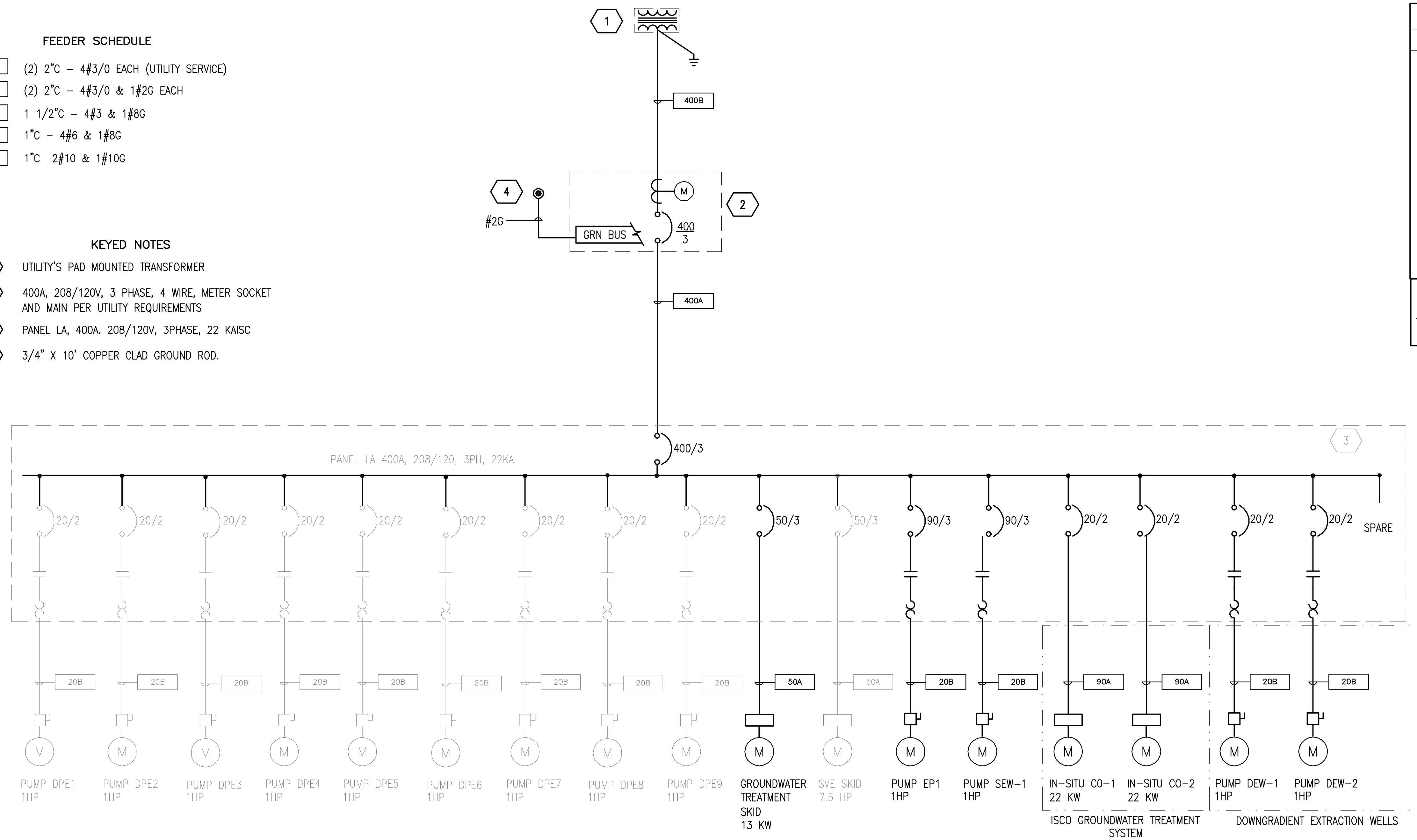
SCALE:	DATE:	DWG. FILE:	SHEET NO.
1"=50'-0"	8/22/2007	E-2.dwg	E-3

FEEDER SCHEDULE

400B	(2) 2"C – 4#3/0 EACH (UTILITY SERVICE)
400A	(2) 2"C – 4#3/0 & 1#2G EACH
90A	1 1/2"C – 4#3 & 1#8G
50A	1"C – 4#6 & 1#8G
20B	1"C 2#10 & 1#10G

KEYED NOTES

1. UTILITY'S PAD MOUNTED TRANSFORMER
2. 400A, 208/120V, 3 PHASE, 4 WIRE, METER SOCKET AND MAIN PER UTILITY REQUIREMENTS
3. PANEL LA, 400A. 208/120V, 3PHASE, 22 KAISC
4. 3/4" X 10' COPPER CLAD GROUND ROD.



