Record of Decision

Griggs and Walnut Ground Water Plume Superfund Site
Las Cruces, New Mexico

June 2007

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

SUPERFUND DIVISION

Part 1: Declaration

A. Site Name and Location

Griggs and Walnut Ground Water Plume Superfund Site
Las Cruces, Doña Ana County, New Mexico
NMD0002271286
Site ID: 0605116

B. Statement of Basis and Purpose

This decision document presents the selected remedial action (the "Selected Remedy") for the Griggs and Walnut Ground Water Plume Superfund Site ("the Site"), in the City of Las Cruces, (CLC) Doña Ana County (County), New Mexico, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (U.S.C.) § 9601-9675 as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 as amended. The Selected Remedy is Alternative 4 Enhanced Ground Water Extraction with Treatment which is described in detail in Section 12 of this Record of Decision (ROD).

This decision is based on the Administrative Record for the Site, which has been developed in accordance with Section 113(k) of CERCLA, 42U.S.C. § 9613(k). The Administrative Record file for this Site is available for review at the Branigan Memorial Library in Las Cruces, New Mexico, the offices of the New Mexico Environment Department, Superfund Oversight Section, Santa Fe, New Mexico, and at the United States Environmental Protection Agency (EPA, Region 6) Records Center in Dallas, Texas. The Administrative Record Index (Appendix D) identifies each of the items comprising the Administrative Record upon which the selection of the Remedial Action is based. The State of New Mexico (New Mexico Environment Department) concurs with the Selected Remedy.

C. Assessment of Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. The primary contaminant at this Site is perchloroethylene (PCE, also known as tetrachloroethene or tetrachloroethylene), a volatile organic compound. The contaminant mass of PCE that will be remediated includes those areas within the designated plume boundaries with PCE concentrations greater than 5 micrograms per liter (μg/L), the Maximum Concentration Limit (MCL) established for PCE under the federal Safe Drinking Water Act. The total mass of PCE estimated to be affecting ground water is between 110 and 160 kilograms (between 242 and 357 pounds). The estimated volume is between 1,928 and 2,892 acre-feet (6.82 to 9.42 billion gallons). The approximate volume of ground water with PCE concentrations greater than 5 μg/L that will be remediated is estimated to be between 735 and 1,102 acre-feet (2.39 to 3.59 billion gallons).

The PCE plume is approximately 1.8 miles by one-half miles in size, based on ground water sampling. The Site is defined by soil vapor and ground water samples found to be contaminated with PCE. The detection of PCE in ground water began at about 190 feet below ground surface (bgs). The PCE detected affects the local municipal water supply to depths of about 650 feet bgs. The Site contamination is located in the subsurface generally between East Griggs Avenue and East Hadley Avenue, in Las Cruces, Doña Ana County, New Mexico, extending east to beyond Interstate 25 (I-25), and west to beyond North Solano Avenue. The predominant land uses in this area are recreational, light industrial/commercial, and residential land uses.

D. Description of Selected Remedy

The Selected Remedy for the Site is Alternative 4, **Enhanced Ground Water Extraction with Treatment** which is estimated to cost $13.8 million dollars.

The remedy includes treatment of ground water and hydraulic control relying upon the existing municipal supply wells to the extent possible.

The objective of the remedy is to remove PCE from ground water to concentrations at or below the drinking water standard through hydraulic containment and treatment to reduce plume size by targeting hydraulic pumping at areas within the plume boundaries with higher PCE concentrations.

The remedy will maximize the existing water pumping and delivery infrastructure already in place with some retrofitting prior to ground water conveyance for treatment. The treatment plant will be centrally located somewhere within the plume boundaries and is expected to take minimal space. Once treated, ground water will then be available for delivery into the public water supply.

The Selected Remedy is intended to address the entire ground water plume Site through treatment. The contamination at the Site is neither a principal threat nor is it a low level threat. Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., concentrations that are several order of magnitude above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a Site, wherever practicable. Low-level threat wastes are those source materials that generally can be reliably contained and that contain contaminant concentrations not greatly above the acceptable levels. The contamination at the Site is neither a principal threat nor is it a low level threat. The waste is not a principal threat because the ground water contamination is not a source material such as a Dense Nonaqueous Phase Liquid (DNAPL). The waste is not a low-level threat because it cannot be reliably contained in place. The remedy will incorporate treatment to reduce the toxicity, mobility and volume of the PCE and the remedy will use engineering controls for plume containment. The remedy will also use institutional controls (e.g., temporary ground water drilling moratorium, interagency, interdepartmental memorandums of agreement, etc.,) to augment the remedy. The reason for such action is because the contamination plume affects a primary drinking water supply source. The remedy expectation is to return the ground water to its beneficial use in an expeditious manner.

Major components of the selected remedy:

Under this Selected Remedy, water will be pumped from municipal supply wells (CLC Well Nos. 18 and 27, or other wells, if it is determined during remedial design and implementation that the use of other wells is appropriate). Based on modeling results it is expected that within approximately five years one new extraction well location will be necessary to continue treating and reducing the PCE concentrations to below the MCL of 5 µg/L. The new extraction well would likely replace CLC Well No. 18 after the first five years of operation because the fate and transport model predicts that over time, CLC Well No. 18 will draw more clean water than PCE affected water and consequently, it will remove contamination less efficiently. PCE plume containment will rely on hydraulic control, and on discontinuing operation at CLC Wells 19, 20, 21, 24, 26, and 38, during remediation. Hydraulic control, treatment of contaminated ground water, and plume reduction will be further evaluated and refined during remedy design to determine the appropriate measures for implementation. The remedy will be supported by the following activities:

Institutional Controls

Long-Term Monitoring Program

Annual Reviews and Reporting

The Remedial Action Objectives (RAOs) are expected to be reached in approximately 14 years.

E. Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and uses permanent solutions and treatment or resource recovery technologies to the maximum extent practicable. The remedy satisfies the statutory preference for treatment, and reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment.

This remedy will allow for unrestricted use of the Site upon completion and will take more than five years to attain the RAOs. The EPA will conduct a review within five years from the start of the Remedial Action to ensure the remedy protects human health and the environment as described in CERCLA Section 121, 42 U.S.C. § 9621.

F. Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for the Site.

Chemicals of Concern (COCs) and their respective concentrations;
Baseline risk represented by the COCs;
Remediation goals established for COCs and the basis for these goals;
Current and reasonably-anticipated future land use assumption, and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD;
Potential land and ground water use that will be available at the Site as a result of the selected remedy;
Estimated capital, operation and maintenance (O&M), and total present worth costs; discount

rate; and the number of years over which the remedy cost estimate are projected; and

Key factors that led to selection of the remedy.

G. Authorizing Signature

Pamela Phillips, Acting

Samuel Coleman, P.E., Director
Superfund Division
EPA Region 6

Date: June 18, 2007

RECORD OF DECISION

Griggs and Walnut Ground Water Superfund Site

Concurrences

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Remedial Project Manager

Date 5/22/07

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LA/NM/OK Team

06/01/2007

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Superfund Branch, Office of Regional Counsel

06/08/07

Pamela Phillips, Deputy Director
Superfund Division

6/18/07

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Figures:

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List of Acronyms

°C	degrees Centigrade
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µS/cm	microsiemens per centimeter
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
ASL	Applied Sciences Laboratory
ATSDR	United States Agency for Toxic Substances and Disease Registry
atm	atmospheres
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment
$CaCO_3$	Calcium Bicarbonate
California EPA	California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-Dichloroethene
CLC	City of Las Cruces
CLP	Contract Laboratory Program
COC	Chain of Custody
COPC	Chemical of Potential Concern
CRQL	Contract-Required Quantitation Limit
CSM	Conceptual Site Model
CT	Central Tendency
DAC	Doña Ana County
DACTD	Doña Ana County Transportation Department
DMC	Deuterated Monitoring Compound
DNAPL	dense non-aqueous phase liquid
DO	Dissolved Oxygen
DPT	Direct-Push Technology
DQE	Data Quality Evaluation
DQO	Data Quality Objective
DWB	Drinking Water Bureau
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ELCR	Excess Lifetime Cancer Risk
FOD	Frequency of Detection
FS	Feasibility Study
FSP	Field Sampling Plan
ft	feet
GC	Gas Chromatograph
gpm	gallons per minute
GPS	Global Positioning System

GWP	Griggs and Walnut Ground Water Plume
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HSA	Hollow-Stem Auger
HRS	Hazard Ranking System
HVAC	Heating, Ventilating, and Air Conditioning
I-25	Interstate 25
IARC	International Association for Research on Cancer
IDRA	Identification of PCE Release Areas
IDW	Investigation-Derived Waste
IRIS	Integrated Risk Information System
JSP	Joint Superfund Project
LHZ	Lower Hydrologic Zone
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mmHg	millimeters of Mercury
MNA	Monitored Natural Attenuation
MSL	Mean Sea Level
MSSL	Media-Specific Screening Levels
MTBE	Methyl Tertiary Butyl Ether
MW	Monitor Well
mV	Millivolt
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NMED	New Mexico Environment Department
NMOSE	New Mexico Office of the State Engineer
NMSA	New Mexico Statutes Annotated
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
O&M	Operation and Maintenance
ORP	Oxidation /Reduction Potential
OSWER	Office of Solid Waste and Emergency Response
PAL	Police Athletic League
PCB	Polychlorinated Biphenyl
PCE	perchloroethylene, tetrachloroethene, or tetrachloroethylene
PDB	Passive Diffusion Bag
ppb	parts per billion
ppbv	parts per billion by volume
PPRTV	Provisional Peer-Reviewed Toxicity Values
PQL	Practical Quantitation Limit
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QC	Quality Control
RAGS	Risk Assessment Guidance for Superfund
RA	Remedial Action
RD	Remedial Design
RCRA	Resource Conservation and Recovery Act

Part 2: Decision Summary

Section 1

Site Name, Location, and Brief Description

This Decision Summary provides a description of the site-specific factors and analyses that led to the selection of the ground water remedy for the Griggs and Walnut Ground Water Plume Superfund Site (Site). It includes background information about the Site, the nature and extent of contamination found at the Site, the assessment of human health and environmental risks posed by the contaminants, and the identification and evaluation of remedial action alternatives for the Site.

The Griggs and Walnut Ground Water Plume Superfund Site is located in the City of Las Cruces (CLC), Doña Ana County (County), New Mexico. The County is located in the south central part of the state and borders Mexico and Texas at its southern boundary. See Site Location Map, Figure 1-1. The geographic coordinates at the Site are approximately 32º 18' 56.0" north latitude and 106º 45' 36.0"west longitude. The Site is a ground water contaminant plume approximately 1.8 miles by one-half miles in size. The Site is defined by soil vapor samples and ground water samples found to be contaminated with primarily perchloroethylene (PCE, also known as tetrachloroethene or tetrachloroethylene). The PCE contamination detected in ground water begins at about 190 feet (ft) below ground surface (bgs) and affects the local municipal water supply to depths of about 650 feet bgs. There are four CLC municipal supply wells (Well Nos. 18, 19, 21, and 27) that have been affected by the PCE contamination at concentrations exceeding the Maximum Concentration Limit (MCL) for PCE established by the Federal SDWA. The Site contamination is located in the subsurface generally between East Griggs Avenue and East Hadley Avenue, extending east to beyond Interstate 25 (I-25), and west to beyond North Solano Avenue (see Site Map, Figure 2-1). The property uses in this area are predominately recreational, light industrial/commercial, and residential land uses.

The Environmental Protection Agency (EPA) is the lead agency for the Remedial Action at the Site. The New Mexico Environment Department (NMED) is the support agency. The Potentially Responsible Parties (PRPs) for the Site are the CLC and the County. The CLC and the County entered into a Settlement Agreement with EPA on April 20, 2005, and financed EPA's Remedial Investigation/Feasibility Study (RI/FS) for the Site. The CLC and County entered into a memorandum of agreement with one another, and formed a local consortium called the Joint

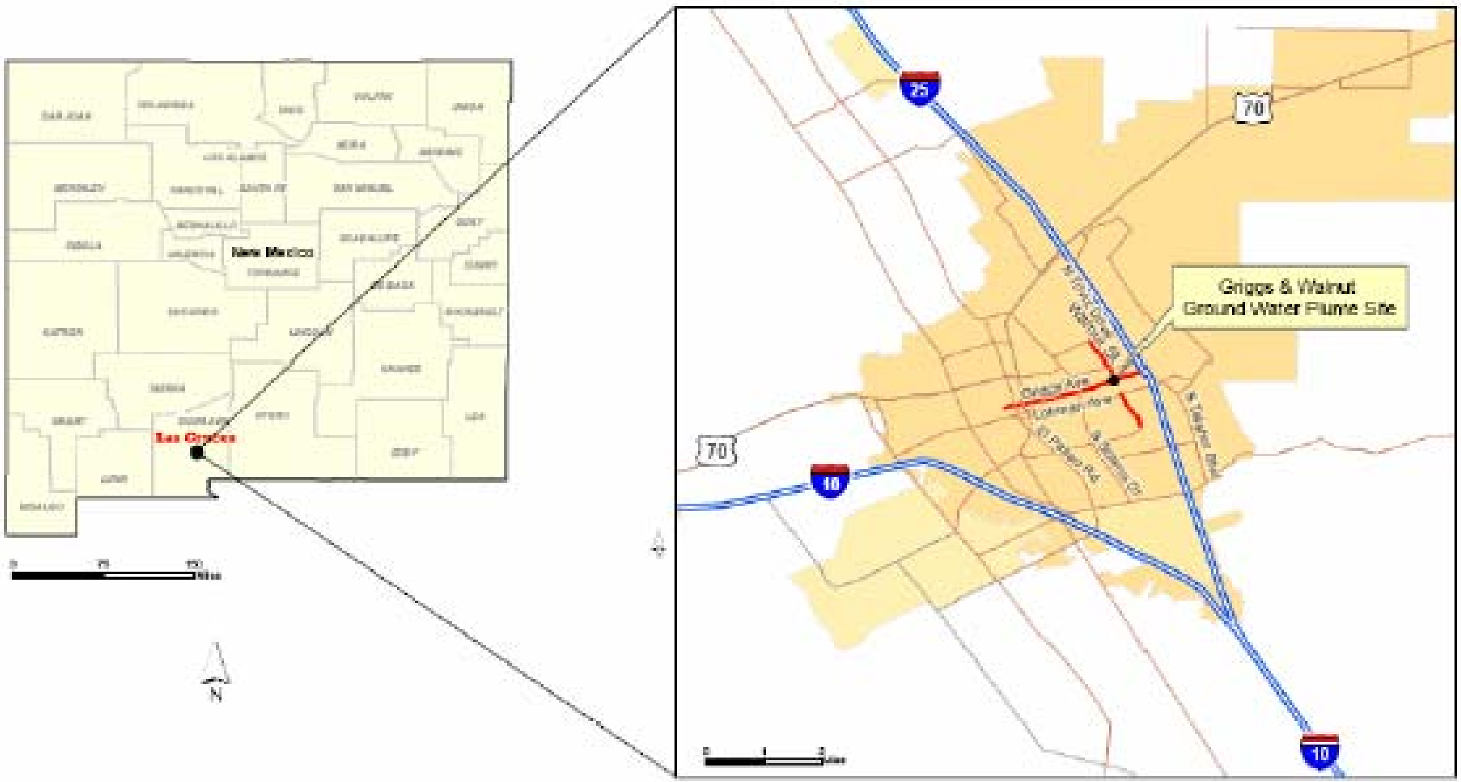
Superfund Project (JSP) prior to settling with EPA and assisting with the RI/FS. The JSP also assisted by performing a fate and transport ground water model analysis for the Site and assisted with the completion of the RI/FS. The fate and transport model was instrumental in the development of the alternatives for the Site.

The PCE-affected ground water occurs within the Mesilla Bolson Aquifer, an aquifer used by the CLC for public drinking water supply and irrigation. This aquifer extends below the entire length of the Mesilla Valley. Ground water occurs 100 ft or more bgs within the Site boundaries. A limited number of private wells also tap into this aquifer along with the municipal water supply wells. Among the private wells that remain in use, the property owners primarily use the wells for home landscape irrigation. Five of the private wells are located within one-half mile of the known boundary of PCE-affected ground water (i.e., plume boundary). There are no private wells known to exist within or immediately down-gradient of the plume boundary.

Location of PCE Affected Municipal Water Supply Wells

The CLC Well No. 18 is located northwest of the intersection of East Griggs Avenue and North Walnut Street, between East Griggs and Hadley Avenue (on the north side of the Doña Ana County Transportation Department [DACTD] maintenance facility). The CLC Well No. 19 is located on the west side of I-25 at the east end of East Griggs Avenue. The CLC Well No. 21 is located along the west side of I-25 at the east end of Craig Avenue. The CLC Well No. 27 is located near the southeast corner of the East Griggs Avenue and North Walnut Street intersection.

Site Location Map – Fig. 1-1



Section 2

Site History and Enforcement Activities

In 1993, the Safe Drinking Water Act (SDWA) formally added PCE to the list of contaminants to be monitored in drinking water supplies during compliance monitoring. That same year, NMED detected PCE contamination in CLC Wells Nos. 21 and 27. In 2000, PCE was first detected in CLC Well No. 24 at slightly less than 1µg/L. CLC Well No. 24 is located about one mile south of CLC Well Nos. 18, 19, 21, and 27. Three unaffected municipal supply wells (CLC Well Nos. 20, 26, and 61) are located between CLC Well No. 24 and CLC Well Nos. 18, 19, 21, and 27.

The Site was added to EPA's National Priorities List (NPL) of Superfund sites on June 14, 2001 (66 Federal Register 32235 [June 14, 2001]). At the time of listing, four CLC municipal drinking water supply wells (CLC Well Nos. 18, 19, 21, and 27) were known to be affected by PCE contamination at concentrations above the MCL of 5 µg/L. The highest and most variable concentrations of PCE were found in CLC Well No. 18, ranging from slightly above (or below) 5 µg/L to over 45 µg/L. The concentrations of PCE in the other affected supply wells have increased over time, but have stayed near (slightly above or below) the MCL.

PCE has also been detected in the past at concentrations below the MCL in one private well (LRG-3191, located southwest and outside of the plume) and in one public school irrigation well (LRG-1457, located south and outside of the plume, near CLC Well No. 24). At the private residential well, the property owner reports that well LRG-3191 is used primarily for residential landscape watering. Recent samples at this well show no detections of PCE. Lynn Middle School used well LRG-1457 in the past to provide landscape irrigation at the school, but this well is no longer in service because of mechanical problems.

Meeting Current Water Supply Demand

Of the four affected supply wells, only CLC Well No. 21 remains in service. PCE concentrations at this well have been detected at slightly above, or slightly below the MCL of 5 µg/L. The CLC manages Well No. 21's usage under a blending program approved by the NMED Drinking Water Bureau (DWB) on September 24, 2002. The CLC designed the Well No. 21 blending program to mix affected water with unaffected water in the Upper Griggs Reservoir in order to reduce PCE concentrations to levels below the MCL before the water reaches the distribution system. The CLC monitors the concentration of PCE in the Upper Griggs Reservoir to ensure that concentrations of PCE remain below the MCL. Periodic sampling performed in 2005 (from

January 2005 through December 2005) revealed PCE concentrations at the Upper Griggs Reservoir ranged from not detected to 3.2 µg/L (with an average concentration of about 1.7 µg/L).

Previous Investigations Conducted at the Site

The NMED provided the first regulatory response at the Site. After PCE was detected at the CLC municipal supply wells by the NMED DWB, the NMED Superfund program performed a preliminary site assessment and site inspection activities in consultation with EPA. The NMED analyzed ground water and soil samples collected at new and existing monitoring well locations and tested soil vapor at the DACTD maintenance facility. The results confirmed the presence of PCE in ground water, soil vapor, and in soil. PCE was detected in only one soil sample, at a concentration of 241 micrograms per kilogram (µg/kg). This sample was collected at 135 ft bgs at MW-5. PCE was detected in the shallow soil vapor at the DACTD maintenance facility at concentrations up to 12 parts per billion by volume (ppbv).