SINGLE LINE DIAGRAM

LOAD SUMMARY

EQUIPMENT	RATING	LOAD
WELL SUMP PUMP DPE-1 TO DPE-9	(9) 2 HP	18,000 VA
SVE SKID	7 1/2 HP	7,500 VA
GROUNDWATER TREATMENT SKID	13 KW	13,000 VA
EXTRACTION PUMPS	(2) 2 HP	4,000 VA
PUMP DEW-1 AND DEW-2	(2) 2 HP	4,000 VA
IN-SITU CHEM. OXIDATION 1	22 KW	22,000 VA
IN-SITU CHEM. OXIDATION 2	22 KW	22,000 VA
RECEPTACLES	.2 KW	200 VA
MISCELLANEOUS	.2 KW	400 VA
TOTAL		91,100 VA
TOTAL AMPS AT 208V, 3PH		253 AMPS

PANEL "LA" SCHEDULE

POWER SOURCE: SERVICE | LOCATION: ELECT RM | 208

TYPE: POWRLINE | BUS: 400A | MAIN 400A | VOLTAGE: 208Y/120 VOLT, 3 PHASE, 4 WIRES | MOUNTING: SURFACE | REMARKS: 22k AIC MIN. SYMM

LOAD SERVED	kvA	CB	CT	PHASE	CT	CB	kvA	LOAD SERVED
SUB PUMP DPE-1	0.9	20/2	1	A	2	50/3	3.1	SVE SKID
	0.9		3	B	4		3.1	
SUB PUMP DPE-2	0.9	20/2	5	C	6		3.1	
	0.9		7	A	8	50/3	4.4	HCU SKID
SUB PUMP DPE-3	0.9	20/2	9	B	10		4.4	
	0.9		11	C	12		4.4	
SUB PUMP DPE-4	0.9	20/2	13	A	14	20/1	0.9	DEW-2
	0.9		15	B	16	20/1	0.9	
SUB PUMP DPE-5	0.9	20/2	17	C	18	20/1		SPARE
	0.9		19	A	20	20/2	0.9	PUMP EPE-1
SUB PUMP DPE-6	0.9	20/2	21	B	22		0.9	
	0.9		23	C	24	20/2	0.9	PUMP SEW-1
SUB PUMP DPE-7	0.9	20/2	25	A	26		0.9	
	0.9		27	B	28	20/2	0.9	PUMP DEW-2
SUB PUMP DPE-8	0.9	20/2	29	C	30		0.9	
	0.9		31	A	32	90/3	7.3	IN-SITU C0-1
SUB PUMP DPE-9	0.9	20/2	33	B	34		7.3	
	0.9		35	C	36		7.3	
RECEP.	0.2	20/1	37	A	38	90/3	7.3	IN-SITU CO-2
MISC.	0.2	20/1	39	B	40		7.3	
SCADA	0.2	20/1	41	C	42		7.3	

NOTE(S):