EPA's Hazard Ranking System (HRS) documentation describes the results of these collective investigations as the basis for EPA adding the Site to the NPL. The data collected by NMED were helpful in establishing preliminary data trends and the NMED information was used to help characterize the nature and extent of contamination.

EPA Issues Identification of PCE Release Areas Report (IDRA)

The EPA summarized the results and conclusions from this first mobilization in the report entitled "Identification of PCE Release Areas Report (IDRA Report). The IDRA Report identified three source areas where PCE was released into the environment and helped support the issuance of the Special Notice Letters to the PRPs. These three PCE source areas are located as follows:

1. Near the intersection of East Hadley Avenue and North Walnut Street (along the former Crawford Municipal Airport runway and along the former arroyo that runs parallel to, and south of the former airport runway).
2. At the Doña Ana County Transportation Department (DACTD) maintenance facility on East Griggs Avenue.
3. At the property where the former New Mexico Army National Guard facility was located on East Hadley Avenue.

Settlement Agreement with the Potentially Responsible Parties

On April 20, 2005, EPA signed a Settlement Agreement with the CLC and the County. This agreement addressed completion of the RI/FS at the Site. The CLC and the County formed the JSP to facilitate their participation in the remedial process. The EPA then formed a Technical Work Group with NMED and JSP to provide a forum for stakeholders to participate in the completion of the RI/FS and to provide input related to stakeholder needs. In addition to supporting and assisting field data collection data efforts, the JSP modeled flow and transport of PCE in the ground water to refine the conceptual site model (CSM) and to support the evaluation of remedial alternatives in the FS.

EPA Remedial Investigation/Feasibility Study (RI/FS)

Working under the Settlement Agreement EPA, JSP and NMED finalized the RI/FS in November 2006. Prior to the Settlement Agreement, EPA had been conducting the early stages of the RI to determine the nature and extent of the ground water and soil vapor contamination throughout the Site. The JSP provided funds to complete the RI/FS through the Settlement Agreement and helped provide technical assistance as well as financial support towards the RI/FS. Ground water and soil vapor samples were collected and analyzed to complete the nature and extent characterization of the PCE contamination and to perform a baseline human health risk assessment (BHHRA). The BHHRA included modeling of indoor vapor intrusion, using soil vapor samples collected near residential properties and near recreational buildings. These data helped evaluate whether PCE vapor from shallow soil directly underlying the residential properties or recreational facilities presented an unacceptable risk to human health.

A chronology of significant events related to the Site is presented in Table 2-1.

LEGEND

City of Las Cruces (CLC) Municipal Water Supply Wells:
- affected by perchloroethylene (PCE)
- not affected by perchloroethylene (PCE)
(screen depths of these wells range from 281 to 1,050 feet below ground surface.)

Private Water Supply Wells:
- affected by perchloroethylene (PCE)
- not affected by perchloroethylene (PCE)
(screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)

Estimated Extent of GWP-related PCE Detections

Notes:
Image Data: Provided by City of Las Cruces, Resolution: 2 Ft
Map Projection: New Mexico Central State Plane, NAD83 Ft
Date Flown: 2004

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).
2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE
3. Private well LRG-7375 was last sampled in June 1998.
4. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

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Figure 2-1
Site Location Map
Griggs & Walnut Ground Water Plume Site
Las Cruces, New Mexico

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Chronology of Site Events
Griggs and Walnut Ground Water Plume
Las Cruces, NM
Table 2-1

Date	Event
June 1991	Samples from City of Las Cruces (CLC) Wells 18, 19, 21, and 27 were collected and analyzed for perchloroethylene (PCE) by the New Mexico Environment Department (NMED) Drinking Water Bureau (DWB). PCE was not detected; the analytical quantitation limit was 1.0 micrograms per liter (µg/L).
August 8, 1993	PCE was detected in CLC Well No. 21 and CLC Well No. 27 in samples collected by the NMED DWB, the first sampling event performed under the Safe Drinking Water Act (SDWA) requirements adding PCE to the list of drinking water contaminants. PCE was detected in CLC Well No. 21 at a concentration of 1.4 µg/L and CLC Well No. 27 at a concentration of 0.9 µg/L. This was the first detection of PCE in CLC supply wells. Results were below the Maximum Contaminant Level (MCL) of 5 µg/L.
January 10, 1995	PCE was detected in CLC Well No. 18 in a sample collected by the NMED DWB. This was the first detection of PCE in this well. The concentration of PCE was 32.0 µg/L.
February 22, 1995	CLC Well No. 18 was re-sampled, and the PCE result was 1.50 µg/L.
January 9, 1996	In a sample collected by NMED DWB from CLC Well No. 18, PCE was again detected above the MCL, at a concentration of 6.4 µg/L (results for subsequent samples collected in February, April, May, and July 1996 were all below the MCL).
September 26, 1996	CLC Well No. 18 was removed by the CLC from the municipal drinking water distribution system (mechanical difficulties were reported).
May to October 1997	In May through October 1997, NMED Superfund Oversight Program performed a Preliminary Assessment for the GWP site. In October 30,1997, NMED issued a report for the Griggs and Walnut Ground Water Plume (GWP) site entitled *Preliminary Assessment, Las Cruces PCE, Doña Ana County, New Mexico* . The report states that the threat to human health and the environment due to the PCE detected at CLC Well No. 18 is likely to be significant via the ground water pathway.
June 1997	An underground storage tank (UST) investigation was initiated at the Doña Ana County Transportation Department (DACTD) maintenance facility on East Griggs Avenue. This investigation was conducted in response to a fuel spill associated with underground fuel storage tanks located at the facility.
February 1998 through July 2000	NMED performed a Focused Site Inspection for the Site. The work plan was dated February 6, 1998, and the last sampling event under this investigation was conducted in July 2000.
September 23, 1997	A UST investigation was initiated at the Gas Card site located on North Solano Drive, to the west of the GWP site, to address a petroleum release unrelated to the GWP site.
February and March 1998	Additional UST investigation work was conducted at the DACTD maintenance facility to determine the extent of the fuel spill detected during the first UST investigation initiated in June 1997. NMED participated in this investigation as part of the GWP site Focused Site Inspection (in part by collecting additional samples for analysis of PCE).
April 1998	EPA issued a Superfund Site Strategy Recommendation for the Site that recommends that the NMED complete a Focused Site Inspection.

Chronology of Site Events
Griggs and Walnut Ground Water Plume
Las Cruces, NM (cont'd)
Table 2-1

Date	Event
May 1998	The NMED sampled the Gas Card Site monitor well. PCE was detected for the first time in this monitor well at a concentration of 15.0 µg/L.
July 1999	NMED conducted a soil vapor survey at the DACTD maintenance facility as part of the Focused Site Inspection for the GWP site.
February and June 2000	NMED installed 10 monitoring wells in the vicinity of the Site to determine extent of contamination and to identify potential sources associated with the Site.
June 6, 2000	PCE first detected in CLC Well No. 24, at a concentration of 0.90 µg/L (less than the MCL).
November 2000	EPA prepares the Hazard Ranking System (HRS) Scoring documentation for the Site under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
January 11, 2001	The Site is proposed for inclusion on the Superfund National Priorities List (NPL).
March 21, 2001	A UST risk assessment investigation is conducted at the Circle K northwest of the GWP site. Because of the GWP site PCE detections in the vicinity, the Circle K monitor wells are sampled for PCE in addition to petroleum constituents; PCE is not detected in any of the samples.
May 2001	The NMED DWB begins monthly sampling of PCE-affected CLC drinking water supply wells. Monthly sampling of the PCE-affected wells continued until July 2003.
June 14, 2001	The Site listing on the NPL becomes final.
September 2001	CLC Well No. 27 is removed from the drinking water supply distribution system due to increases in the PCE concentration (up to 4.90 µg/L at that time).
April 29, 2002	EPA initiates the first mobilization field work for the GWP Remedial Investigation (RI) process under Superfund.
June 2002	CLC begins pumping of CLC Well Nos. 18 and 27 to provide some measure of plume control with the goal of preventing further migration of PCE toward CLC Well Nos. 19 and 21.
July 2002	CLC submits a blending plan to the NMED DWB for CLC Well No. 21. The plan is designed to maintain PCE concentrations in drinking water from the Upper Griggs Reservoir below drinking water standards.
September 24, 2002	NMED DWB approves the final blending plan.
February 2003	Field work for the first mobilization of the RI is completed.
October 2003	The NMED DWB begins quarterly sampling of PCE-affected CLC drinking water supply wells.
November 2003	EPA issues the report *Identification of PCE Release Areas in the Vicinity of the Griggs and Walnut Ground Water Plume* documenting the results of the first field mobilization.
January 2004	EPA performs comprehensive ground water sampling event to document current condition and changes at the Site.

Chronology of Site Events
Griggs and Walnut Ground Water Plume
Las Cruces, NM (cont'd)
Table 2-1

Date	Event
April 2005	A settlement agreement between the EPA, CLC, and Doña Ana County (DAC) is signed. A Technical Activities Work Group is formed between the EPA, CLC, DAC, and NMED to provide a forum for stakeholder input into the RI/FS process for the site.
July 2005	CLC Well No. 19 taken out of service due to mechanical problems.
July 21, 2005	The Technical Activities Work Group meets and finalizes the scope of the RI/FS for the site.
October 17, 2005	Field activities for second field mobilization of the RI begin.
December 27, 2005	RI for the second field mobilization activities is completed.
November 21, 2006	RI/FS completed and released.
December 4 2006, – Jan. 5 2007	Public Comment Period on Proposed Plan
December 7, 2006	Public Meeting on Proposed Plan

Section 3

Community Participation

Throughout the Site's history, EPA, JSP and NMED kept the community, other governmental entities, citizen advisory groups and interested parties informed of the Site activities. Listed below is a detailed summary and chronology of the various public outreach efforts. In addition to the outreach activities listed below, and the public website maintained by EPA, the JSP also maintains a website specifically devoted to the Site. The EPA uses various methods for informing communities on site activities at Superfund sites and seeking public participation in the process. One routine activity EPA uses for updating a community is the development of site Fact Sheets. Informational Fact Sheets at Superfund sites are routinely mailed to individuals on the site mailing list, which includes community members located within approximately one mile of the site, elected officials, and other interested parties who have requested information or who have attended public meetings. At the Site, EPA met community members and performed various outreach activities in response to the Site-specific needs of the community. This included responding to citizen concerns, neighborhood associations, and the community through informal discussions, community open houses, and public meetings. The JSP was particularly helpful in the success in all of the events listed below and provided local support throughout EPA's community involvement process and by assisting in newspaper publications through various local outlets.

- January 11, 2001: *The Environmental News*, a national periodical, published an article concerning EPA's decision to propose the Site to the NPL.
- January 20, 2001: EPA issued a Public Notice in newspapers in wide circulation throughout the State announcing that the Site was being proposed to the NPL, when the comment period would open for public comments, and when the comment period would end.
- February, 2001: In a Federal Register notice, EPA proposed the Site to the NPL due to the presence of PCE contaminating the ground water.
- June 16, 2001: The Associated Press in Las Cruces, reports that the EPA has added the Site to the NPL.
- June 25, 2001: EPA places an ad in the local newspaper of general distribution (the *Las Cruces Sun News)* regarding the listing of the Site on the NPL.

- July 21, 2001: EPA placed a notice in the *Las Cruces Sun News* stating that Region 6 has received a letter of intent from a citizen group indicating that it intended to apply for a Technical Assistance Grant (TAG) related to the Site.

- EPA postpones the September 11, 2001 open house in response to 9/11 terrorists attacks and airport closings.

- September 12, 2001: EPA sends out post card announcements inviting the residents near the Site, and those listed on EPA's mailing list to an open house meeting to be held at the local elementary school (Hermosa Elementary) to discuss the Superfund program, the Site conditions that made the Site eligible for NPL listing, and answer other related questions from the public.

- October, 2001: EPA sends out a Fact Sheet to citizens within 2 miles from the plume boundaries and those other interested parties listed on the EPA mailing list describing recent and upcoming developments at the Site.

- November 8, 2001: EPA sends out flyers inviting residents on the EPA mailing list to an Open House to be held on September 11, 2001 at the Sierra Middle School Cafeteria in Las Cruces, New Mexico.

- November 9, 2001: EPA releases information to the *Las Cruces Sun News,* with an update about the Site and some information that was to be discussed at the Open House.

- January 1, 2002 EPA assists ATSDR in conducting its health assessment and evaluation of the Site.

- February 21, 2002: EPA meets with a Community Advisory Group (CAG) and holds a public meeting at the Sierra Middle School to update the community on Site activities and options associated with applying for TAG grants.

- April 4, 2002: EPA announces an open house scheduled to answer questions associated with Site activities. EPA sends out Fact Sheet to citizens on the mailing list updating them on Site plans and sampling activities taking place near their neighborhoods. Announcement published in local newspapers including the *Las Cruces Sun News* and the *Las Cruces Bulletin.*

- April 9, 2002: EPA sends out invitation to those on the mailing list announcing the open house scheduled to be held on April 25, 2002 at the Hermosa Heights Elementary School Cafeteria.

- April 24, 2002: EPA met with the CAG members and answered questions from parties interested in applying for the TAG. The EPA never received any formal applications, and only inquiries, therefore, a TAG was never awarded.

- April 25, 2002: EPA holds open house.

- August 12, 2002: The CLC begins mailing a bi-monthly Fact Sheet entitled, *Superfund PCE Project Update* to interested persons on alternating months. The update contains data results collected from municipal water supply wells and explains how the blending program is maintaining compliance with the drinking water standards.

- November, 2002: EPA sends out Fact Sheet to residents on the mailing list summarizing data findings at the Site and provides the community an update on Site activities.

- ATSDR announces in the *Las Cruces Sun News*, and other local publications about a scheduled open house on January 13, 2003 to discuss the public health assessment performed for the Site.

- January 31, 2003: EPA sends out notification letters and postcards to residents who requested EPA to sample their tap water.

- November, 2003: EPA mails a Fact Sheet to residents on the mailing list updating them on Site activities.

- July 21, 2005: EPA holds an open house at the Sierra Middle School Cafeteria. Fact Sheets were mailed prior to the meeting, along with invitations to residents on the EPA mailing list. The Fact Sheet provided an update to residents on recent Site activities including the Settlement Agreement reached with the JSP (CLC and County) for completing the RI/FS.

- November 25, 2006: EPA announces in the Las Cruces Sun News the public comment period begins on December 4, 2006 and ends January 5, 2007 on the Proposed Plan publication and invites the public to attend the public meeting where EPA will discuss the proposed remedy and hear comments from the public. EPA also mailed post cards inviting residents on the mailing list to the public meeting and identified where the Site documents could be reviewed, before the comment period ended. EPA also mailed a Fact Sheet summarizing the contents of the Proposed Plan document and described how EPA proposes to clean up the ground water Site. The public meeting was held on December 7, 2006 at Sierra Middle School.

Section 4

Scope and Role of Response Action

- The ground water remedy will treat the entire PCE plume by pumping ground water from selected wells and piping it to a treatment facility where it will be treated to meet the MCL prior to delivery into the municipal water supply. The treatment facility will be located within the plume boundaries.

- Ground water will be extracted at rates sufficient to contain the plume and to prevent plume expansion. The remedy includes pumping modifications to existing CLC supply wells and one replacement well.
- The JSP model determined CLC Wells 19, 20, 21, 24, 26, and 38 should be turned off for purposes of controlling plume expansion. The modeling results also identified CLC Wells Nos. 18 and 27 as appropriately located wells and for remediating the entire plume. During design, final adjustments will be made toward refining locations and pumping rates if necessary.
- The selected wells and their associated infrastructure will be modified to extract water from targeted ground water zones that contain higher PCE concentrations.
- In addition to pumping CLC Well 18 and 27 a minimum of one new extraction well will be installed. Preliminary modeling results indicate the most effective location for extracting contaminants to be along the axis of the CLC Well No. 27. The extraction well will be installed in about the first five years of operation as CLC Well No. 18 begins to demonstrate that it will draw more clean water than PCE-affected water, thus becoming less efficient.
- The goal is to restore the aquifer in approximately 14 years however, once the remedy is operational, the data could indicate that more time (or less) may be required to meet remedial action objectives.
- PCE- contaminated water that is extracted from the plume will be treated until PCE concentrations meet the MCL. It is anticipated that air stripping technology will be used to treat the extracted contaminated ground water. However, during bench scale analysis, remedy design, etc., the remedy may show that other treatment options or methods identified in the Proposed Plan, i.e., GAC, or chemical/UltraViolet (UV) oxidation would be more effective for treating the contaminated ground water, and these other methods may be employed as part of the remedy.

Section 5

Site Characteristics

The Site is a ground water contaminant plume site located within the City of Las Cruces (CLC) in the central portion of Doña Ana County (County). The contaminant plume is approximately 1.8

miles by one-half mile in aerial extent. The elevation at the Site varies from a maximum of about 4,080 ft above MSL to 3,930 ft above MSL. The topography at the Site slopes towards the Rio Grande, located west of the Site.

The eastern area of the Site includes two topographically elevated areas with an arroyo valley extending east-west in between. The arroyo once flowed east to west parallel to, and south of the present-day East Hadley Avenue. The topographically elevated areas on either side of this feature were aligned approximately along East Hadley Avenue and East Griggs Avenue. This arroyo no longer serves as a channel for surface water flow, and is presently intersected by the recreational parks, streets, and storm-water retention basins.

Portions of a separate and larger arroyo (the Las Cruces Arroyo) are still present south of the GWP Site. The Las Cruces Arroyo trends east-to-west from I-25 to near East Lohman Avenue west of North Walnut Street, with some remnants of the original arroyo located slightly north and parallel to the Arroyo Plaza Shopping Center. The Las Cruces Flood Control Dam and I-25 intercept the original extent of Las Cruces Arroyo, reducing the flow of this arroyo drainage originating west of I-25.

Precipitation

The average annual precipitation in the Mesilla Valley ranges between 8.0 and 9.0 inches per year, with most precipitation in the form of rain. Most rain is limited to brief, sometimes intense thunderstorms, with more than half of the annual precipitation falling during the period July through September. Nearly three-fourths of the annual precipitation occurs in the warmest six months of the year (May through October). Potential evaporation and transpiration greatly exceeds rainfall. Potential evaporation rates measured in an evaporation pan average about 97 inches per year. Potential evaporation and transpiration rates limit the amount of surface water available in the area. This also limits the amount of recharge the aquifer receives from rainfall.

Demography and Land Use

The population of the CLC, as reported from the 2000 census, was 74,267. The population reported for the County from the 2000 census was 174,682. Land use at and near the GWP Site is characterized by a broad mix of commercial, public recreational, light industrial, and residential areas. Just north of CLC Well No. 18 and extending west to North Solano Drive and east to past North Walnut Street, a large portion of the area is used for public recreation such as, soccer, basketball, and baseball parks, and skate boarding facilities. Residential neighborhoods are present west of North Solano Drive, east of North Walnut Street, north of East Hadley Avenue, and south of East Griggs Avenue. The rest of the area along East Hadley Avenue and East Griggs Avenue between North Solano Drive and just east of North Walnut Street is light industrial/commercial. Other commercial and light industrial properties can be found along the major roadways in the vicinity of the Site, including East Lohman Avenue, North Solano Drive, and East Spruce Avenue (refer to **Figure 2-1** for the layout of the streets).

Development in the area of the Site has resulted in changes in land uses since the 1950s. As development evolved from the open desert space to the current land uses, significant modification of the landscape has occurred (e.g., the reworking of soils, installation of turf, importation of fill materials and asphalt cover) in various areas of the Site.

Several past land use activities were determined to be relevant to the Site and represent the sources of contamination in ground water. These land uses are (1) the historical operations at the former New Mexico Army National Guard facility, (2) historical operations at the former Crawford Municipal Airport and other maintenance facilities owned or operated by the CLC and (3) suspected historical uncontrolled dumping of waste materials and historical and/or current operations at the DACTD maintenance facility.

Surface Water

The Site receives a low amount of precipitation annually and experiences a rapid rate of soil infiltration, particularly during the monsoon season. Surface water flow at the Site can be characterized as ephemeral. Most surface water flow resulting from rainfall is channeled along streets into the CLC's storm water sewer system. Several storm water retention basins are present throughout the vicinity of the Site and accumulate surface runoff during rain events before drainage or evapotranspiration occurs. The arroyo that once flowed east to west parallel to the present-day East Hadley Avenue no longer serves as a channel to surface water flow, having been intersected by the parks and streets and storm water retention basins. The Las Cruces Arroyo flows east-to-west from about I-25 to near East Lohman Avenue west of North Walnut Street. The Las Cruces Flood Control Dam and I-25 block the majority of stormwater flow from traveling into the central areas of Las Cruces.

Regional Geology

The CLC is located in the Mexican Highlands section of the Basin and Range physiographic province. In general, the physiography of the area consists of uplifted fault-block mountain ranges and intermontane basins. The intermontane basins are structurally depressed low areas that have been displaced downward with respect to the mountains. The mountain ranges and intermontane basins generally have a north-south trend. Other mountain types in the area include broad domal uplifts and erosional remnants of igneous intrusive bodies.

The major physiographic features in the Las Cruces area are the entrenched Rio Grande and two intermontane basins; the Jornada del Muerto and the Mesilla Bolson. Las Cruces is located in the Mesilla Valley (located within the Mesilla Bolson) east of the Rio Grande. The Jornada del Muerto is located north and east of Las Cruces. A subsurface high area in the bedrock, known as a horst, separates the two basins. The horst is located approximately 1 mile east of the GWP Site and was not encountered during drilling of any Site monitoring wells.

The regional geology is composed of the Quaternary flood plain alluvium and the Miocene to Middle Pleistocene Santa Fe Group. The flood plain alluvium was deposited by the Rio Grande. It generally consists of a thick basal sand and gravel channel unit overlain by finer-grained flood plain deposits. The flood plain alluvium is generally about 4 miles wide and 80 ft thick. The Santa Fe Group is composed of sequences of unconsolidated to moderately-consolidated sedimentary deposits of clay, silt, sand, gravel, some basalts, and minor ash-fall deposits. The Santa Fe Group can be up to 4,000 ft thick.

Site Geology

A Site stratigraphic model was developed through data obtained from drilling 10 deep multi-port ground water monitoring wells. This included use of the soil boring logs and geophysical logs completed for each well. The boreholes for these wells were drilled to depths comparable to the depths of PCE-affected CLC municipal supply wells.

The Site stratigraphy data observed during drilling operations is consistent with the regional stratigraphy documented in published literature for the Rio Grande Alluvium and the Santa Fe Group. Alternating beds of gravels, sands, silts, and clays occur across the vicinity of the Site. Many beds can be correlated across most of the area. Hydro-geophysical cross-sections were prepared based on both geologic and hydrogeologic observations from the geophysical logs and boring logs obtained during drilling operations. Visual descriptions of drill cuttings logged during well construction served to cross-check the geophysical data and confirm the lateral correlations presented on the cross-sections.

The Rio Grande Alluvium is present across the western portion of the Site from ground surface to a depth of between 80 and 120 ft bgs. It is composed of primarily sand and gravel deposits, with some inter-bedded clays and silts. Only the lower 10 to 15 ft of the alluvium is saturated. The Santa Fe Group sediments are present beneath the Rio Grande Alluvium west of GWMW03 and at ground surface east of GWMW03. Along the eastern portion of the Site, the upper part of the Santa Fe Group consists of mostly inter-bedded sand and gravel deposits. The surficial deposits are between 150 and 260 ft thick. This upper portion of the Santa Fe Group is unsaturated.

A thick layer composed of fine sand with varying percentages of silt and clay is present below the upper portion of the Santa Fe Group deposits and the base of the Rio Grande Alluvium. The thickness of this layer is between 50 and 115 ft, and is continuous across the Site, but thins towards the east. The first water encountered beneath the eastern portion of the Site occurs within this unit. At its base, the unit becomes inter-bedded with silt and clay deposits. These inter-bedded clay and silt deposits are not present beneath the far eastern portion of the GWP Site at monitoring well GWMW15.

Below these layers, the Santa Fe Group is composed primarily of fine to coarse sand units ranging in thickness from 10 to 130 ft. These units are commonly separated with thin, inter-bedded finer grained units. These finer-grained beds are more numerous in the western portion of the Site, with the beds pinching out towards the east. Some gravel beds are present at lower depths. The base of the Santa Fe Group was not encountered in any of the boreholes drilled at the Site, down to an elevation of 3,325 ft MSL.

Regional Hydrogeology

The CLC is located within the Mesilla Ground Water Basin (Mesilla Basin), which is primarily located within the County, but also extends into El Paso County, Texas, and the State of Chihuahua, Mexico. The Rio Grande Alluvium and the Santa Fe Group are the two major ground water aquifers within the Mesilla Basin, with the two aquifers forming a complex aquifer system. Regionally, recharge to ground water is primarily from the Rio Grande River and inter-connected irrigation canals along the Rio Grande River into the flood plain alluvium. Minor amounts of recharge also occurs as mountain and slope-front recharge. Mountain-front recharge occurs along the western slopes of the Organ and Franklin Mountains, located to the east of Las Cruces. Slope-front recharge occurs from surface water that has accumulated in arroyos during precipitation events.

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Water migrates downward through the Rio Grande Alluvium to the upper Santa Fe Group through a series of interconnected gravel, sand, and silt lenses. Vertical flow within the system is limited by thin, inter-bedded clay lenses in the lower part of the alluvium and the upper portion of the Santa Fe Group. This vertical heterogeneity indicates that the permeability is greater horizontally than vertically.

Ground water occurs under unconfined conditions within the Rio Grande Alluvium and under unconfined to semi-confined conditions within the Santa Fe Group. Ground water flow within the Mesilla Basin is generally to the southeast.

Ground water is removed from the aquifer by pumping wells and as discharge along irrigation canals when ground water levels are sufficiently high. Minor amounts of ground water leave the basin through the El Paso Narrows, at the southern end of the basin. The primary use of ground and surface water within the Mesilla Basin is for irrigation. Communities within the basin rely on ground water as the source of municipal and industrial water supplies. During non-drought years, most irrigation water is diverted from the Rio Grande. During years of drought, ground water is used to make up for the shortfall in surface water supplies for irrigation. Prior to about 1975, most irrigation wells were completed within the Rio Grande Alluvium, but after 1975, wells were drilled deeper into the Santa Fe Group to acquire better quality water.

The Mesilla Basin aquifer has excellent recharge, transmission, and storage capacity. These characteristics make the aquifer system capable of producing large quantities of high quality water for agricultural, municipal, and industrial uses. Ground water is currently the only source of drinking water for the CLC. The CLC obtains water from both the Mesilla and the adjacent Jornada Ground Water Basin.

The CLC Municipal Water System is a blended system supplying water from approximately 30 wells. The Site map (**Figure 2-1**) presents the CLC wells within and near the Site. The CLC's municipal wells are completed within sand and gravel layers in the Santa Fe Group. Most wells are located on the east side of the Rio Grande, but there are also wells located west of the Rio Grande on the West Mesa. No single well supplies more than 40% of the total water within the system, and the system produces approximately 19 million gallons per day on average. There are few private wells in the area of the GWP Site and they are used primarily for residential irrigation purposes.

Site Hydrogeology

Directly beneath the Site is an unsaturated zone (also known as the vadose zone) of sands, silts and clays ranging in thickness from 80 ft on the western side of the Site to over 200 ft on the east. This zone is typically a permeable layer of sediments through which water infiltrates to the aquifer. Air and other vapors can migrate in horizontal and vertical directions in the unsaturated zone through physical processes such as diffusion.

Underlying the unsaturated zone, there are two distinct hydrologic zones beneath the Site, referred to as the Upper Hydrologic Zone (UHZ) and the Lower Hydrologic Zone (LHZ). (See **Figures 5-2, 5-3**, and **5-4**). Both zones are fully saturated and can be correlated across the area of the Site. The boundaries between the zones were established from observed water levels and geophysical changes observed with depth. Water levels were obtained from the multi-port and nested monitoring wells screened across each zone.

Upper Hydrologic Zone (UHZ)

The UHZ is composed of the lower portions of the Rio Grande Alluvium and the upper portion of the Santa Fe Group. It represents the uppermost portion of the aquifer and is over 100 ft thick along the western portion of the Site. Representative thickness of the UHZ in the eastern part of the Site range from 20 ft at GWMW09 to 50 ft at GWMW15. The zone is thicker in the western portions of the Site, but becomes thinner towards the east. Ground water in this zone occurs under unconfined or water-table conditions. Water level data from the UHZ and LHZ indicate greater hydraulic communication between the two zones to the east.

Ground water flow in the UHZ is towards the east-southeast in the western portion of the Site. The ground water flow becomes more eastward near monitoring wells GWMW03 and MW-SF6. This easterly flow direction is consistent across the eastern portion of the Site, flowing towards the CLC's municipal supply wells in the area of I-25. The ground water flow direction indicates that the UHZ is affected by pumping at the CLC municipal supply wells, especially in areas east of monitoring well GWMW03.

There is a downward vertical gradient (range of 0.02 to 0.06 (ft per foot)) that exists between the UHZ and LHZ at all locations.

Lower Hydrologic Zone (LHZ)

The LHZ is within the Santa Fe Group. Most of the LHZ is composed of fine to coarse sand with some fine gravel. The boundary between LHZ and the UHZ is marked by overlapping layers of fine sand with clay and silt, clay, and silt that are present across most of the Site. These finer grained sediment layers appear to pinch out east of monitoring wells GWMW09 and GWMW10. The LHZ is divided into upper and lower portions based primarily on contaminant concentration differences and lithologic differences that occur in areas of the Site west of monitoring wells GWMW09 and GWMW10. Some subtle hydrologic differences also occur between the units, particularly with respect to ground water flow direction.

While the total thickness of the LHZ is unknown, it does extend from the base of the UHZ to at least 800 ft bgs at an elevation of 3,300 ft above MSL. The bottom of the LHZ was not encountered in any of the boreholes drilled at the Site. This zone is the primary ground water production interval for the CLC municipal supply wells located within the Site boundaries.

It is important to note that ground water flow in both the upper and lower portions of the LHZ are directly influenced by pumping at the CLC municipal water supply wells, with water levels responding somewhat, to peak periods of pumping, and water level trends within the upper and lower portions of the LHZ being similar. The horizontal hydraulic conductivity is significantly greater than the vertical hydraulic conductivity as a result of the inter-bedded nature of this zone, especially in the western portion of the Site. The pumping data from the CLC wells were compared against water level responses in monitoring wells, and seemed to support a hydraulic connection between the UHZ and LHZ at the time of this ground water flow characterization.

It was also determined that vertical potentiometric head differences are less pronounced within the LHZ. The water levels in multi-port wells screened within the LHZ are similar in the upper and lower portions. Therefore, vertical gradients were not calculated between the upper and lower portions of the LHZ.

Comparison of the Site Hydrogeology to the JSP Site Model

The ground water model developed by JSP assists in refining the Site hydrogeologic conceptual model. The JSP model divides the Site hydrogeology into five model layers. The five model layers are based on the hydrostratigraphic units and lithofacies assemblages. The JSP ground water model report further details how the model and hydrogeologic framework were determined and explains each model layer.

Table 5-1 provides a cross-reference of the UHZ, upper portion of the LHZ, and lower portion of the LHZ to the JSP's ground water model layers and the hydrostratigraphic units and lithofacies assemblages. The UHZ is equivalent to layer 1 of the ground water model. The upper portion of the LHZ is equivalent to layer 2 of the ground water model and the uppermost portion of layer 3 of the ground water model. The lower portion of the LHZ is equivalent to the majority of layer 3 and layers 4 and 5 of the ground water model.

The ground water model indicates that ground water flow at the Site is towards the south-southeast and southeast within the LHZ (model layers 2 through 5). The ground water model report states that a lack of water level data exists north and east of CLC Well 21 and east of I-25 and does not fully reflect the current monitoring well network to delineate the cone-of-depression created by pumping at the CLC Wells. The current monitoring well network is limited to a narrow west-to-east area beginning near monitoring wells GWMW07 and GWMW06 and east to GWMW15. The CLC supply wells are screened across most of the LHZ. The flow patterns indicate that ground water flow in the LHZ at the Site is affected by pumping at the CLC municipal supply wells. This observation is also consistent with EPA's assessment on the influence of the supply wells to ground water flow at the Site, as discussed above.

Extent of Environmental Impacts

PCE is the primary Contaminant of Concern (COC) at the Site. It is the most widespread contaminant in both soil vapor and ground water. Low levels of PCE were detected in soil vapor (ranging from non-detect to 1,186 ppbv or 8.8 µg/L) in the unsaturated zone between 15 and 184 ft bgs. The highest concentrations of PCE in soil occur beneath, and in the vicinity of, the three identified source areas. (See Figure 5-8) Shallow soil vapor sampling confirms that broad areas of the subsurface are impacted by the PCE contamination from the source areas. Concentrations of PCE in more than half of the soil vapor samples collected from the shallow subsurface in the residential area northeast of the intersection of East Hadley Avenue and North Walnut Street exceeded screening criteria for PCE through the vapor intrusion pathway. Laterally, the concentration of PCE in soil vapor decreases in samples collected further away from each source area.

In ground water, the highest levels of PCE contamination occur in the UHZ and the upper portion of the LHZ. The highest detections of PCE are typically in wells screened at the water table or at the upper portion of the LHZ near the DACTD maintenance facility. Lower concentration levels of PCE are detected in the shallow wells located near the other two source areas. Ground water contamination in the LHZ is more extensive due to the presence of higher permeability strata that serve as the primary production zone for the City's municipal wells. Pumping of these wells has resulted in the vertical migration of PCE contamination into deeper portions of the aquifer. PCE contour maps depict the extent of PCE contamination in ground water for the UHZ, and the upper and lower portions of the LHZ.

The PCE ground water plume with concentrations that exceed the MCL for PCE extends approximately 9,500 ft west to east and approximately 2,700 ft north to south. The plume however, is not well defined in certain areas. In particular, the plume is not well defined in the area that is west and northwest of up-gradient monitoring well GWMW06, and, in the area east of down-gradient monitoring well GWMW15.

Laterally, there are two areas where PCE concentrations exceed the MCL. The first of these two areas is located near monitoring well GWMW06 and the second is located in an area extending from the DACTD maintenance facility east to monitoring well GWMW15. These two areas are separated by intervening wells where the PCE concentrations are less than the MCL. The PCE contaminated ground water plume extends vertically to a depth of approximately 635 ft bgs. The depth of the plume is defined vertically at the point where concentrations fall below the MCL for PCE.

Other VOCs detected in the ground water within the footprint of the PCE plume are benzene, toluene, methyl tertiary butyl ether (MTBE), and the PCE degradation products: TCE, and 1,2 cis- and 1,2 trans-DCE. Of these, only benzene has been detected in Site monitoring wells above its corresponding MCL (in seven monitoring wells), and MTBE is detected above its corresponding EPA Region 6 Medium-specific screening level (MSSL) in one monitoring well. Benzene is not detected in any municipal supply wells. MTBE is detected in one municipal supply well at concentrations below the MSSL.

Ground water samples collected in January 2004 were analyzed for Target Analyte List (TAL) metals at the multi-port monitoring wells during January 2004 (see Table 5-5). The samples were collected for the analysis of total (unfiltered) metals. Metals that were detected included aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc. Of these metals, aluminum, antimony, arsenic barium, calcium, chromium, cobalt, copper, iron, lead magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc were detected in more than five percent of the samples. However, none of these metals were detected at concentrations that exceeded drinking water standards.

The NMED collected samples for metal analysis during the Site Inspection activities that occurred in 2000. With the exception of arsenic, the NMED's analytical results were similar to those obtained in January 2004, for metals at the multi-port wells. Based on data collected at municipal water supply compliance wells, the CLC water system is currently meeting the arsenic standard of 10 parts per billion, or 10 µg/L.

Uranium has also been detected at concentrations exceeding its corresponding MCL in seven municipal supply wells (Well Nos. 10, 19, 20, 21, 24, 38 and 44). It was originally discovered by NMED in 2005 when it sampled the CLC wells to evaluate the drinking water system's compliance with the new MCL for uranium (30 µg/L). However, based on previous work by the U.S. Geological Survey (USGS) on ground water quality in portions of New Mexico, it was determined that the elevated concentrations of uranium (<1.0 µg/L and 102 µg/L) and other radionuclides in the Mesilla Basin are naturally occurring. The CLC also performed an evaluation of the potential sources of uranium in their municipal supply wells. This evaluation concluded that the uranium was naturally occurring (JSAI, 2006b). The CLC and NMED continue to monitor these wells for uranium, and the CLC is currently evaluating options for addressing the uranium exceedences in the drinking water supply as part of compliance with the SDWA.

Ground Water Quality

General water quality parameters that were measured included acidity (pH), alkalinity, temperature, oxidation/reduction potential (ORP – also known as redox potential), conductivity, and dissolved oxygen (DO).

General Water Chemistry

Ground water samples were collected in December 2005 for analysis of general water chemistry, and the analyses included alkalinity (carbonate, bicarbonate, and total as calcium bicarbonate [$CaCO3$]), calcium, magnesium, chloride, hardness, nitrate/nitrite, sulfate, sulfide, total dissolved solids (TDS), and total organic carbon (TOC). This data assists in evaluating the physical nature and conditions of ground water at a Site and in evaluating the fate and transport of contaminants, and the likelihood for natural degradation of organic compounds and contaminants such as organic solvents. Water chemistry data also provides a better understanding of the general Site conditions when evaluating appropriate remedies.

Migration Pathways and the Conceptual Site Model

PCE in ground water is probably the result of surface spills with subsequent leaching/infiltration and volatilization into the soil (or unsaturated zone). After leaching into the subsurface, some of the PCE volatilized within the unsaturated zone, forming soil vapor, while the remaining PCE continued its migration into the saturated zone and affected ground water. Dense non-aqueous phase liquid (DNAPL) chemicals have not been found to exist within the unsaturated zone or in the aquifer at the Site. Dissolved phase PCE in ground water is likely a result of induced infiltration and air diffusion. Local pumping from CLC municipal supply wells has drawn PCE horizontally and vertically across the Site into deeper portions of the aquifer. (See CSM Fig. 5-1).

Shallow soil vapor data suggested that PCE in soil vapor could potentially migrate into residential homes located in an area northeast of the intersection of East Hadley Avenue and North Walnut Street. Consequently, additional soil vapor data was collected to further evaluate the potential for indoor vapor intrusion at residential homes and to determine if the concentrations exceeded acceptable risk range levels to human health. The soil vapor samples were collected in a manner consistent with the guidance for evaluating the potential for indoor air vapor intrusion. The Baseline Human Health Risk Assessment (BHHRA) concluded that the concentrations at or near residential properties are within acceptable health risk range levels.

The JSP Team has completed a ground water model report for the Site that supplemented the fate and transport analysis. The results of the model indicate that the PCE plume located at, and down-gradient of, the DACTD maintenance facility will migrate southeast towards CLC Wells 20, 24, 26, and 61.

The current distribution of PCE contamination in the vadose zone and the current distribution of PCE contamination in both the UHZ and LHZ ground water indicate that the contamination in the subsurface is at or near equilibrium. While the soil vapor is believed to be a source of contamination to ground water, the low PCE concentration levels present in soil vapor indicate a decreasing threat to ground water. Although it is plausible that some contamination could volatilize from the water table to the vadose zone down-gradient from the three source areas, the concentration levels of PCE near the water table down-gradient of these source areas contain lower concentrations of PCE and are not likely to present a significant source of PCE contamination for the vadose zone.

The existing ground water plume is likely to continue migrating toward operational municipal supply wells, acting as a low level source of PCE to these wells. Natural attenuation, principally via dispersion and diffusion of PCE in both soil vapor and ground water, is expected to further reduce the concentrations of PCE over time.