PHASE A= 30.4 kvA
PHASE B= 30.4 kvA
PHASE C= 29.5 kvA

TOTAL = 90.3 kvA
TOTAL = 250.8 Amperes

NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

REVISIONS

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SINGLE LINE DIAGRAM

SCALE:	DATE:	DWG. FILE:	SHEET NO.
N.T.S.	8/22/2007	E-3.dwg	E-4

Cost Estimate Summary For The Selected Remedy For Groundwater	
Description	**Cost**
Capital Costs	
Construction	
ISCO install	$262,763
Above Ground Treatment Process install	$46,140
Treatment Compound Slab	$22,368
Treatment Compound Fence and Bollards	$23,250
Bio Barrier Install	$692,368
POTW Connection Fee	$247,125
Monitor well Install	$162,800
Treatment Trenching and Piping (Source Area)	$127,774
Treatment Trenching and Piping (Downgradient)	$143,750
Extraction and Injection Wellheads and Equipment Install (Source Area)	$128,200
Extraction Wellheads and Equipment Install (Downgradient)	$86,973
SCADA System	$25,000
Initial Startup Test	$13,500
Subtotal (construction)	$1,982,011
Bid contingencies(5% of total)	$99,101
Report preparation (RAWP, HASP, Plans, Final O&M)(5% of total)	$99,101
Field and laboratory testing during construction (1% of total)	$19,820
Reporting during construction (1% of total)	$19,820
Total Capital Cost	**$2,219,852**
OPERATIONS AND MAINTENANCE COSTS	
Subtotal O&M (discounted first three years) [a]	$929,557
Subtotal O&M (Remaining 17 years discounted) Downgradient	$1,650,387
Subtotal O&M (Discounted)	**$2,579,944**
MONITORING AND REPORTING	
Subtotal Monitoring and Reporting (Total Time- 23 yr) [a,b]	**$1,230,383**
TOTAL COST	**$6,030,179**

Date: September 13, 2007

Note: Inflation rates for 2007 through 2030 (As provided in the ROD) was factored into the 7% discount

[a] A 7% discount assumed for 20 years of O&M operation

[b] Closure sampling is assumed to occur in 2031

Detail Cost Sheet

Source Area O&M Costs					
O&M Labor Annual					$21,600
Liquid Carbon Change Out Annual					$2,000
Hydrogen Peroxide Annual					$2,761
Electricity Annual 64 kw per design drawing E-4					$72,883
O&M Labor Downgradient Extraction wWells Annual					$7,200
System service life costs Annual					$5,384
POTW permit cost Annual					$21,181
ISCO Rental Annual					$192,000
Advanced oxidation process Rental Annual					$54,000
Subtotal O&M Annual (base value)					$379,009
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.8734	$331,026	
2	1.066	0.8163	0.8163	$309,385	
3	1.093	0.7629	0.7629	$289,146	
TOTAL Present Value O&M 3 years				**$929,557**	

Down Gradient Containment and Treatment O&M Costs					
O&M Labor Source Area Annual					$21,600
Liquid Carbon Change Out Annual					$2,000
Hydrogen Peroxide Annual					$2,761
Electricity Annual based on 20 kw per design drawing E-4					$22,776
O&M Labor Downgradient Annual					$7,200
System service life costs Annual					$5,384
POTW permit cost Annual					$21,181
Advanced oxidation process Rental Annual					$54,000
Subtotal O&M Annual (Base value)					**$136,902**
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
4	1.12	0.8734	0.98	$133,915	
5	1.15	0.8163	0.94	$128,289	
6	1.18	0.7629	0.90	$122,894	
7	1.21	0.7130	0.86	$117,727	
8	1.24	0.6663	0.82	$112,766	
9	1.27	0.6227	0.79	$108,022	
10	1.30	0.5820	0.76	$103,486	
11	1.33	0.5439	0.72	$99,129	
12	1.36	0.5083	0.69	$94,957	
13	1.40	0.4751	0.66	$90,973	
14	1.43	0.4440	0.64	$87,144	
15	1.47	0.4150	0.61	$83,488	
16	1.51	0.3878	0.58	$79,967	
17	1.54	0.3624	0.56	$76,597	
18	1.58	0.3387	0.54	$73,378	
19	1.62	0.3166	0.51	$70,305	
20	1.66	0.2959	0.49	$67,351	
TOTAL Present Value 17years following the initial 3 years				**$1,650,387**	