Figure 5-1
Conceptual Model of PCE Release and Subsurface Contamination
Griggs and Walnut Ground Water Plume Site
Las Cruces, New Mexico

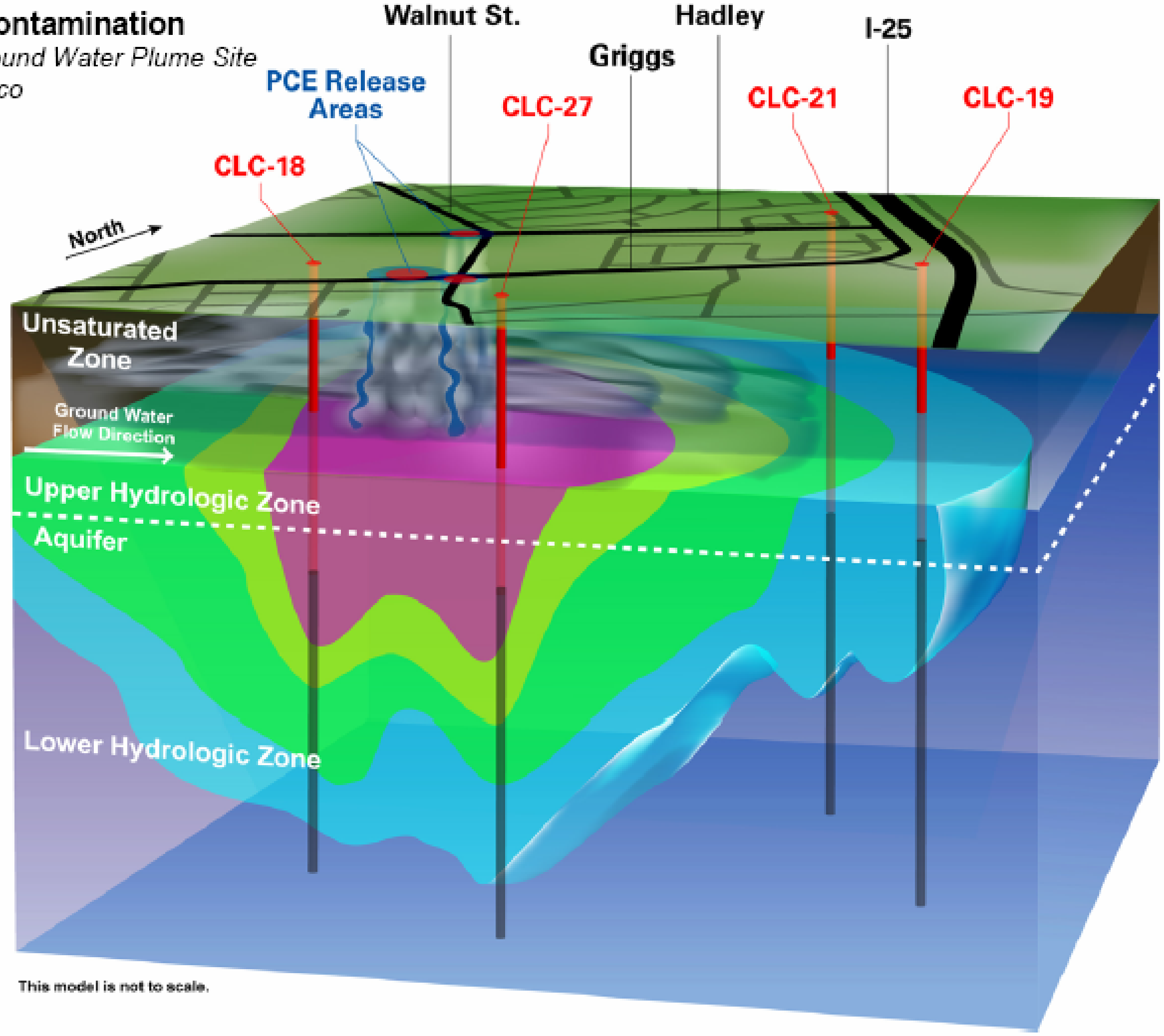


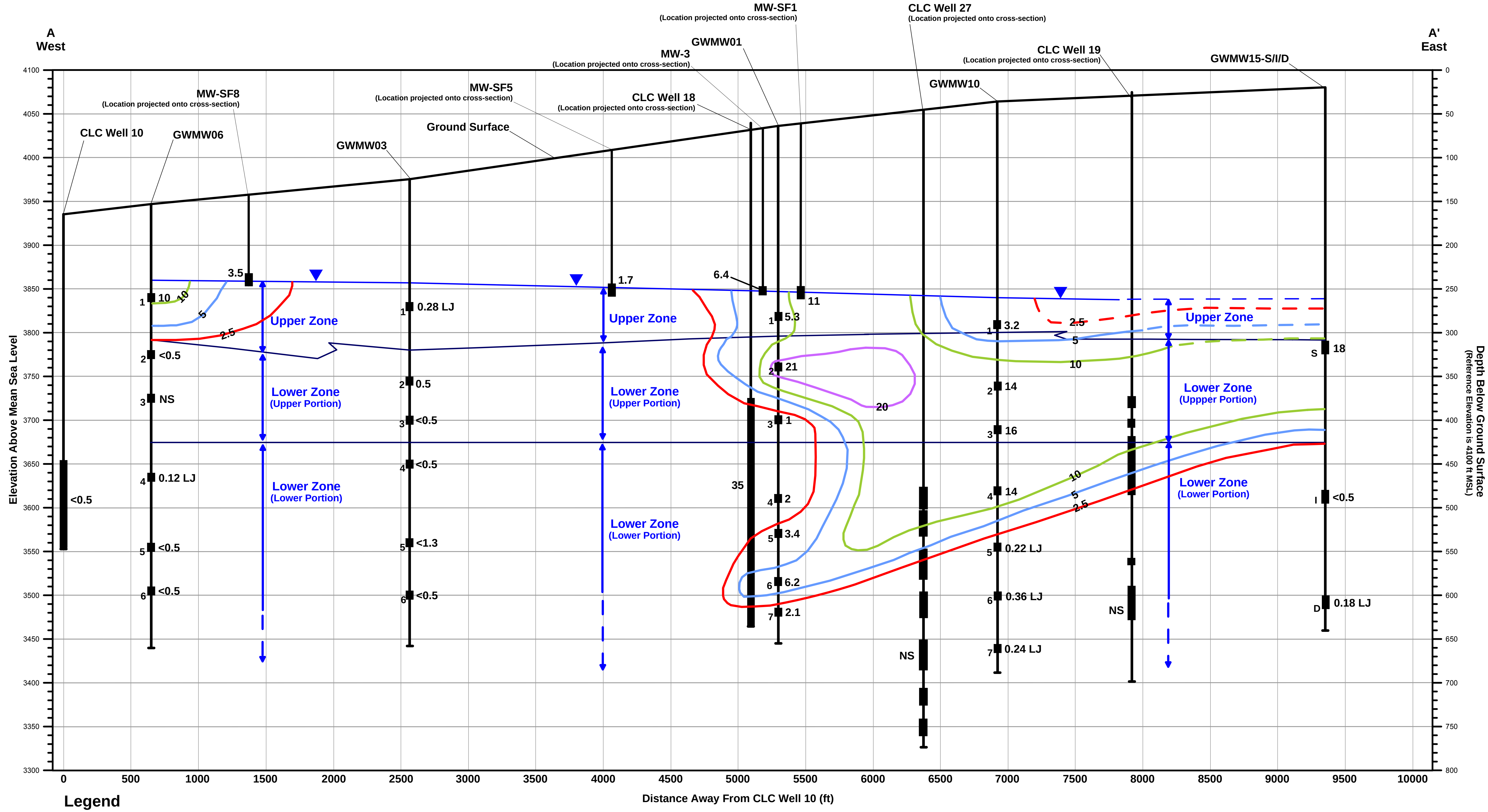
Table 5-1

Comparison of Griggs and Walnut Ground Water Model Layers, Hydrologic Zones, and Units Defined by Hawley and Kennedy (2004)
Griggs and Walnut Ground Water Plume
Las Cruces, New Mexico

Griggs and Walnut Model layer	Griggs and Walnut Ground Water Model layer thickness (ft)	Hawley and Kennedy (2004) Hydrostratigraphic unit	Hawley and Kennedy (2004) lithofacies assembleges in the Santa Fe Group Sediments	Site Specific geologic unit (RI/FS)	Site Specific Hydrologic Zone (RI/FS)
1	75	USF	LFA 1	Rio Grande Alluvium and Upper Santa Fe Group Sediments	Upper Hydraulic Zone (UHZ)
2	80	RA and USF	LFA a3 and 1	Silt and clay layer between Rio Grande Alluvium and Upper Santa Fe Group Sediments	Upper Portion of Lower Hydraulic Zone (LHZ)
3	200	USF	LFA 1 and 2	Santa Fe Group Sediments (alternating layers of sand, gravel, and fine-grained beds)	
4	200	USF and MSF	LFA 1 and 5	Same as above	Lower Portion of Lower Hydrologic Zone (LHZ)
5	Variable	MSF and LSF	LFA 2 and 3	Same as above	

Descriptions of Lithofacies assembleges (LFA) from Hawley and Kennedy (2004):
LFA a3 (silty clay, clay and sand)
LFA 1 (sand and pebble gravel, lenses of silty clay)
LFA 2 (sand, lenses of pebble sand, and silty clay)
LFA 3 (interbedded sand and silty clay, lenses of pebbly sand)
LFA 5 (predominately gravel and sand, and some silt and clay)

Hydrostratigraphic Units (HSU) from Hawley and Kennedy (2004):
RA Rio Grande Alluvium
USF Upper Santa Fe Group Sediments
MSF Middle Santa Fe Group Sediments
LSF Lower Santa Fe Group Sediments



Legend

PCE Concentration (ug/l)

Screened Interval

Monitor Well Port ID
(Multi-port and cluster wells only)

City of Las Cruces Municipal Supply Well and Screened Interval(s)
(see Table 3-2 for completion details)

PCE Isoconcentration Contours
(units are ug/l)
Dashed where infered

- 20
- 10
- 5
- 2.5

Water Table Surface
(dashed where inferred)

Hydrologic Zone Boundary

SCALE:

Horizontal: 1" = 725'
Vertical: 1" = 110'
Vertical Exageration = 6.6:1

NOTES:

Water table elevation based on water levels collected between November 29 and December 1, 2005

PCE concentrations are for samples collected during December 2005.

See Figure 3-4 for location of cross-section.

Where samples were collected using PDBs and low-flow purge method, the PDB data are presented.

Data for CLC Municipal Supply Wells is provided for informational purposes only. These data were not used for contouring.

Abbreviations: PCE - tetrachloroethene; PDB - passive diffusion bag; CLC - City of Las Cruces; ug/l - micrograms per liter; NS - Not Sampled
LJ - Result is estimated and below the contract required quantitation limit.

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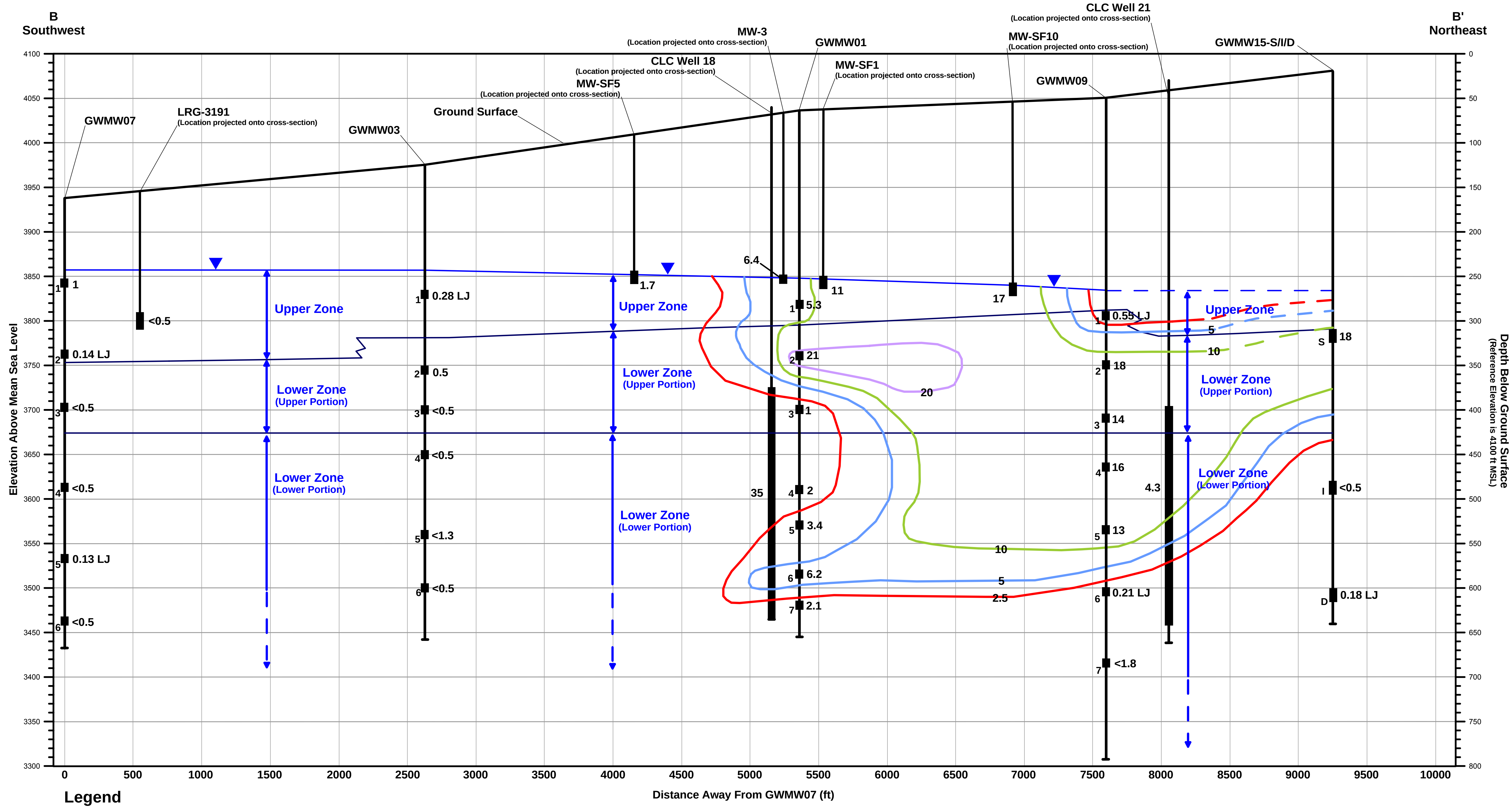
FIGURE 5-2
Vertical Distribution of PCE
Cross-Section A-A'
Griggs and Walnut Ground Water Plume Site
Las Cruces, New Mexico



Legend

PCE Concentration (ug/l)

10

1

Screened Interval

Monitor Well Port ID
(Multi-port and cluster wells only)

City of Las Cruces Municipal Supply Well and Screened Interval(s)
(see Table 3-2 for completion details)

PCE Isoconcentration Contours
(units are ug/l)
Dashed where infered

- 20
- 10
- 5
- 2.5

Water Table Surface
(dashed where inferred)

Hydrologic Zone Boundary

SCALE:

Horizontal: 1" = 725'
Vertical: 1" = 110'
Vertical Exageration = 6.6:1

NOTES:

Water table elevation based on water levels collected between November 29 and December 1, 2005

PCE concentrations are for samples collected during December 2005.

See Figure 3-4 for location of cross-section.

Where samples were collected using PDBs and low-flow purge method, the PDB data are presented.

Data for CLC Municipal Supply Wells is provided for informational purposes only. These data were not used for contouring.

Abbreviations: PCE - tetrachloroethene; PDB - passive diffusion bag; CLC - City of Las Cruces; ug/l - micrograms per liter; NS - Not Sampled
LJ - Result is estimated and below the contract required quantitation limit.

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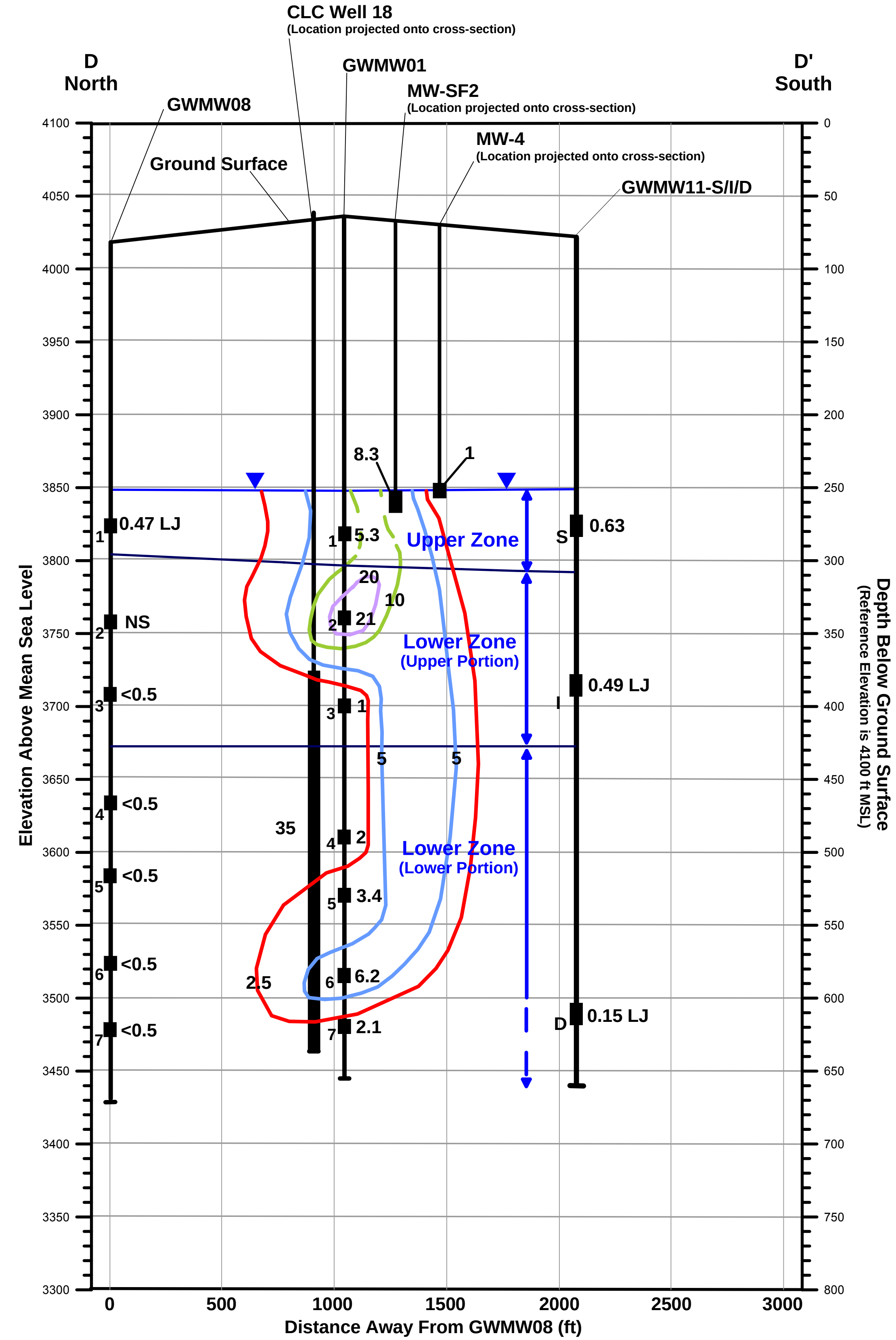
FIGURE 5-3
Vertical Distribution of PCE
Cross-Section B-B'
Griggs and Walnut Ground Water Plume Site
Las Cruces, New Mexico



Legend

PCE Concentration (ug/l)

10

1

Screened Interval

Monitor Well Port ID
(Multi-port and cluster wells only)

City of Las Cruces Municipal Supply Well and Screened Interval(s)
(see Table 3-2 for completion details)

PCE Isoconcentration Contours
(units are ug/l)
Dashed where infered

- 20
- 10
- 5
- 2.5

Water Table Surface
(dashed where inferred)

Hydrologic Zone Boundary

SCALE:

Horizontal: 1" = 725'
Vertical: 1" = 110'
Vertical Exageration = 6.6:1

NOTES:

Water table elevation based on water levels collected between November 29 and December 1, 2005

PCE concentrations are for samples collected during December 2005.

See Figure 3-4 for location of cross-section.

Where samples were collected using PDBs and low-flow purge method, the PDB data are presented.

Data for CLC Municipal Supply Wells is provided for informational purposes only. These data were not used for contouring.

Abbreviations: PCE - tetrachloroethene; PDB - passive diffusion bag; CLC - City of Las Cruces; ug/l - micrograms per liter; NS - Not Sampled
LJ - Result is estimated and below the contract required quantitation limit.

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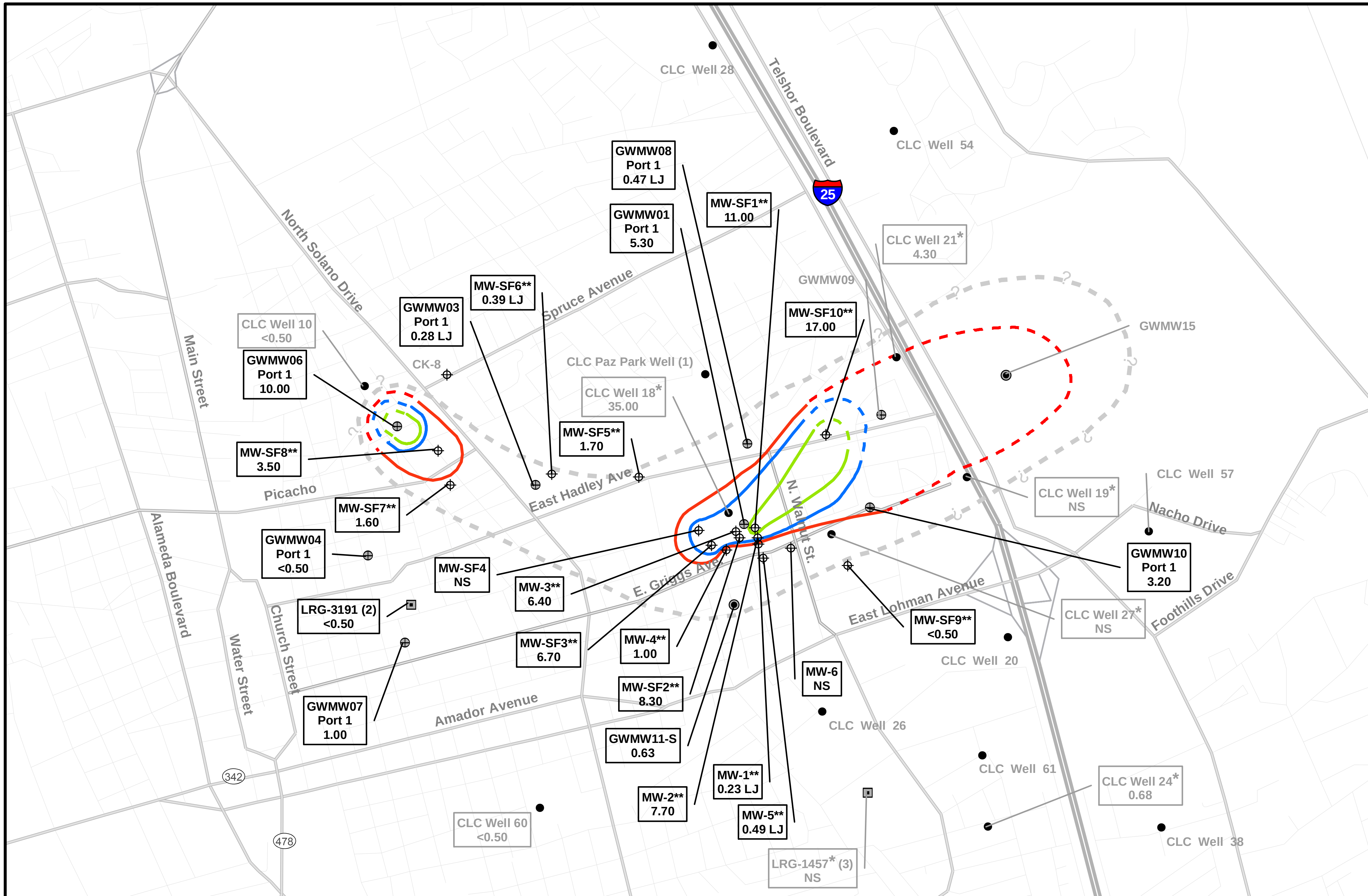
FIGURE 5-4
Vertical Distribution of PCE
Cross-Section D-D'
Griggs and Walnut Ground Water Plume Site
Las Cruces, New Mexico



Notes:

PCE Concentrations in micrograms per liter (ug/L).

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).
2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE
3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

Gas Card Monitor Well and Private Well LRG-7375 have been abandoned and are not shown on figure.

Unit Qualifiers:
J - Estimated
L - Concentration below the reporting limit

Concentration Data Contoured by Hand.

NS - Not Sampled

The municipal supply well concentrations are used for informational purposes only. The PCE concentrations in these wells were not used to prepare the PCE isoconcentration contours shown on this figure.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.

** PCE results shown were obtained using Passive Diffusion Bags (PDBs). Duplicate samples were collected at a subset of locations using low flow sampling method. The concentration of samples collected with the low flow method was about two to three times higher then the corresponding samples collected using PDB samples. For a comparison of analytical results obtained from using PDBs versus low flow sampling, see RI Report, Appendix G-2.

Feet
0 750 1,500 3,000

LEGEND

- Water Table Monitor Well (screen depths of these wells range from 101 to 204 feet bgs.)
- City of Las Cruces (CLC) Municipal Water Supply Wells (screen depths of these wells range from 281 to 1,050 feet bgs.)
- Private Water Supply Wells (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- Multi-Port Monitor Well (screen depth of these wells range from 90 to 640 feet bgs)
- Nested Monitor Well (screen depths of these wells range from 190 to 590 ft bgs)
- GWMW06 Port 1 10.00 — Monitor Well ID, Port Number & PCE Concentration
- ? Indicates Uncertainty of Extent of GWP-Related PCE Detections
- Estimated Extent of GWP-Related PCE Detections

PCE Concentration Levels (Dashed Where Infered)
- 2.5 ug/L
- 5 ug/L
- 10 ug/L
- 20 ug/L

CH2MHILL

Figure 5-5
Horizontal Distribution of PCE in the Upper Hydrologic Zone (December 2005)
Griggs & Walnut Ground Water Plume Site
Las Cruces, New Mexico

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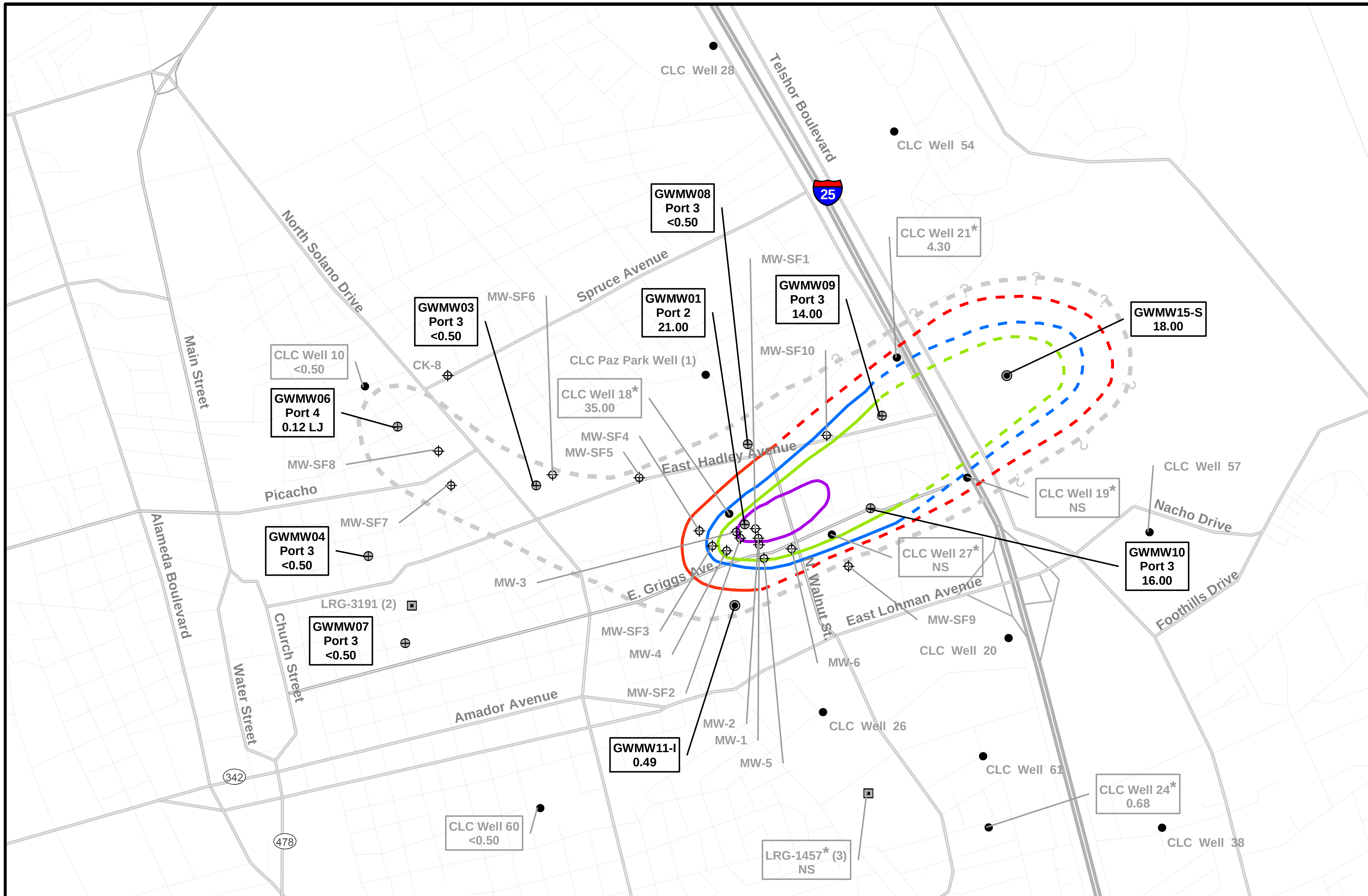

Notes:

PCE Concentrations in micrograms per liter (ug/L).

No Data obtained from GWMW06 Port 3. Data for Port 2 was <0.50 and data for Port 4 was 0.12 LJ. Therefore, PCE contamination is assumed to extend past GWMW06.

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).
2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE
3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

Gas Card Monitor Well and Private Well LRG-7375 have been abandoned and are not shown on figure.

Unit Qualifiers:
J - Estimated
L - Concentration below the reporting limit

Concentration Data Contoured by Hand.

NS - Not Sampled

The municipal supply well concentrations are used for informational purposes only. The PCE concentrations in these wells were not used to prepare the PCE isoconcentration contours shown on this figure.

Upper portion of Lower Zone corresponds to an approximate elevation range of 3675 to 3775 ft MSL.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.

Feet
0 750 1,500 3,000

LEGEND

- Water Table Monitor Well (screen depths of these wells range from 101 to 204 feet bgs.)
- City of Las Cruces (CLC) Municipal Water Supply Wells (screen depths of these wells range from 281 to 1,050 feet bgs.)
- Private Water Supply Wells (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- Multi-Port Monitor Well (screen depth of these wells range from 90 to 640 feet bgs)
- Nested Monitor Well (screen depths of these wells range from 190 to 590 ft bgs)
- GWMW07 Port 3 <0.50 — Monitor Well ID, Port Number & PCE Concentration
- ? Indicates Uncertainty of Extent of GWP-Related PCE Detections
- Estimated Extent of GWP-Related PCE Detections

PCE Concentration Levels (Dashed Where Infered)
- 2.5 ug/L
- 5 ug/L
- 10 ug/L
- 20 ug/L

CH2MHILL

Figure 5-5
Horizontal Distribution of PCE in Upper Portion of the Lower Hydrologic Zone (December 2005)
Griggs & Walnut Ground Water Plume Site
Las Cruces, New Mexico

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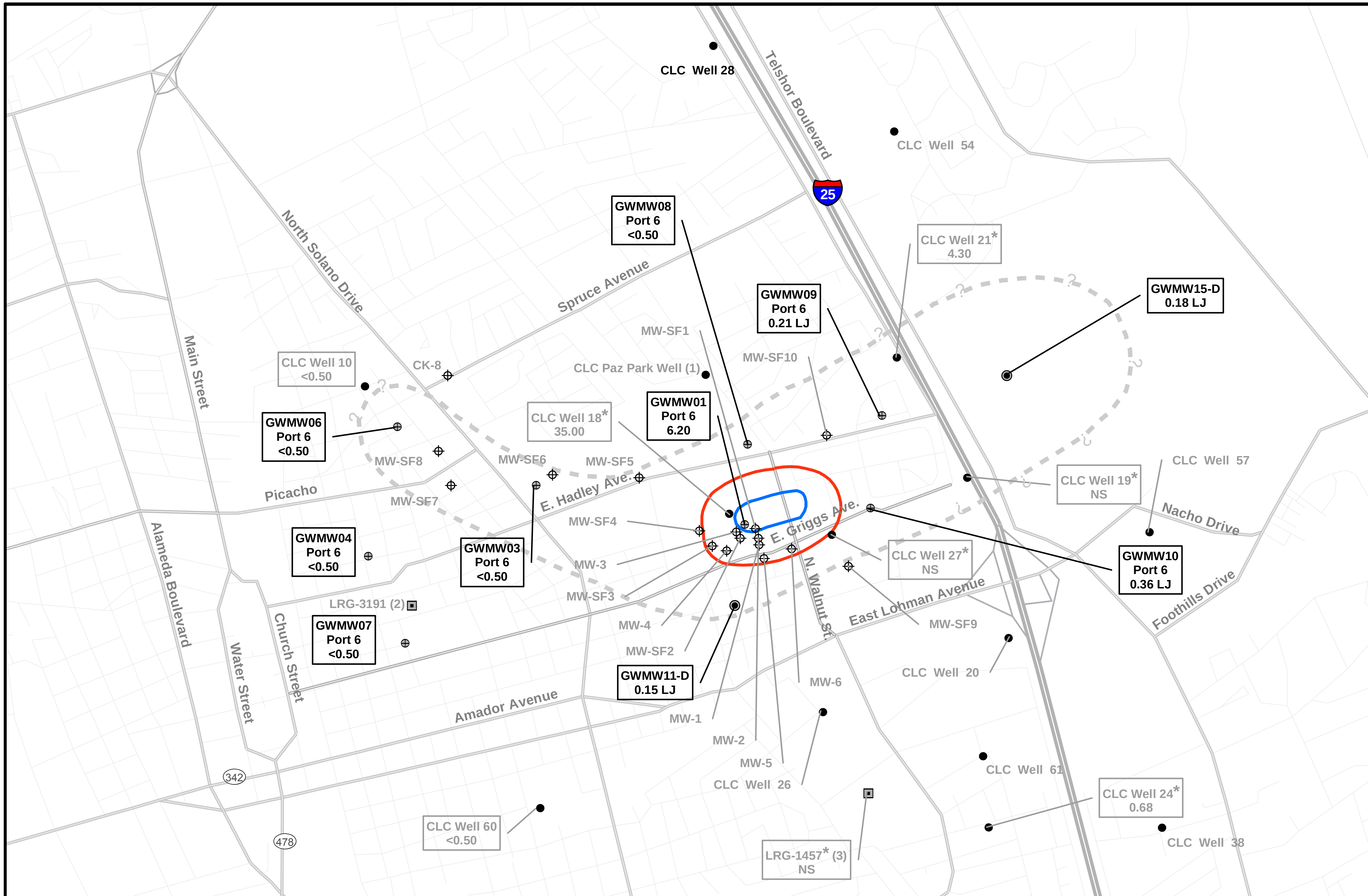
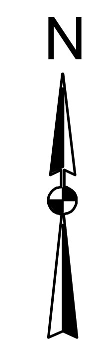




Notes:

PCE Concentrations in micrograms per liter (ug/L).

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).
2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE
3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

Gas Card Monitor Well and Private Well LRG-7375 have been abandoned and are not shown on figure.

Unit Qualifiers:
J - Estimated
L - Concentration below the reporting limit

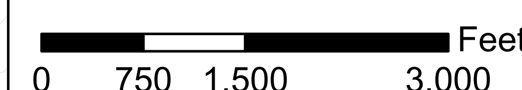
Concentration Data Contoured by Hand.

NS - Not Sampled

The municipal supply well concentrations are used for informational purposes only. The PCE concentrations in these wells were not used to prepare the PCE isoconcentration contours shown on this figure.

Lower portion of Lower Zone corresponds to an approximate elevation 3450 to 3675 ft MSL.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.



LEGEND

- **Water Table Monitor Well** (screen depths of these wells range from 101 to 204 feet bgs.)
- **City of Las Cruces (CLC) Municipal Water Supply Wells** (screen depths of these wells range from 281 to 1,050 feet bgs.)
- **Private Water Supply Wells** (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- **Multi-Port Monitor Well** (screen depth of these wells range from 90 to 640 feet bgs)
- **Nested Monitor Well** (screen depths of these wells range from 190 to 590 ft bgs)
- GWMW07 Port 6 <0.50 — Monitor Well ID, Port Number & PCE Concentration
- ? — Indicates Uncertainty of Extent of GWP-Related PCE Detections
- Estimated Extent of GWP-Related PCE Detections

PCE Concentration Levels
(Dashed Where Infered)
- 2.5 ug/L
- 5 ug/L

CH2MHILL

Figure 5-7
Horizontal Distribution of PCE in Lower Portion of the Lower Hydrologic Zone (December 2005)
Griggs & Walnut Ground Water Plume Site
Las Cruces, New Mexico

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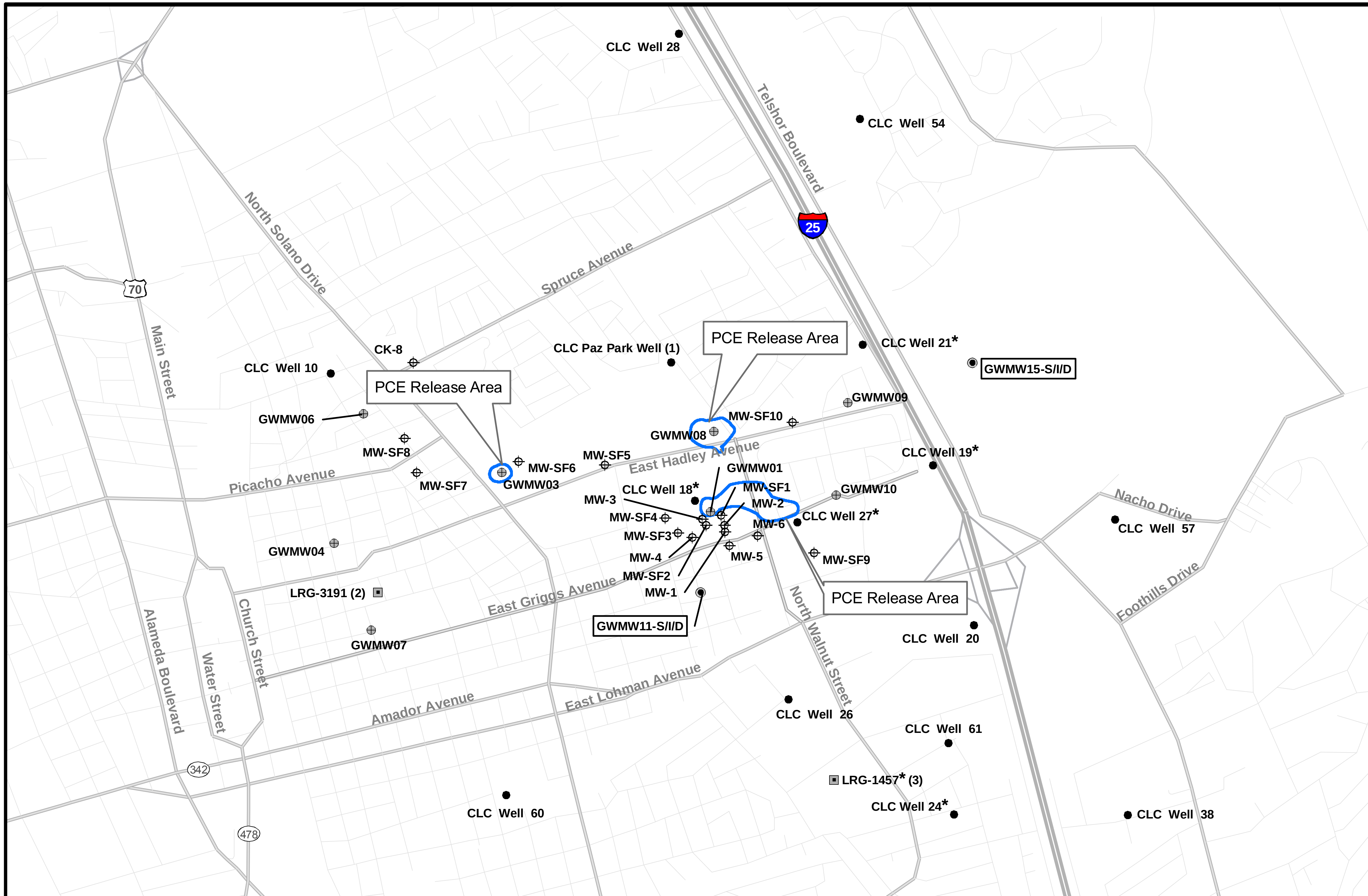

N

Notes:

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).
2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE
3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.