OU 1 Source Area Strategy - Capital Costs

Item	Unit Cost	Unit	Quantity	Extended Cost
ISCO Costs				
ISCO injection points	$750	ea	24	$18,000
ISCO wellhead kits	$750	ea	24	$18,000
Sparge well install	$12,500	well	12	$150,000
Conveyance piping (including ozone and hydrogen peroxide)	$6	ft	750	$4,500
Conveyance tubing	$2.25	ft	650	$1,463
Electrical Installation	$51,800	LS	1	$51,800
Permit costs	$3,000	LS	1	$3,000
ISCO ODC's (including demob)	$10,000	LS	1	$10,000
Startup O&M Labor	$6,000	LS	1	$6,000
Subtotal				$262,763
ISCO system install and startup assist	$1,500	day	9	$13,500
Trenching costs (including labor, material costs)	$127,774	LS	1	$127,774
TOTAL				$404,037
Treatment Equipment Costs				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Install and startup assist	$1,500	day	5	$7,500
Demobilization costs	$1,500	unit	1	$1,500
Liquid GAC costs	$35,640	LS	1	$35,640
Freight costs (in and out)	$4,500	RT	2	$9,000
Subtotal				$46,140
Treatment pad installation and setup	$45,618	ea	1	$45,618
TOTAL				$145,398
Extraction Well Install				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Extraction well (20 gpm)	$30,000	ea	1	$30,000
Conveyance piping to well	$2.25	foot	200	$450
Submersible pump cost	$1,100	ea	1	$1,100
Flow meters	$3,100	ea	1	$3,100
Valves and fittings	$100	ea	10	$1,000
Traffic-Rated Well vaults	$5,000	ea	1	$5,000
Subtotal				$40,650
Injection Well Install				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Injection well (25 gpm)	$30,000	ea	2	$60,000
Conveyance piping to well	$2.25	foot	600	$1,350
Injection pump to well	$900	ea	2	$1,800
Flow meters	$3,100	ea	4	$12,400
Valves and fittings	$100	ea	20	$2,000
Traffic-Rated Well vaults	$5,000	ea	2	$10,000
Subtotal				$87,550
Total Extraction and Injection Wells				$128,200
Accessories				
Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
SCADA system	$25,000	ea	1	$25,000

OU 1 Source Area Strategy - Recurring (O&M) Costs

Item	Unit Cost	Unit	Quantity	Extended Cost
Preventative maintenance	$5,384	year	1	$5,384
O&M labor	$1,800	month	12	$21,600
Electricity based on 64 Kw for 24/7 operation 365yr	$0.13	kWh	560,640	$72,883
Electrical based on design drawings E-4				
Hydrogen peroxide	$2,761	year	1	$2,761
Liquid GAC changeouts	$2,000	year	1	$2,000
Ex-situ oxidation treatment unit rental	$4,500	month	12	$54,000
ISCO treatment unit rental	$16,000	month	12	$192,000

OU 1 Downgradient Area Strategy - Capital Costs

Extraction Well Installation **Item**	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Extraction well (2*25 gpm per well)	$30,000	ea	2	$60,000
Conveyance piping to well	$2.53	foot	1150	$2,913
Submersible pump, well equip cost	$4,430	ea	2	$8,860
Well electrical permit cost	$3,000	ea	1	$3,000
Flow meters	$3,100	ea	2	$6,200
Valves and fittings	$100	ea	10	$1,000
Traffic-Rated Well vaults	$5,000	ea	1	$5,000
Subtotal				$86,973
Trenching costs	$125	foot	1150	$143,750
Bioremediation Barrier Installation **Item**	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
Carbon substrate cost- first injection	$331,245	LS	1	$331,245
Carbon substrate cost- second injection	$165,623	LS	1	$165,623
Direct push injection/ startup-1	$3,700	day	25	$92,500
Direct push injection/ startup-2	$3,700	day	15	$55,500
Technician support	$20,000	event	2	$40,000
Freight costs (in and out)	$1,500	RT	3	$4,500
Electrical permit costs (estimate from Henry O)	$3,000	LS	1	$3,000
TOTAL				$692,368
POTW Connection Fee	$247,125	LS	1	$247,125
Electricity based on 20 Kw for 24/7 operation 365yr Electrical based on design drawings E-4	$0.13	kWh	175,200	$22,776

OU 1 Downgradient Area Strategy - Recurring (O&M) Costs

Item	**Unit Cost**	**Unit**	**Quantity**	**Extended Cost**
O&M cost (2 technicians- 12 hrs/event - quarterly sampling - 1 year)	$75	hr	96	$7,200
POTW permit costs	$21,181	year	1	$21,181

Annual Performance Monitoring					$50,285
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$45,676	
2	1.066	0.8163	0.87	$43,757	
3	1.093	0.7629	0.83	$41,917	
4	1.120	0.7130	0.80	$40,155	
5	1.148	0.6663	0.76	$38,463	
6	1.177	0.6227	0.73	$36,844	
7	1.206	0.5820	0.70	$35,297	
8	1.236	0.5439	0.67	$33,811	
9	1.267	0.5083	0.64	$32,388	
10	1.299	0.4751	0.62	$31,029	
11	1.331	0.4440	0.59	$29,723	
12	1.365	0.4150	0.57	$28,476	
13	1.399	0.3878	0.54	$27,275	
14	1.434	0.3624	0.52	$26,126	
15	1.469	0.3387	0.50	$25,028	
16	1.506	0.3166	0.48	$23,980	
17	1.544	0.2959	0.46	$22,972	
18	1.582	0.2765	0.44	$22,003	
19	1.622	0.2584	0.42	$21,076	
20	1.663	0.2415	0.40	$20,190	
21	1.704	0.2257	0.38	$19,341	
22	1.747	0.2109	0.37	$18,525	
23	1.790	0.1971	0.35	$17,745	
		23 YEAR TOTAL		$681,798	