Feet
0 750 1,500 3,000

LEGEND

- ⌖ **Water Table Monitor Well** (screen depths of these wells range from 101 to 204 feet bgs.)
- ● **City of Las Cruces (CLC) Municipal Water Supply Wells** (screen depths of these wells range from 281 to 1,050 feet bgs.)
- ▣ **Private Water Supply Wells** (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- ⊕ **Multi-Port Monitor Well** (screen depth of these wells range from 90 to 640 feet bgs)
- ◉ **Nested Monitor Well** (screen depths of these wells range from 190 to 590 ft bgs)
- PCE Release Area

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Figure 5-8 PCE Release Areas and Well Locations

Griggs & Walnut Ground Water Plume Site

Las Cruces, New Mexico

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Section 6

Current and Potential Future Site and Resource Uses

Local Zoning

The Site is characterized by a broad mix of commercial, public recreational, light industrial, and residential land uses. Just north of CLC Well No. 18 and extending between North Solano Drive and North Walnut Street, a large portion of this area is served by various recreational facilities such as soccer fields, baseball and basketball facilities, and skate boarding designated areas. Residential neighborhoods are present west of North Solano Drive, east of North Walnut Street, north of East Hadley Avenue, and south of East Griggs Avenue. The rest of the area along East Hadley Avenue and East Griggs Avenue between North Solano Drive and just east of North Walnut Street, light industrial/commercial, activities are visible, along with the DACTD maintenance facility located on Griggs Avenue and the CLC fleet facility located on Hadley Avenue. Other commercial and light industrial properties can be found along the major roadways in the vicinity of the Site, including East Lohman Avenue, North Solano Drive, and East Spruce Avenue (refer to **Figure 2-1** for the layout of the streets).

Development in the area of the Site has resulted in changes in land uses since the 1950s. The current landuse activities and associated zoning are not expected to change in the near future. The community however, within the city limits continues to grow, and the demands on the ground water resource are expected to continue increasing. Ground water is the primary source of potable water for the area, and most, if not all municipal, industrial, and private wells are screened in the LHZ.

Section 7

Summary of Site Risks

Under the NCP, 40 CFR § 300.430, the role of the baseline risk assessment is to address the risk associated with a site in the absence of any remedial action or control, including institutional controls. The baseline assessment is essentially an evaluation of the no-action alterative. (See 55 Fed. Reg. 8666, 8710-8711 (March 8, 1990)). The baseline risk assessment also provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the 2006 Baseline Human Health Risk Assessment (BHHRA) for the Site and included in the November

2006 Remedial Investigation Report (Section 7 of the RI Report). The BHHRA includes both a Baseline Human Health Risk Assessment and a discussion on the Ecological Risk Assessment Checklist performed for the Site.

A four-step process is utilized for assessing Site-related human health risks in the BHHRA:
(1) Identification of Chemicals of Potential Concern (COPCs) – identifies those contaminants that are carried forward through the BHHRA process based on frequency of detection (FOD) and a comparative analysis to EPA human health risk-based screening levels or other appropriate levels (i.e., MCLs);
(2) Exposure Assessment – estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g,, ingesting contaminated well water) by which humans are potentially exposed;
(3) Toxicity Assessment – determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response), and;
(4) Risk Characterization (including the uncertainty analysis) – summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of Site-related risks. With the completion of this four-step risk assessment process, those exposure pathways and chemicals of concern (COCs) found to pose actual or potential threats to human health at the Site are identified for remedial action.

Identification of Chemicals of Potential Concern

The EPA used a two-step screening process to select COPCs in soil vapor and ground water for the BHHRA. The process evaluated the frequency of detection (FOD) and compared Site data to EPA human health risk-based screening levels or other levels (i.e., MCLs). First, those constituents detected at a frequency of five (5) percent or less in soil vapor or ground water were considered for elimination from the BHHRA. Second, for each constituent carried forward to the second step of the screening process, the maximum detected concentration was compared to its human health risk-based screening level or other screening level for soil vapor and ground water, as identified below:

Soil Vapor − EPA draft generic screening levels for deep soil vapor concentrations for indoor air vapor intrusion, based on a residential scenario, a target excess lifetime cancer risk (ELCR) of 1x10-5, and a non-cancer hazard index (HI) of 1.

Ground Water – The federal MCL, if one is available (EPA, 2002b). For those chemicals without MCLs, the EPA Region 6 MSSL for tap water based on a residential scenario, a target ELCR of 1x10-6, and a non-cancer HI of 1.

It is noted that those constituents considered for elimination in the first step were also compared to the screening levels. With the exception of cis-1,3-dichloropropene, all chemicals with a frequency of detection of 5 percent or less resulted in concentrations less than the screening levels. Cis-1,3-dichloropropene was detected in only 1 of 79 ground water samples, and was detected at a concentration only slightly higher than its screening level (0.41 µg/L versus 0.40 µg/L).

Data Used in the Screening Process

Soil vapor − Soil vapor samples collected in November 2005 were used in completing the BHHRA. Soil vapor data were collected from the immediate vicinity of three areas: (1) eight residences (adjacent to an area of release and area of higher PCE concentrations); (2) the PAL Boxing Facility; and (3) the Meerscheidt Recreation Center. The samples were collected from shallow depths ranging between 3 to 10 ft bgs. A summary of soil vapor analytical data is provided in Appendix A, Table A1-2.1 through Table A1-2.3.

Ground Water − Potential current exposure points were identified in ground water at locations where municipal supply wells or reservoirs distribute water directly to users (e.g., the Upper Griggs Reservoir, one private well [LRG-3191], and CLC wells that are not blended or are currently off-line). Potential future ground water exposure points were identified in the Mesilla Basin under the scenario where additional CLC wells installed in the future or existing CLC wells become impacted with COPCs from ground water migration.

The ground water data were grouped for the BHHRA based on the current use (i.e., water that is distributed to city residents) and potential future use (i.e., ground water in the Mesilla Basin) as follows:

- Municipal supply wells and reservoir currently distributing potable water to city residents—this data group includes the Upper Griggs Reservoir and CLC wells (excluding five CLC wells blended in the Upper Griggs Reservoir and CLC wells 18 and 19).
- One private well—this data group includes the data collected from private well LRG-3191. The well is currently used for irrigation purposes only, and is not the source of drinking water at the residence, although the resident may consume water from the well on an infrequent

basis.

- CLC wells blended in the Upper Griggs Reservoir —this data group includes the data collected from the five CLC wells (CLC wells 10, 21, 29, 32, and 60) providing water to the Upper Griggs Reservoir (the detailed CLC blending plan is provided in Appendix A4). The data collected from the Upper Griggs Reservoir are a better representation of concentrations at exposure points than are the five wells.

- CLC wells 18 and 19—this data group includes the data collected from two CLC wells previously used as part of the public water supply. CLC wells 18 and 19 have not been used since 1996 and 2005, respectively and, therefore, there are no current exposures to these wells.

- Monitoring wells—this data group includes the ground water data collected during the RI from 24 monitoring wells. The specific data used were the most recent available, i.e., from the December 2005 sampling event. In the future, one or more of the following scenarios may occur: (1) the CLC may install additional wells in the Mesilla Basin in areas that are impacted by chemicals above MCLs, (2) the CLC may discontinue their ground water blending program and chemical concentrations in CLC wells may exceed MCLs, or (3) ground water in the Mesilla Basin will likely continue to migrate and impact currently-used CLC wells at levels above MCLs. Therefore, future concentrations in CLC wells may be at levels above MCLs and pose an unacceptable risk.

COC Selection Process

The COC for the Site is PCE. The EPA identified COPCs that were present at concentrations that either exceeded EPA's risk-based screening levels or exceeded MCLs and carried them forward for detailed analysis in the BHHRA. PCE was identified as a COPC for indoor air (from vapor intrusion) based on the estimated lifetime cancer risk (ELCR) calculated from soil vapor samples collected outside of seven residential properties and outside of the PAL Boxing Facility, all of which are located above the current ground water plume. For ground water, EPA identified PCE and Benzene detections at concentrations exceeding the MCL of 5 µg/L for each chemical, and Methyl Tertiary Butyl Ether (MTBE), which was detected at concentrations exceeding the EPA Region 6 MSSL.[1]

[1] [There is no regulation regarding MTBE under the Safe Drinking Water Act, so it has no MCL; however, EPA has responded to requests for guidance by reviewing and updating an advisory for MTBE in December 1997. This Drinking Water Advisory: Consumer Acceptability and Health Effects Analysis provides guidance to communities that may become

Maximum detected concentrations of benzene, MTBE, and PCE at current exposure points (Upper Griggs Reservoir, CLC wells currently on-line and not blended, and one private well) are less than MCLs. However, future concentrations of these three COPCs at exposure points may exceed MCLs if the current blending program fails to maintain concentrations in the Upper Griggs Reservoir at concentration levels that are below MCLs, if additional wells are installed in the GWP Site plume within the Mesilla Basin, or if online wells become impacted via ground water plume migration. If MCLs are exceeded, unacceptable risks may be posed by the water supply. Therefore, the selected remedy must address these concerns, either through treatment, monitoring, or institutional controls for the Site.
In addition, reporting limits (RLs) were compared to screening levels for analytes that were not detected in any samples in a given data group. The reporting limits for TCE in soil vapor slightly exceeded screening levels (10 ppbv versus 4.1 ppbv) at most locations. Additionally, reporting limits for 6 VOCs in ground water exceed screening levels. Those chemicals became identified as COPCs and were carried forward. Quantitative analysis of COPCs for specific exposure pathways were performed in the subsequent section of the BHHRA for these chemicals.

In a baseline risk assessment, the EPA uses a concentration for each COPC to calculate the risk. This concentration, called the exposure point concentration, is a statistically-derived number based on all of the sampling data collected for a Superfund Site. Generally, the 95 percent upper confidence limit (UCL) on the arithmetic mean concentration for a chemical is used as the exposure point concentration. The 95 percent upper confidence limit on the arithmetic mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of Site data, equals or exceeds the true mean 95 percent of the time.

The summary of the COPCs and the medium-specific exposure point concentrations is included in Appendix A, Tables A1-A9.

Uranium was detected above the MCL in seven CLC wells; however, elevated concentrations of uranium are naturally occurring in the area ground water. The EPA's CERCLA authority does

exposed to drinking water contaminated with MTBE. The advisory recommends control levels that prevent adverse taste and odor (*i.e.* 20 to 40 parts per billion). EPA believes managing water supplies to avoid the unpleasant taste and odor effects at levels in this range would also provide protection against other potential adverse health effects with a large margin of safety.]

not directly apply to naturally occurring contamination such as the uranium contamination found at the Site. Accordingly, the Selected Remedy does not address naturally occurring uranium contamination in the Site ground water. The CLC, however, is currently taking actions to ensure that it continues to meet Safe Drinking Water Act standards wherever uranium exceeds the standards. It is EPA's expectation that the CLC's actions to address uranium in the water supply will be coordinated with the remedial action for PCE if uranium reaches unacceptable levels within the plume boundaries.

Exposure Assessment

In the exposure assessment part of the BHHRA, a detailed evaluation was completed for each potential exposure scenario at the Site. This evaluation included identification and characterization of contaminant sources and release mechanisms, transport media, exposure points, exposure routes, and human receptors. Human receptors identified and assessed as part of the potential exposure scenarios included current and future on-Site adult and child residents, current and future on-Site workers at the PAL Boxing Facility, and current and future adolescent recreational users of the on-Site PAL Boxing Facility. For these exposure scenarios, future land use was assumed to remain the same as present land use.

Potential Effects on Human Health

The BHHRA assessed whether Site-related contaminants pose a current or future risk to human health if no remedial actions are performed. A large part of the BHHRA is the determination as to whether a complete exposure pathway exists. In a BHHRA, exposure pathways are means by which hazardous substances move through the environment from a source to a point of contact with human receptors. A complete exposure pathway must have four parts: (1) a source of contamination, (2) a mechanism for transport of a substance from the source to the air, surface water, groundwater and/or soil, (3) a point where human receptors come in contact with contaminated air, surface water, groundwater or soil, and (4) a route of entry into the body. Routes of entry can be eating or drinking contaminated materials, (ingestion) breathing contaminated air, (inhalation) or absorbing contaminants through the skin (dermal contact). Risks can be assessed when an exposure pathway is complete.

If any part of an exposure pathway is absent, the pathway is said to be incomplete and no exposure or risk is possible. In some cases, although a pathway is complete, the likelihood that significant exposure will occur is very small. Risk assessments include a "pathways analysis" to identify those pathways that are complete and most likely to produce significant exposure.

The pathway analysis at the Site determined that two complete exposure pathways exist for PCE, the contaminant of concern (COC) at the Site. A complete exposure pathway exists for PCE in subsurface soil vapor, and in ground water as a drinking water supply. The inhalation exposure pathway results from soil vapor (by way of indoor vapor intrusion) at residential properties or recreational facilities. Under certain conditions and concentrations, PCE in soil can volatilize and migrate into building structures. The complete pathway for ingestion is by way of consuming PCE-affected ground water. PCE in vapor phase within the unsaturated zone can volatilize and potentially migrate into building structures.

The risk assessment determined that PCE in the proximity of the PAL Boxing Facility and 7 residential properties located northeast of the intersection of East Hadley Avenue and North Walnut Street exceeded screening values and warranted further evaluation to determine if this complete pathway resulted in an unacceptable risk. Some measured risk levels associated with some of the residential properties and the PAL facility exceed EPA's $1x10^{-6}$ point of departure goal, however, EPA has determined further action is unwarranted at either the residential properties or recreational facilities. This determination is based in part, on calculated risk levels at these locations that are within the acceptable risk range. The determination is also based on the conservative nature of the method used for evaluating indoor vapor intrusion, the analytical difficulties in taking air measurements, and the possible presence of contributions of contamination from "background" sources, including ambient (outdoor) air sources[2]. Finally, the risk found at these 7 properties and at the PAL facility is within the 1×10^{-4} to 1×10^{-6} risk range that is acceptable for carcinogens under the NCP when the types of factors identified in this paragraph are present.

In the other complete exposure pathway that EPA identified at the Site, PCE in ground water is pumped from municipal water supply wells (and potentially from domestic wells), where PCE is distributed to Site residents and businesses where it may be ingested as tap water; however, as explained in the next paragraph, the City of Las Cruces has taken management measures to ensure that consumers are protected.

[2] "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." (2002) EPA/530/D-02/004 (Although this is "draft" guidance, EPA recommends using it at CERCLA Sites (*see* 67 Fed. Reg. 71169, 71171. 71172)).

It is important to note that the CLC is continuing to maintain its ability to provide safe, potable water supply. The CLC has either discontinued use of the PCE affected wells, or, blends the one remaining on-line well affected with PCE with ground water from unaffected wells to meet Drinking Water Standards (known as Maximum Contaminant Levels (MCLs)) established under the Safe Drinking Water Act (SDWA).

Potential Receptors Considered in the Screening Levels

Adult and child residents, industrial workers, and adolescent recreational users were identified as current and future receptors near the Site. These receptors were considered when identifying the appropriate screening levels for Site data. Future land uses and activities are expected to remain the same as currently present.

Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Assessment

The ATSDR was established by Congress in 1980 under CERCLA, and is required to conduct Public Health Assessments (PHA) at each Site listed on the NPL. The ATSDR also conducts PHAs when petitioned by concerned individuals living near a Superfund Site. A public health assessment includes a preliminary assessment of the potential threats that individual Sites pose to human health. The public health assessment is required to be completed "to the maximum extent practicable" before completion of the RI/FS. ATSDR's public health assessments are intended to help public health and regulatory officials (e.g., EPA) determine if actions should be taken to reduce exposure to hazardous substances and to recommend whether additional information on human exposure and associated risk is needed. EPA considers the information obtained in the public health assessment and the results of the BHHRA when evaluating the potential health threats posed by a Site.

On February 25, 2005, the ATSDR released its Public Health Assessment for the Site, wherein it evaluated the potential indoor air impacts from residential use of evaporative coolers and use of the municipal water supply for irrigating residential gardens. ATSDR'S findings indicated that use of evaporative coolers posed an insignificant risk to residents when water supply concentrations are equal to the drinking water standard (MCL) for PCE. In addition, ATSDR indicated that PCE does not bio-accumulate in plants and therefore associated health risks are not significant. Since ATSDR uses an approach similar to the approach that EPA uses in evaluating risk, and since ATSDR found no risk associated with plants grown in Site ground water or with evaporative coolers that use Site ground water, EPA did not reevaluate these risks in the BHHRA.

The human health conceptual Site model (CSM) presents potential chemical sources, release mechanisms, receptors (current and future), and exposure routes. The risk assessment CSM is provided in Table A1-1. The table identifies which receptors and exposure pathways are quantified in the BHHRA.

Exposure Pathways Quantified in the BHHRA

The following exposure pathways were evaluated to estimate potential risks for the indicated receptors:

- Current/Future Resident (adult and child) – Inhalation of indoor air at each individual home.
- Current/Future Industrial Worker – Inhalation of indoor air at the PAL Boxing Facility.
- Current/Future Recreational user (adolescent) – Inhalation of indoor air at the PAL Boxing Facility.

The maximum detected concentration of the COC for each exposure point was used as the exposure point concentration (EPC) under a reasonable maximum exposure (RME) scenario. If the potential risks associated with an RME scenario exceeded acceptable risk levels, a central tendency (CT) scenario was quantified using the arithmetic mean concentration of the COC as the EPC.

Potential future unacceptable exposures to ground water concentrations above MCLs (from the Mesilla Basin) were not quantified in this BHHRA, primarily because the MCLs are ARARs for public drinking water supply systems. As stated in EPA policy presented in *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, “For ground water actions, MCLs and non-zero MCLGs will generally be used to gauge whether remedial action is warranted.”

Exposure Point Concentrations

Exposure point concentrations are used in the intake calculations. Using the Johnson and Ettinger model, EPA calculated the indoor air concentrations of PCE resulting from soil vapor intrusion. Maximum detected concentrations of PCE in soil vapor were used when quantifying RME scenarios, while the arithmetic mean concentration of PCE in soil vapor was used when quantifying the CT scenarios. EPA evaluated potential indoor air exposures to PCE by adult and child residents at the seven residences, and by industrial workers and adolescent recreational users at the PAL Boxing Facility.

Exposure Factors

Standard default exposure factors presented in EPA guidance were used for adult/child residents and industrial workers, while a combination of exposure factors based on EPA guidance and best professional judgment was used for adolescent recreational users. For the CT exposure scenario, the same set of exposure factors as the RME exposure scenario were used (i.e., only the EPC was different).