SOURCE AREA EXTRACTION AND INJECTION WELLS 3 YEARS					$7,740
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$7,031	
2	1.066	0.8163	0.87	$6,735	
3	1.093	0.7629	0.83	$6,452	
		3 YEAR TOTAL		$20,218	

Annual ISCO WDR Monitoring					$62,957
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$57,186	
2	1.066	0.8163	0.87	$54,783	
3	1.093	0.7629	0.83	$52,480	
		3 YEAR TOTAL		$164,449	

Annual HRC WDR Monitoring					$34,100
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$30,974	
2	1.066	0.8163	0.87	$29,673	
3	1.093	0.7629	0.83	$28,425	
4	1.120	0.7130	0.80	$27,230	
5	1.148	0.6663	0.76	$26,083	
		5 YEAR TOTAL		$142,385	

Annual Treatment System Monitoring					$14,720
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$13,371	
2	1.066	0.8163	0.87	$12,809	
3	1.093	0.7629	0.83	$12,270	
4	1.120	0.7130	0.80	$11,754	
5	1.148	0.6663	0.76	$11,259	
6	1.177	0.6227	0.73	$10,785	
7	1.206	0.5820	0.70	$10,333	
8	1.236	0.5439	0.67	$9,898	
9	1.267	0.5083	0.64	$9,481	
10	1.299	0.4751	0.62	$9,083	
11	1.331	0.4440	0.59	$8,701	
12	1.365	0.4150	0.57	$8,336	
13	1.399	0.3878	0.54	$7,984	
14	1.434	0.3624	0.52	$7,648	
15	1.469	0.3387	0.50	$7,326	
16	1.506	0.3166	0.48	$7,020	
17	1.544	0.2959	0.46	$6,725	
18	1.582	0.2765	0.44	$6,441	
19	1.622	0.2584	0.42	$6,170	
20	1.663	0.2415	0.40	$5,910	
		20 YEAR TOTAL		$183,304	

Annual POTW Monitoring					$3,070
Year	Inflation	P/F	Discounted Inflation	Cost/Year	
1	1.040	0.8734	0.91	$2,789	
2	1.066	0.8163	0.87	$2,671	
3	1.093	0.7629	0.83	$2,559	
4	1.120	0.7130	0.80	$2,452	
5	1.148	0.6663	0.76	$2,348	
6	1.177	0.6227	0.73	$2,249	
7	1.206	0.5820	0.70	$2,155	
8	1.236	0.5439	0.67	$2,064	
9	1.267	0.5083	0.64	$1,977	
10	1.299	0.4751	0.62	$1,894	
11	1.331	0.4440	0.59	$1,815	
12	1.365	0.4150	0.57	$1,739	
13	1.399	0.3878	0.54	$1,665	
14	1.434	0.3624	0.52	$1,595	
15	1.469	0.3387	0.50	$1,528	
16	1.506	0.3166	0.48	$1,464	
17	1.544	0.2959	0.46	$1,402	
18	1.582	0.2765	0.44	$1,343	
19	1.622	0.2584	0.42	$1,287	
20	1.663	0.2415	0.40	$1,233	
		20 YEAR TOTAL		$38,230	

Total Present Value Costs for Monitoring Life of Project	$1,230,383

COOPER DRUM MONITORING COST (GW BDR)

PERFORMANCE MONITORING **$1,156,560**

Annual Cost	$50,285.22

Monitoring required for 23 years

24 Wells-quarterly sampling for 10 years (3 rounds x 10 yrs=30 events)
32 wells- annually for 23 years (= 23 events)
After 10 years sampling frequency reduced to semi-annual(= 13 events)
VOCs quarterly @ $100/sample
1,4-dioxane twice per yr @ $175 sample
MNA parameters annually @ $515 per sample
Labor and equipment @$290per well
(Includes Blaintech, technician, shipment, waste disposal)
(MNA includes chloride,nitrate, sulfate, sulfide, ethene/ethane/menthane,
plus field parameters, iron (II), pH, DO, ORP, Temp, conductivity)