Toxicity Assessment

Site contaminants were assessed for carcinogenicity and for non-carcinogenic systemic toxicity. The incremental upper bound lifetime cancer risk, presented in this ROD as the "estimated lifetime cancer risk" or "ELCR," represents the additional Site-related probability that an individual will develop cancer over a lifetime because of exposure to a certain chemical (i.e., this ELCR is in addition to the general nationwide lifetime risk of cancer which is about one in three).

To protect human health, EPA has set the acceptable additional risk range for carcinogens at Superfund Sites from 1 in 10,000 to 1 in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}). A risk of 1 in 1,000,000 (1×10^{-6}) means that one person out of one million people could be expected to develop cancer as a result of a lifetime exposure to the Site contaminants. Where the aggregate risk from contaminants of concern (COCs) based on existing ARARs exceeds $1x10^{-4}$, or where remediation goals are not determined by ARARs, EPA uses the $1x10^{-6}$ as a point of departure for establishing preliminary remediation goals. This means that a cumulative risk level of $1x10^{-6}$ is used as the starting point (or initial "protectiveness" goal) for determining the most appropriate risk level that alternatives should be designed to attain. Factors related to exposure, uncertainty and technical limitations may justify modification of initial cleanup levels that are based on the $1x10^{-6}$ risk level.

For non-carcinogenic toxic chemicals, the toxicity assessment is based on the use of reference doses (RfDs) whenever available. A reference dose is the concentration of a chemical known to cause health problems. The estimated potential Site-related intake of a compound is compared to the RfDs in the form of a ratio, referred to as the hazard quotient (HQ). If the HQ is less than 1, no adverse health effects are expected from potential exposure. When environmental contamination involves exposure to a variety or mixture of compounds, a hazard index (HI) is used to assess the potential adverse effects for this mixture of compounds. The HI represents a sum of the hazard quotients calculated for each individual compound. HI values that approach or exceed 1 generally represent an unacceptable health risk that requires remediation.

The current EPA carcinogenic classification for benzene is A (human carcinogen). The EPA however, has no current carcinogenic classification for MTBE. The International Agency for Research on Cancer (IARC) classification for PCE is 2A (probably carcinogenic to humans). The oral non-cancer toxicity values for benzene are based on effects on the blood and immune system, while the oral non-cancer toxicity values for PCE are based on liver toxicity. The inhalation non-cancer toxicity values for benzene are also based on effects on the blood, while the oral non-cancer toxicity values for MTBE and PCE are based on liver and kidney toxicity.

Risk Characterization

EPA's target range (i.e., acceptable risk range) for excess lifetime carcinogenic risk associated with CERCLA Sites and specified in the NCP (40 Code of Federal Regulations [CFR] 300.430) is 1-in-10,000 (1×10^{-4}) to 1-in-1,000,000 (1×10^{-6}) in the human population. Therefore, the risk associated with Site-related exposures should not exceed this target range.

The estimated ELCRs associated with an RME scenario exceeded an ELCR of 1×10^{-6} at the seven residential properties; therefore, a CT scenario was quantified for these locations. The following potential risks were calculated:

Current/Future Resident (Adult and Child)

The following inhalation exposures were estimated from samples collected in the residential neighborhood northeast of East Hadley Avenue and North Walnut Street.

- **Property A** – Inhalation exposures to PCE at Property A were estimated. An ELCR of 3×10^{-5} and HIs of 0.03 and 0.06 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of 2×10^{-6}; therefore, a CT scenario was quantified. An ELCR of 8.8×10^{-6} was calculated for the CT scenario.

- **Property B** – Inhalation exposures to PCE at Property B were estimated. An ELCR of 4×10^{-5} and HIs of 0.03 and 0.07 were calculated for adult and child residents, respectively.

PCE exceeded an individual ELCR of $1x10^{-5}$; therefore, a CT scenario was quantified. An ELCR of $1.3x10^{-5}$ was calculated for the CT scenario.

- **Property C –** Inhalation exposures to PCE at Property C were estimated. An ELCR of $3x10^{-5}$ and HIs of 0.02 and 0.05 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of $9x10^{-6}$; therefore, a CT scenario was quantified. An ELCR of $1.8x10^{-5}$ was calculated for the CT scenario.

- **Property D –** Inhalation exposures to PCE at Property D were estimated. An ELCR of $1x10^{-5}$ and HIs of 0.01 and 0.03 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of $9x10^{-6}$; therefore, a CT scenario was quantified. An ELCR of $1.2x10^{-5}$ was calculated for the CT scenario.

- **Property E –** Inhalation exposures to PCE at Property E were estimated. An ELCR of $2x10^{-5}$ and HIs of 0.02 and 0.05 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of $1x10^{-5}$; therefore, a CT scenario was quantified. An ELCR of $9.4x10^{-6}$ was calculated for the CT scenario.

- **Property F** – Inhalation exposures to PCE at Property F were estimated. An ELCR of $1x10^{-5}$ and HIs of 0.01 and 0.02 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of $1x10^{-5}$; therefore, a CT scenario was quantified. An ELCR of $1.6x10^{-5}$ was calculated for the CT scenario.

- **Property G –** Inhalation exposures to PCE at Property G were estimated. An ELCR of $2x10^{-5}$ and HIs of 0.02 and 0.04 were calculated for adult and child residents, respectively. PCE exceeded an individual ELCR of $2x10^{-5}$; therefore, a CT scenario was quantified. An ELCR of $9.7x10^{-6}$ was calculated for the CT scenario.

Current/Future Adult Industrial Worker

Inhalation exposures to PCE at the PAL Boxing Facility were estimated. An ELCR of $7x10^{-7}$ and an HI of 0.02 were calculated.

- **Current/Future Recreational User (Adolescent)**

  Inhalation exposures to PCE at the PAL Boxing Facility were estimated. An ELCR of $4x10^{-8}$ and a HI of 0.02 were calculated.

It is important to note that the calculated risk scenario relied upon conservative exposure assumptions, and was based on uncertainty factors inherent in the use of the Johnson-Ettinger screening level model. The Johnson-Ettinger Model (JEM) was developed for use as a screening level model and, consequently, is based on a number of simplifying assumptions regarding contaminant distribution and occurrence, subsurface characteristics, transport mechanisms, and building construction. As a result, the risk calculated for the Site tend to overestimate the risk by an order of magnitude or more . For these reasons, the Site specific risk values of 1×10^{-5} to 4×10^{-5} which exceeds the point of departure of 1×10^{-6} were considered acceptable for the vapor intrusion exposure pathway. The JEM assumptions are typical of most simplified models of subsurface contaminant transport with the addition of a few assumptions regarding vapor flux into buildings.

Under the JEM, the contaminants are assumed to be homogeneously distributed at the source. Vapor from the source is also assumed to diffuse directly upward (one-dimensional transport) through uncontaminated soil to the base of a building foundation, where convection carries the vapor through cracks and openings in the foundation into the building. Under JEM, both diffusive and convective transport processes are assumed to be at steady state. Under the JEM, neither sorption nor biodegradation is accounted for in the transport of vapor from source to the base of the building. All of these assumptions under the JEM cause it to overestimate risk, and, in light of this, EPA believes that the estimated $4x10^{-5}$ risk, which is within EPA's acceptable risk range, is protective for the Site.

In summary, estimated ELCRs at the seven residential properties and the PAL Boxing Facility were within EPA's acceptable risk range (1×10^{-4} to 1×10^{-6}). Estimated non-cancer HIs were also below the EPA's target HI level (less than or equal to one). Therefore, current and future exposures to indoor air concentrations from vapor intrusion are within acceptable levels. Current risks associated with the municipal water supply are within acceptable levels due to the well management and blending activities implemented by the municipality. However, in the future, benzene, MTBE, and PCE concentrations at drinking water exposure points may exceed

MCLs if a management program is discontinued, if additional wells are installed in the Mesilla Basin, or if additional on-line wells become impacted via ground water plume migration.

Uranium Detections in Ground Water

Elevated concentrations of uranium are naturally occurring in the area. The CLC is addressing the elevated uranium concentrations in the drinking water supply as part of compliance with the SDWA and therefore risks associated with uranium in drinking water are not addressed in this BHHRA. If the uranium concentrations exceed MCLs at the distribution point, unacceptable risks may be posed by the water supply. EPA's CERCLA remediation authority generally does not directly apply to naturally occurring contamination such as the uranium contamination found at the Site. Accordingly, the selected remedy does not address naturally occurring uranium contamination in the Site ground water. It is EPA's intent that the CLC's actions to address uranium in the water supply will be coordinated with remedial actions that address PCE contamination.

Future Ground Water User at Wells above MCLs

In the future, one or more of the following scenarios may occur, resulting in unacceptable concentrations in potable wells above MCLs:

- The CLC may install additional wells in the Mesilla Basin in areas that are impacted by chemicals above MCLs.
- Private landowners may install wells in the Mesilla Basin in areas that are impacted by chemicals above MCLs.
- The blending program that is currently in place to meet the MCLs could experience a malfunction.
- Ground water in the Mesilla Basin will continue to migrate and impact additional potable wells not currently impacted.

If any of the above scenarios were to occur, PCE concentrations in the wells described may exceed the MCL and therefore pose an unacceptable risk. Under the NCP at 40 CFR § 300.430(e)(2)(i), the lead agency at a Superfund Site (in this case EPA) develops remediation goals that establish acceptable exposure concentration levels that are protective of human health and the environment considering, among other things, MCLs for ground water contamination (where the corresponding Maximum Contaminant Level Goal (MCLG) is zero). Since the

MCLG for PCE is zero, EPA has selected the MCL as the remediation goal.

Uncertainty Assessment

The following discussion presents the major uncertainties associated with this BHHRA.

Data Issues

Reporting Limits (RLs) for some analytes in soil vapor and ground water samples exceeded their respective screening levels. The RL (10 ppbv) of TCE in soil vapor exceeded its screening level of 4.1 ppbv. However, in accordance with the Quality Assurance Protection Plan (QAPP), ten (10) percent of these field soil vapor samples were collected in Summa canisters and sent to an off-Site laboratory for confirmation analysis by EPA Method TO-15. Although EPA Method TO-15 however can achieve lower RL (0.1 ppbv), there was consistency between the field screening method applied for the soil vapor samples and the fixed laboratory results. Therefore, use of a field screening method for identifying soil vapor concentrations is not expected to contribute a significant level of uncertainty to the BHHRA.

Indoor Air Exposure Point Concentrations (EPCs)

Initially, maximum detected concentrations of PCE in soil vapor were used to model the EPCs in indoor air. However, this approach assumes that an individual is exposed daily to these concentrations and that the maximum concentration is present uniformly underneath the building. Therefore, the modeled indoor air EPCs, which are based on attenuation factors from the Johnson and Ettinger model are expected to be overestimated. The Johnson and Ettinger model conservatively estimates the risks posed to PCE in indoor air through the soil vapor intrusion pathway. Use of the arithmetic mean PCE concentrations in soil vapor (for the Central Tendency scenario) to model the EPCs in indoor air more likely represent the lifetime average concentrations in indoor air.

PCE Toxicity Value

At the current time, the cancer toxicity values to be used for evaluating potential exposure to PCE are under review. In the absence of relevant toxicity values in IRIS or an NCEA Preliminary Peer-Reviewed Toxicity Value (PPRTV)—the first two tiers of human health toxicity values in the EPA Superfund hierarchy—EPA supports use of the California EPA Air Toxic Hot Spots Program inhalation unit risk factor of 5.9×10^{-6} $(\mu g/m^3)^{-1}$ in the Superfund Program and relies upon it until an EPA-promulgated toxicity value becomes available. In general, California EPA develops its toxicity values in a manner that is quite similar to the EPA IRIS program, in that many of the same databases and considerations are used. California EPA assessment used information from some of the same sources that EPA typically considers in the IRIS program, including the most recent relevant studies known to exist, and California EPA considered this information in a manner similar to the EPA IRIS program. California EPA uses similar assumptions in deriving their screening values, except for the use of slightly more stringent toxicity values. Presently, there are no Federal screening values for evaluating indoor vapor intrusion. Therefore, EPA Regions frequently consider the values proposed by California EPA.

Applicability of Soil Vapor Data

Potential exposures and risks associated with the vapor intrusion pathway were evaluated using shallow soil vapor sampling data collected during November 2005, which were then modeled using the Johnson & Ettinger model. Using the November 2005 data set, the excess lifetime cancer risk associated with potential exposure to PCE in indoor air was estimated to be from one to four in 100,000 in the residential area (i.e. 1×10^{-5} to 4×10^{-5}). Because of the uncertainty inherent in the use of the Johnson-Ettinger screening level model, the risk calculated using conservative exposure assumptions tend to overestimate the risk by an order of magnitude or more. Therefore the Site specific risk values of 1×10^{-5} to 4×10^{-5} which exceeds the point of departure of 1×10^{-6} were considered acceptable for the vapor intrusion exposure pathway. The Johnson-Ettinger Model (JEM) was developed for use as a screening level model and, consequently, is based on a number of simplifying assumptions regarding contaminant distribution and occurrence, subsurface characteristics, transport mechanisms, and building construction. The JEM assumptions are typical of most simplified models of subsurface contaminant transport with the addition of a few assumptions regarding vapor flux into buildings.

Under the JEM, the contaminants are assumed to be homogeneously distributed at the source. Under the JEM, vapor from the source is assumed to diffuse directly upward (one-dimensional transport) through uncontaminated soil to the base of a building foundation, where convection carries the vapor through cracks and openings in the foundation into the building. Under JEM, both diffusive and convective transport processes are assumed to be at steady state. Under the JEM, neither sorption nor biodegradation is accounted for in the transport of vapor from source to the base of the building. All of these assumptions under the JEM cause it to overestimate risk, and, in light of this EPA is confident that the estimated 4×10^{-5} risk, which is within EPA's acceptable risk range, is protective for the site.

There are two issues to consider when using this estimation of risk for decision-making related to further action associated with shallow soil vapor. First is the question of seasonal variation – are the data collected in November 2005 representative of conditions throughout the year? The second is the question of using one set of data to estimate risk, as opposed to two or more events. An additional factor to consider when weighing the relative importance of either one of these issues is the conservative nature of the Johnson & Ettinger model, which is thought, in general, to over-estimate risk.

1. **Seasonal Variability**

   The data set used to estimate risk was collected in November when ambient temperatures were relatively mild for the Las Cruces area (temperatures during the sampling event historically are in the high 50s to low 60s (degrees F). In the summer, temperatures are generally in the mid to high 90s. Higher summer temperatures might contribute to some warming of surface soils within the top 2 feet, but is less likely to influence significantly temperatures in slightly deeper soils, where the November data was collected. In addition, barometric pressures are relatively uniform throughout the year in this area, so that there is no significant seasonal "pumping" effect affecting soil vapor flux.

   The vapor intrusion pathway is more significantly affected by advective transport of soil vapor from the subsurface to indoor air. This advective transport is driven by differences in pressure between indoors and the subsurface, resulting from indoor/outdoor temperature differences (the "stack effect") and turbulence induced by the operation of heating, ventilating, and air conditioning (HVAC) systems. Some guidance suggests that there is significant seasonal variability in indoor air concentrations with higher concentrations under winter conditions where the stack effect is presumably greater. However, modeling of air infiltration and radon entry into residences suggests that the stack effect will have little seasonal impact for houses with slab or crawl-space construction, as is found in Las Cruces. The stack effect would be a more important driving force for vapor entry into structures with basements under "hard" winter-time conditions, and not for slab-on-grade construction in more temperate climates such as that observed in Las Cruces.

2. Use of one sampling event to estimate risk

The November 2005 sampling event was actually the second time shallow soil vapor samples have been collected in the residential area of the Site. The first was in 2002, when EPA collected over 600 soil vapor samples at the Site, including the residential area. The data between the 2002 and 2005 sampling events are not directly comparable, having been collected through different methods and for a different purpose (Site characterization vs. evaluation of risk to indoor air). With that caveat, it may be helpful to note the overall similarity or variation in concentrations detected in the residential area in 2002 and 2005.

For example, PCE was detected in August 2002 at about 736 and 1,108 ppbv at depths of 10 feet below ground surface (bgs) in residential street sample locations R9002 and R9004, located >50 feet from any residence, in the middle of the street). In November 2005, PCE was detected at concentrations ranging from 240 to 644 ppbv at depths of 10 feet bgs in the front yards of lots facing this same cul-de-sac.

Overall, the average PCE concentration detected in soil vapor at all depths during the 2005 sampling event is, in general, somewhat lower than the average concentration detected at all depths during the 2002 sampling event. It is unlikely this difference is due to the effects of seasonal variability (based on the discussion presented in the previous section). The apparent reduction in PCE concentrations could be the result of the attenuation of PCE in the soil vapor, the variation in depths sampled (the 2002 data was collected from 10 feet bgs or more, the 2005 data was collected from 10 feet bgs or less), the locations sampled (the street vs. the yards), and/or the different method of collection. The sampling conducted in 2005 was designed for the estimation of risk and is more suitable for evaluation of vapor intrusion pathways because the samples were located near structures.

Note, both PCE and TCE were analyzed in 2002 and 2005. In 2005, TCE was not detected in any samples. In 2002, TCE was detected in only 3 out of 32 locations sampled in the residential area. The maximum detection of TCE in the residential area was 15 ppbv at 30 feet bgs at location R9002.

Conservative Nature of the Johnson & Ettinger Model

Potential indoor air concentrations were estimated from soil vapor using the Johnson and Ettinger model. The assumptions used in the Johnson and Ettinger model were conservative, providing an overstatement of the potential risks associated with inhalation of indoor air. The modeling is conservative principally because of the use of assumptions that calculate a high rate of soil vapor flow into indoor spaces. The key assumptions were that soils underlying the foundations were highly porous, that the houses were very “leaky,” but that the outside air exchange rate was very low. This produces a situation unlikely to be present in the real world, because leaky houses also would have high outside air exchange rates. The conservative nature of these assumptions was confirmed by comparing the modeled soil vapor flow rate with the range of values that have been reported in the literature. The modeled rates used for this Site were at the high end of the range of literature values.

Also, the soil vapor concentrations used for the assessment of vapor intrusion risks were developed from laboratory analyses that were based on atmospheric pressure at sea level. This would provide soil vapor concentrations for use in modeling and risk assessment that would be slightly higher compared with soil vapor concentrations under Site-specific conditions (Site-specific conditions being 3,896 feet above MSL). Use of analytical data calculated on a sea-level basis therefore results in slightly higher estimates of indoor air concentrations and risks than would be anticipated under Site-specific conditions.

In summary, current and future exposures to indoor air concentrations from vapor intrusion are within target risk levels for Superfund. Because of the uncertainty inherent in the use of the Johnson-Ettinger screening level model, the risk calculated using conservative exposure assumptions tend to overestimate the risk by an order of magnitude or more. Therefore the site specific risk values of 1×10^{-5} to 4×10^{-5} which exceeds the point of departure of 1×10^{-6} were considered acceptable for the vapor intrusion exposure pathway. The Johnson-Ettinger Model (JEM) was developed for use as a screening level model and, consequently, is based on a number of simplifying assumptions regarding contaminant distribution and occurrence, subsurface characteristics, transport mechanisms, and building construction. The JEM assumptions are typical of most simplified models of subsurface contaminant transport with the addition of a few assumptions regarding vapor flux into buildings.

Current exposures to the municipal water supply are within acceptable levels as long as CLC maintains compliance with drinking water standards. As the most widespread contaminant at the GWP Site in both soil vapor and ground water, found in both monitoring wells and municipal supply wells, PCE is considered the primary COC for the GWP Site because a potential for future unacceptable exposure exists.

Ecological Considerations

The process for an ecological risk assessment, according to EPA Superfund guidance, begins with preparing an ecology checklist. Next, consideration is given to whether exposure pathways are complete. If they are, then one would proceed to performing a screening ecological risk assessment. If exposure pathways for ecological receptors are determined to be incomplete, then the ecological risk assessment process can be exited. For the GWP Site, an ecology checklist was prepared for the GWP Site, as required for all Superfund sites. Information regarding the ecological condition of the Site as well as aerial photographs of the Site was collected during Site visits and the field investigation. The Site can be described as a moderately developed area, with limited ecological habitat. Some disturbed and undeveloped lots exist within the vicinity of East Griggs Avenue and North Walnut Street, but are vegetated mostly with invader species of shrubs. Except for small isolated areas of remnant desert scrub/shrub habitat, the majority of the vegetation is in the form of ornamental landscaping, and turf maintained at recreational soccer/baseball fields.