Reporting will be don under performance monitoring after 10th year for remaining 13 years ($2.5K per rpt)

VOCs only (2 events /yr x 10years x 24 wells x [$100 + $290])= $187,200
VOCs and 1-4Dioxane (1 event/yr x 23 yr x 24 wells x [275 +290])= $311,880
MNA (1 event/yr x 23 yrs x 32 wells x [$515- $290])= $592,480
Reports (13 yrs x 2 rpt/yr x $2.5K/rpt)= $65,000

SOURCE AREA EXTRACTION AND INJECTION WELLS 3 YEARS **$23,220**

Annual Cost	$7,740.00

1 source area extraction well quarterly for 3 years (same analysis as ISCO MW's)

4/yr x 3 yr x $645= $7,740
2 source area injection wells quarterly for 3 years (same analyis as ISCO monitor well)
4/yr x 3 yrs x 2 wells x $645= $15,480

ISCO WDR **$188,870**

Annual Cost	$62,956.67

Duration of WDR permit will be for 3 years at which time sampling will shift to

Performance Monitoring Program
10 wells quarterly sampling for 3 years
(6 monthly, one baseline, 10 additional sampling events = 17 total events)

Assumes 6 of 10 wells will be sampled as part of performance Monitoring program)

Quarterly reporting ($1.5K per report, $4K for final rpt)
Analysis $645 per sample(includes VOCs, 1,-4 dioxane, chloride, bromide, nitrate, nitrite, o-phosphate, sulfate, sulfide, TOC, TOC, TDS, TSS, boron,barium, calicium, magnesium, manganese, potassium, sodium,PP metals annually,and field parameters)
17 events x 4 wells x ($645+$290)=$63,580
5 events x 6 wells x ($645+290)= $28,050
12 events x 6 wells x ($645 -$100vocs= $545)=$39,240
36 reports plus one final = $58,000

HRC WDR **$170,500**

Annual Cost	$34,100.00

Duration of WDR permit will be for 10 years at which time sampling and

reporting will shift to Performance Monitoring Program
10 wells - quarterly sampling for 5 years (= 20 sampling events)
Assumes 6 of 10 wells will be sampled under performance monitoring program
Quarterly reporting ($1.5K per report, $4K for final rpt)
Analytical $715 per well (includes VOCs, 1,-4 dioxane, ethene/ethane, carbon dioxide, methane, chloride, nitrate, nitrite, o-phosphate, sulfate, sulfide, alkalinity, TOC, TDS, BOD, boron, calcium, magnesium, iron, potassium, sodium,and field parameters)
20 events x 4 wells x ($715+$290)= $80,400
5 events x 6 wells x ($715 - $515 = $200)=$6,000
5 events x 6 wells x ($715 - $275 = $440)=$13,200
10 events x 6 wells x ($715 - $100 = $615)= $36,900
20 reports plus one final, (41 rpts x $1.5K)= $34,000

TREATMENT SYSTEM 20 YEAR **$294,400**

Annual Cost	$14,720.00

4/yr x 20yrs x 2 wells x $715= $114,400
Treatment plant monitoring influent and effluent locations monthly for 20 years (VOCs and 1,4-dioxane only)
12/yr x 20 yrs x 2 x $275= $132,000
Intermediate treatment plant – 2 locations- monthly - 20 years- VOCs only
12/yr x 20 yrs x 2 x $100=$48,000
All sampling performed during O&M.
Source area injection and extraction wells
Sample Reporting included in specific WDR

POTW **$61,400**

Annual Cost	$3,070.00

System operation 20 years
1 sampling location COD and TSS, and VOC analysis only
COD ($20) and TSS ($25) bi-monthly
6/yr x 20 yrs x $45=$5,400
VOC ($100) quarterly
4/yr x 20 yrs x $100= $8000
Quarterly reports ($600each)
4/yr x 20 yrs x $600=$48,000

TOTAL MONITORING COST **$1,894,950**

NEW WELL INSTALLATION **$162,800**

13 new wells at $100/foot (1300 ft)=$130K
Includes material and development (4-inch pvc/12-inch boring)
Labor 195 hr x $90/hr + 15% = $20.18K
expenses $3.3K
Waste disposal 1300ft x 0.82 ft3/12-inch= 67 tons
$100/ton x 67 tons = $6.7K$
Permits $200 each x 13=- $2,600

Source Area Treatment System Equipment Service Life and Replacement Costs

Equipment	Expected Service Life[1] (years)	Estimated Replacement Purchase Price[2]	Estimated Replacement Labor Cost[3]	Total Estimated Replacement Cost	Expected replacement interval	Extended cost
Subsystem: Influent Tanks						
EP-1 Injection Pump	7	$560	$210	$770	1	$770
T-100 Holding Tank	20	$5,500	$2,120	$7,620	0	$0
Subsystem: Advanced Oxidation System						$0
Advanced Oxidation System	7	$730	$210	$940	1	$940
Subsystem: Carbon Vessels					0	$0
Primary Liquid Phase Carbon Vessel	20	$4,257	N/A[4]	$4,257	0	$0
Secondary Liquid Phase Carbon Vessel	20	$4,257	N/A[4]	$4,257	0	$0
GWTP Effluent Flow Meter	7	$5,000	$2,120	$7,120	1	$7,120
Subsystem: GWTP Controls						
Main Control Panel Central Processing Unit	5	$2,000	$3,560	$5,560	3	$16,680
Advanced Oxidation System Control Panel Radio	7	$2,000	$420	$2,420	1	$2,420
SCADA Computer	5	$1,200	$2,000	$3,200	3	$9,600
GWTP Programmable Logic Controller	20	$11,000	N/A4	$11,000	0	$0
Subsystem: Submersible Pump/Motor Assemblies						
SEW-1 pump and motor assembly	10	$1,033	$3,340	$4,373	1	$4,373
Subsystem: Extraction Well Flow Meters						
SEW-1 flow meter	10	$2,400	$420	$2,820	1	$2,820
Subsystem: Extraction Well Hardware						
Check Valve	10	$75	$140	$215	1	$215
Gate Valve	10	$100	$175	$275	1	$275
Well Vault Sump Pump	10	$110	$35	$145	1	$145
Miscellaneous Hardware (e.g., pressure gauges, ball valves, and GFCI outlets)	10	$100	$70	$170	1	$170
Subsystem: Extraction Well Controls						$0
TimeMark Controller	10	$150	$175	$325	1	$325
Submersible Motor Starter	10	$125	$210	$335	1	$335
Control Panel Breaker	10	$150	$210	$360	1	$360
					Total	$46,548

Notes:

1. Expected service life is based on O&M contractor's experience and information obtained from equipment manufacturers.
2. Estimated replacement purchase prices were obtained from manufacturers or vendors, and are in 2007 dollars.
3. Estimated replacement installation cost includes labor costs, subcontractor costs, and equipment rental costs. The following costs
4. Labor costs are not estimated for this activity due to extensive project coordination requiredor a lifecycle greater than 100 years.
5. Estimated replacement installation cost includes labor costs and subcontractor costs. The following costs were used in generating

SEW = source area extraction well

Downgradient Treatment System Equipment Service Life and Replacement Costs

Equipment	Expected Service Life[1] (years)	Estimated Replacement Purchase Price[2]	Estimated Replacement Labor Cost[3]	Total Estimated Replacement Cost	Expected replacement interval	Extended cost
Subsystem: Bioremediation Barrier						
Biobarrier	7		$210	$210	0	$0
Effluent Flow Meter	7	$5,000	$2,120	$7,120	6	$42,720
Subsystem: Submersible Pump/Motor Assemblies						
DEW-1 pump and motor assembly	10	$1,220	$3,340	$4,560	1	$4,560
DEW-2 pump and motor assembly	10	$1,220	$3,340	$4,560	1	$4,560
Subsystem: Extraction Well Flow Meters						
DEW-1 flow meter	10	$2,400	$420	$2,820	1	$2,820
DEW-2 flow meter	10	$2,400	$420	$2,820	1	$2,820
Subsystem: Extraction Well Hardware						
Check Valves	10	$75	$140	$215	2	$430
Gate Valves	10	$100	$175	$275	2	$550
Well Vault Sump Pumps	10	$110	$35	$145	2	$290
Miscellaneous Hardware (e.g., pressure gauges, ball valves, and GFCI outlets)	10	$100	$70	$170	2	$340
Subsystem: Extraction Well Controls						
TimeMark Controller	10	$150	$175	$325	2	$650
Submersible Motor Starter	10	$125	$210	$335	2	$670
Control Panel Breaker	10	$150	$210	$360	2	$720
					Total	$61,130

Total replacement cost
Annual $5,384

Notes:

1. Expected service life is based on O&M contractor's experience and information obtained from equipment manufacturers.
2. Estimated replacement purchase prices were obtained from manufacturers or vendors, and are in 2007 dollars.
3. Estimated replacement installation cost includes labor costs, subcontractor costs, and equipment rental costs. The following costs
4. Labor costs are not estimated for this activity due to extensive project coordination requiredor a lifecycle greater than 100 years.
5. Estimated replacement installation cost includes labor costs and subcontractor costs. The following costs were used in generating

SEW = source area extraction well

Item	Cost
Check valve	$ 75
Gate Valve	$ 100
Sump Pumps	$ 110
Miscellaneous	$ 100
Drop Pipe - 1.5" Stainless	$ 7
Drop Pipe - 2" Stainless	$ 9
Drop Pipe - 3" Stainless	$ 30
Drop Pipe threading	$ 10
TimeMark	$ 150
Submersible Motor Starter	$ 125
Control Panel Breakers	$ 150
LABOR	$ 70
Subcontractor	$ 100
Redevelopment - Sub	$ 2,500
Crane	$ 1,000
Manlift	$ 700
Forklift	$ 500

Notes

EW Assumptions

assume labor = 12 hours per submersible replacement, with $2,500 for sub costs

assume flow meter replacement labor = 6 hours

OU 1 and OU 2
Remedial Action Schedule
Cooper Drum Company Superfund Site

ID	Task Name	Duration	Predecessors
1	**Cooper Drum Remedial Actions**	**6723 days**	
2	**OU 1 (Groundwater) RA**	**6674 days**	
3	**RA Solicitation**	**54 days**	
4	Post solicitation	30 edays	
5	Receive proposals	0 days	4
6	Review soliciatation proposals	10 days	5
7	Award solicitation	0 days	6
8	Notice-to-Proceed	0 days	7FS+30 edays
9	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	8
10	Regulatory Agencies Review of Draft Plans	60 edays	9
11	Incorporate Comments and Submit Draft Final Plans	30 days	10
12	Regulatory Agencies Review of Draft Final Plans	60 edays	11
13	Incorporate Comments and Submit Final Plans	30 days	12
14	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	13FF
15	Installation of Remedy	30 days	14
16	Initial Startup and Testing	15 days	15
17	**Full Scale O&M of RA Remedy**	**5995 days**	
18	Source Area in situ ISCO system	1095 edays	16
19	Downgradient P&T System	8395 edays	16
20	**Biobarrier Injections**	**561 days**	
21	First Injection	30 edays	19SS+30 edays
22	Second Injection	25 edays	21FS+730 edays
23	Remedy Performance Monitoring	8395 edays	16
24	Site Closure Work Plan	30 days	23
25	Site Closure Sampling/Monitoring	365 edays	24FS+30 edays
26	Site Closure Monitoring Results Report	30 days	25
27	Receive Site Closure	0 days	26FS+45 edays
28	**OU 2 (Soil) RA**	**1620 days**	
29	**RA Solicitation**	**62 days**	
30	Post solicitation	30 days	
31	Receive proposals	0 days	30
32	Review soliciatation proposals	10 days	31
33	Award solicitation	0 days	32
34	Notice-to-Proceed	0 days	33FS+30 edays
35	Preparation of Draft Plans (RAWP, SAP, HASP)	60 days	34
36	Regulatory Agencies Review of Draft Plans	60 edays	35
37	Incorporate Comments and Submit Draft Final Plans	30 days	36
38	Regulatory Agencies Review of Draft Final Plans	60 edays	37
39	Incorporate Comments and Submit Final Plans	30 days	38
40	Permitting for RA (WDR, NPDES, Building Dept, etc)	90 edays	39FF
41	Installation of Remedy	30 days	40
42	Initial Startup and Testing	15 days	41
43	Full Scale O&M of RA Remedy	1095 edays	42
44	**Remedy STOP Evaluation**	**394 days**	
45	Site Closure Sampling/Monitoring	550 edays	43
46	Submit Remedy STOP Report	0 days	44FS+60 days
47	Receive Approval to STOP OU 2 RA	0 days	46FS+45 edays