The few undeveloped lots near the Site demonstrate the presence of desert scrub species including invader shallow rooted non-native vegetation, commonly found on highly disturbed desert landscape. Given the land use of this urban environment (i.e., the last 30 years), this Site does not appear to be critical habitat because of the urban setting. PCE is not detected in soil until depths of about 10 ft. bgs were reached, so it is unlikely that a complete exposure pathway exists for biota (flora or fauna, particularly burrowing organisms) to the VOCs. Additionally, the contaminated ground water does not discharge to surface water, and therefore does not affect flora or fauna. Ground water does not discharge naturally to the surface at the GWP Site and the contaminants are too deep for biota exposure, therefore, it can be concluded that no complete ecological exposure pathways exist.

Section 8

Remedial Action Objectives

The Remedial Action Objectives (RAOs) and Remediation Goals are based on current uses and on potential future uses of ground water and on exposure scenarios that are consistent with these uses. Generally, drinking water standards (federal MCLs, non-zero MCLGs, or more stringent state ground water standards) are ARARs and are incorporated into remediation goals for Site ground water determined to be a current or potential future source of drinking water (40 CFR §300.430(e)(2)(i)(B and C)). Since the MCLG for PCE is zero under the provisions of the NCP, the MCL of 5 µg/L for PCE is the ARAR for the Site and has been selected as the remediation goal for ground water.

The RAOs for ground water at this Site were established in accordance with the *Presumptive Response Strategy and Ex Situ Treatment Technologies for Contaminated Ground water at CERCLA Sites*, and are provided as follows:

- Prevent human exposure to contaminated ground water above the MCL (5 µg/L) for PCE.
- Maintain capture of the PCE-contaminated ground water plume above the MCL (5 µg/L) for PCE.
- Restore ground water to its beneficial use as a drinking water supply with PCE concentrations no greater than the MCL (5 µg/L).

PCE was identified as the COC for ground water based on a comparison between ground water concentrations and MCLs in monitoring wells. Concentrations of PCE were measured below the MCLs at current ground water exposure points, primarily as a result of the blending program enacted by the CLC to meet drinking water regulations. Nonetheless, a potential for future unacceptable exposure above the MCL exists if:

(1) PCE is not maintained below the MCL in the municipal water supply;

(2) if private wells are completed in the plume; or

(3) if the ground water plume expands beyond the current Site boundary.

Remediation Goals

The target contaminant defined for ground water at the Site is PCE. The New Mexico Water Quality Control Commission Regulations (20.6.2.3103 of the New Mexico Administrative Code [NMAC]) include ground water standards for PCE based on human health (0.02 mg/L). The MCL for PCE established under the SDWA is lower (0.005 mg/L) and therefore the MCL will be used as the Remediation Goal.

PCE degradation products (TCE, cis-1,2 DCE, trans-1,2, DCE) have been detected within the PCE plume boundary but no remediation goal was established because their concentrations remain below their respective MCLs and because the aquifer conditions were evaluated and determined to be non conducive toward natural attenuation of PCE. Therefore, it is difficult to determine if these degradation products are in fact, degrading from the PCE releases, or are from other off-Site related releases. Nonetheless, these other chlorinated solvents are within the plume and will therefore, be treated with PCE and the selected treatment process. These PCE degradation products will also continue to be monitored and treated to ensure compliance with their respective MCLs.

Benzene has also been detected in Site monitoring wells above its MCL of 5 µg/L, although it has not been detected in samples from municipal supply wells. A Remediation Goal will not be established for benzene at the Site because benzene is addressed under the New Mexico Petroleum Storage Tank regulations (NMAC 20.5). It will be monitored as part of the Long Term Monitoring (LTM) program however, to primarily ensure other source areas are not uncontrolled, as well as to reduce concentrations within the plume. Annual evaluations of ground water data collected at the Site will monitor water quality trends.

EPA's CERCLA remediation authority generally does not directly apply to naturally occurring contamination such as the uranium contamination found at the Site. Accordingly, the selected remedy does not address naturally occurring uranium contamination in the Site ground water. The CLC is working with the New Mexico Drinking Water Bureau to address uranium and has taken steps to ensure that it continues to meet Safe Drinking Water Act standards when, or if uranium detection in municipal water supply wells exceed its MCLs.

Section 9

Description of Alternatives

The remedial alternatives were developed to meet the RAOs and Remediation Goals in consideration of Site conditions, ARARs, and the technology options appropriate for the Site. Five alternatives were developed for final consideration at the Site. The five alternatives are defined as follows:

- Alternative 1: No Action
- Alternative 2: Ground Water Extraction with Blending
- Alternative 3: Ground Water Extraction with Treatment
- Alternative 4: Enhanced Ground Water Extraction with Treatment
- Alternative 5: In-Well Air Stripping in Higher Concentration Areas of the Ground Water Plume

Common Elements

Remedial components common to all or most of the remedial alternatives evaluated, including the selected remedy, include Institutional Controls (ICs), long-term ground water monitoring (LTM) for PCE as well as for other contaminants, and technical support (*e.g.,* model refinement). LTM also will include sampling for other VOCs (including halgoenated VOCs), (*e.g.,* benzene, MTBE, PCE daughter products such as TCE, 1,2 cis-and 1,2 trans-DCE, and vinyl chloride). Common elements are described in the sections below:

A. Institutional Controls

One of the elements that is common to all of the action remedial alternatives evaluated including the selected remedy is institutional controls. ICs are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use; are generally to be used in conjunction with, rather than in lieu of, engineering measures such as waste treatment or containment; can be used during all stages of the cleanup process to accomplish various cleanup-related objectives; and, should be "layered" *(i.e*., use multiple ICs) or implemented in a series to provide overlapping assurances of protection from contamination. The Site remedy will incorporate the following controls to compliment the overall remedy for the Site:

1. Future private well drilling at the Site will be temporarily restricted, and no well drilling will be allowed until the Site remedial action meets the RAOs or, without the

prior written consent and approval of the JSP, in coordination with the State Engineer's Office for the State of New Mexico.

The BHHRA indicated that human ingestion of the PCE contaminated ground water above the MCLs at the Site would pose a risk to human health. Therefore, this prohibition to private well drilling will support the remedy and help prevent human exposure.

2. For purposes of preventing comingling of contaminants at the Site, the JSP has agreed that it will communicate with other local departments, state agencies, and authorities, to develop a process under which these other departments, agencies, and authorities will notify the JSP whenever a release occurs that may affect the Site ground water or the remediation efforts under this ROD. Under this process, JSP has agreed that it will notify these departments, agencies and authorities when it becomes aware of such a release. In addition, the process will encourage the exchange of information and data related to ground water quality.

B. Long-Term Monitoring Program

Another common element of all the action remedial alternatives that were evaluated including the selected remedy is Long Term Monitoring. To confirm that remediation goals are met, LTM is required. This LTM will measure the progress of the remedy. The remedial monitoring program will be fully developed during the RD for purposes of refining the monitoring locations and will include an exit strategy for discontinuing or modifying the program once the remedial action objectives have been met. While the objectives of the monitoring program will continue, the sampling locations may need to change over time, depending upon the data trends, plume control, and other associated factors.

CLC Wells will continue to be monitored, and if PCE concentrations increase in areas within the plume boundaries, (*e.g.,*if concentrations of PCE increase in monitoring wells, such as GWMW06, or if PCE is detected in CLC Well No. 10,) further investigation may be necessary.

At GWMW15, PCE currently exceeds the MCL in the upper portion of the LHZ. GWMW15 is presently the furthest down-gradient well at the Site and the one sample collected during the 2005 sampling event at the nested well detected 18 µg/L of PCE. The extent of the PCE detections in this eastern area of the plume has not been defined to concentrations below the MCL.

Therefore three new nested monitoring well locations are called for in this ROD. A nested monitoring well should be considered at the eastern portion of the plume consisting of three individual wells installed within the same borehole. During the Site investigation this location was identified as a location that could assist in refining the plume delineation. The suggested screened intervals are approximately 290 to 305 feet bgs, 460 to 475 feet bgs, and 580 to 595 feet bgs to correlate with the known contaminated zones of the aquifer (the screened intervals should be finalized during RD). Another nested monitoring well location could be located either south of the currently defined plume boundaries at a location consistent with the JSP fate and transport model prediction of future flow patterns toward the south, or, at a location near CLC Well 10 and GWMW06 depending upon which location the remedial design determines to be most appropriate for meeting the RAOs. Three locations for the suggested nested monitoring wells for purposes of implementing LTM are shown on **Figure 9-1**.

With the addition of the three nested monitoring wells (a total of 9 new sample locations), to be used along with existing monitoring wells, the LTM program should be sufficient to evaluate the effectiveness of the remedy. The suggested monitoring wells recommended for routine sampling are listed in **Table 9-1**.

During LTM, monitoring wells will be sampled for VOCs (including halogenated VOCs) to address PCE as well as other VOCs detected at the Site. These other detected VOCs include benzene and MTBE, both identified in the BHHRA contaminants of potential concern (COPCs) in ground water. Benzene has been detected in seven Site monitoring wells at concentration levels that exceed its corresponding MCL. MTBE is detected above its corresponding MSSL in one monitoring well (MTBE does not have an MCL). Benzene is not detected in any municipal supply wells. MTBE is detected in one municipal supply well at concentrations that are below the MSSL. PCE is the contaminant of concern for the Site. PCE is the most widespread contaminant, in both soil vapor and ground water at the Site and has been detected in both monitoring wells and municipal supply wells. However, these other detected contaminants identified above (benzene and MTBE) are also important to monitor during LTM to keep them under control or as part of the treatment process.

The LTM program will include sampling for the compounds that result from PCE degradation in the environment including TCE, 1,2 cis - and 1,2 trans-DCE and vinyl chloride, although bio-degradation of PCE does not appear to be occurring at the Site in appreciable rates. These other compounds are included in the standard VOC parameter list.

For costing purposes, it was estimated that the monitoring wells in the LTM program will be sampled annually during the first five years and biannually in subsequent years. The frequency of monitoring and the list of included analytes will be refined during the RD. Five year review reports that are consistent with the EPA guidance will be required during the project duration.

Approximately ten (10) piezometer wells will most likely be necessary to adequately measure water levels. The piezometer wells will also be used to help determine the extent of the treatment zone for the extraction wells. The exact number and locations of the piezometers will be determined during the RD.

C. Annual Reviews and Reporting

Each alternative evaluated including the selected remedy, included annual reporting requirements. Annual reports will include a review of remedy performance to date, and recommend adjustments that should be made in the remedy to meet remediation goals and remedial action objectives. Each annual review will include a discussion of remedy performance based on the results of the monitoring data collected during the previous year(s). Each annual report should include recommendations associated with pumping rates, any necessary changes in pumping locations, or new approaches for data collection procedures. Each annual report should also include sufficient information an analysis of the Site conditions to potentially update and improve the Site ground water model based on data collected to date. Data collected and summarized in the annual report will include:

1. Measurement of water levels sufficient to support that the plume is being captured by the extraction wells and sufficient to document the predictive capabilities of the ground water model.
2. Monitoring of the ground water concentrations of PCE and the products of its environmental degradation (including TCE, MTBE, benzene, and the analytes on the VOC list determined during remedy design, and sufficient to document remedy progress and the predictive capabilities of the ground water model).
3. Monitoring of contaminant concentrations sufficient to document that the remedy continues to protect public health and the environment.

D. Uranium Treatment

EPA's CERCLA remediation authority generally does not directly apply to naturally occurring contamination such as uranium concentrations found at the Site. Accordingly, the selected remedy does not directly address naturally occurring uranium contamination at the Site ground water. The CLC however, has taken steps to ensure that ground water continues to meet Safe Drinking Water Act Standards for uranium. The CLC is undertaking actions in coordination with the New Mexico Drinking Water Bureau. The cost for treatment of uranium is not included in the FS cost estimates or the ROD cost estimates because uranium removal within the plume boundaries is not anticipated and the additional treatment for uranium is not part of the CERCLA action for this Site.

E. Technical Support

Each remedial alternative includes a line item for technical support. This component includes the continual technical evaluation of the selected remedy, as the remedy is being implemented. This component includes without limitation, evaluation of system parameters, review of field and analytical data, and system optimization. This support will provide real-time evaluation of the selected remedy with the purpose of optimizing the operation and effectiveness of the selected remedy and monitoring program. Technical support includes routine review of the Site conditions, changes in water levels, well pumping rates, and water usage.

Description of Alternatives Evaluated

In the following paragraphs, the ROD describes the various remedial alternatives that were evaluated prior to selection of the final remedy for this ROD. The Selected Remedy is Alternative 4: Enhanced Ground Water Extraction with Treatment and is described in further detail in Section 12 of the ROD.

Alternative 1: No Action

As part of its responsibilities under the NCP, the EPA must examine what would happen should no further response action be taken at the Site. The evaluation of the "No Action" alternative serves as a baseline for comparing the other remedial alternatives. Under this no action alternative, the water supply system would function with no modifications. Treatment is the preferred remedy for contaminated ground water under CERCLA and the NCP; however, under the no action alternative the PCE in ground water extracted by municipal wells would not be treated. The ground water at the GWP Site would continue to exceed the MCLs such that the RAOs for ground water would not be met. Under the no action alternative, the PCE in the ground water plume would be allowed to attenuate naturally by dilution and dispersion but this would take so long that other municipal water supply wells that are not contaminated would become contaminated, to the detriment of the public water supply and it its beneficial use. Specifically, as predicted by the ground water modeling performed by the JSP, if no hydraulic containment is provided, the PCE plume would eventually contaminate CLC Well No. 26 and migrate past toward CLC Well No. 24.

Alternative 2: Ground Water Extraction with Blending

The CLC has managed the PCE concentration in the drinking water by blending the water from those supply wells within the PCE contaminated area with the water from those wells in areas that are not impacted with PCE above the MCL. The blending program has been an effective short term alternative in preventing exposure to PCE at concentrations that exceed the MCL and in continuing to provide water supply under the current demand. In addition, the municipal wells pump the contaminated plume, creating a cone of depression, thereby providing a measure of interim plume containment. Alternative 2 relies on the blending approach, but would add a controlled hydraulic plume containment. Under Alternative 2, the containment would be accomplished by pumping the ground water flow from the contaminated plume towards the above ground reservoir where it would be blended, prior to distribution into the public water supply. Pumped water would be blended with water from wells that have not been affected by PCE. Costs associated with this alternative however, did not consider the potential need for building a new blending facility, should capacity at the current reservoir tank be exceeded, and if additional modeling results indicate an increase in pumping is necessary for purposes of plume containment. For this alternative, CLC Well Nos. 18 and 27 would be used to provide hydraulic containment of the plume to prevent expansion, pumped to levels that do not exceed the MCL and then blended, prior to distribution. Modeling results show that plume containment can be achieved using existing municipal supply wells CLC Well Nos. 18 and 27. The CLC Well Nos. 18 and 27 would be pumped at a long term average of 380 and 520 gpm, respectively. The modeling scenario assumed that neighboring CLC Wells 20, 24, and 26 would continue to pump and that CLC Wells 19, 21, and 38 would be turned off. Based on the total mass of PCE removed in one year, assuming the long-term average pumping rates and the December 2005 PCE analytical data for each well, the water pumped from these wells would have to be blended with more than 6.1 million gallons per day (MGD) of PCE-free water to achieve concentrations below the MCL. Blending would be expected to take place at the Upper Griggs Reservoir. Revisions to the blending program would require approval from EPA and the NMED DWB and become state and federally enforceable. Alternative 2 provides no active engineering remediation treatment system. Since treatment is preferred under CERCLA and the NCP, Alternative 2 is disfavored on this basis.

Alternative 3: Ground Water Extraction with Treatment

Under this alternative to contain the PCE contaminated ground water plume, CLC municipal supply well Nos. 18 and 27 would be pumped at increased flow rates (compared to their current flow rate), while remaining within their current design capacity. In order to capture the plume, the modeling scenario for this alternative assumed that neighboring CLC Well Nos. 19, 20, 21, 24, 26, and 38 would be turned off. In addition, the extracted ground water from CLC Well Nos. 18 and 27 would be treated until PCE concentrations are below the MCL prior to distribution to the municipal supply system; moreover, since it would be treated, the extracted water will not require blending to meet the MCL. Pumping at higher flow rates, followed by treatment to meet the MCL would reduce the time of remediation, but pumping at higher flow rates could exceed the capacity of the present wells, and consequently, the current wells would have to be replaced. The JSP model estimates that 21 years of active extraction and treatment would be necessary to remove all concentrations of PCE that exceed the MCL from the ground water.

The estimated long-term average flow rates for CLC Wells 18 and 27 are estimated to be 460 and 620 gpm, respectively. It is expected that these wells will operate 95 percent of the time at their design capacity. Under Alternative 3, extracted ground water would be conveyed to a central treatment facility location for treatment to meet the PCE MCL before it is distributed to consumers. The cost associated with Alternative 3 includes building the central treatment facility. The treatment facility would likely be located near municipal supply well CLC Well No. 27. The potential treatment technologies considered for the extracted ground water were as follows:

Air Stripping: A low-profile tray air stripper system could be used to lower the PCE to below the MCL in the extracted ground water in a continuous flow system. In an air stripper system, mineral buildup or "scaling" can occur over time, thereby reducing the efficiency of a system and requiring de-scaling treatment Some remedies include pre-treatment, to help reduce the scaling from occurring. Therefore, the cost tables include an estimate for both pretreatment as well as air stripping without prior treatment.

Las Cruces is an attainment area under the Clean Air Act. During any air stripping treatment, there is a possibility the air-stripping process could require emission controls to prevent any violations to the National Ambient Air Quality Standards. In accordance with the OSWER Directive 9355.0-28 “Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites” (**EPA, 1989**), preliminary calculations of air emission rates associated with air stripping of PCE were prepared. These preliminary calculations indicate it is unlikely that air emission controls will be required for the GWP Site. The alternatives that include air stripping include an estimate of the costs associated with air monitoring to confirm emissions are in compliance.

Under Alternative 3, once ground water has been treated, ground water will be conveyed to the municipal supply system for use as potable water. In addition to air-stripping, other treatment options that were considered include the following:

GAC: A continuous flow granular activated charcoal (GAC) filtering system could be used to remove contaminants from the extracted ground water. Carbon filter change-outs would be required with this option and would be performed by the vendor. The spent carbon would be returned to the vendor for regeneration or disposal and the treated ground water would be conveyed to the municipal supply system for use as potable water.

Chemical/UV Oxidation: A self-contained, skid-mounted unit that combines ozone and hydrogen peroxide could be used to destroy ground water contaminants. Because this is a destruction technology, no air emissions nor waste are produced. After treatment, ground water would be conveyed to the municipal supply system for use as potable water.

The evaluation of Alternative 3 included cost estimates for ground water extraction and treatment including estimates for the verification of the capacity of the extraction well network (and refurbishing where necessary), estimates for the design and installation of conveyance piping and a centralized treatment plant, estimates for treatment equipment, estimates for design and installation of a supervisory control and data acquisition (SCADA) system, and estimates for annual O&M costs for operation of the treatment infrastructure for a period of 21 years.

Alternative 4: Enhanced Ground Water Extraction with Treatment: The Selected Remedy Under This ROD

EPA has selected Alternative 4 as the remedy for the GWP Site under this ROD. Alternative 4 is similar to Alternative 3, but Alternative 4 uses enhanced ground water extraction to reduce the time required to meet remediation goals. Under this Selected Remedy, CLC municipal supply wells Nos. 18 and 27 will maximize their pumping capacity and flow rates, while remaining within their current design capacity. The ground water model was used to help determine the best way to optimize extraction of contaminated water and obtain plume containment. Targeted pumping will be used to extract ground water from CLC wells and will be modified most likely, by screening across the vertical layers of the aquifer that have the highest contaminant concentration. The targeted screen interval for CLC Well Nos. 18 and 27 is 315 to 515 ft bgs. Well modifications can be achieved in a variety of ways, including, but not limited to, placing sections of blank well casing against selected screen intervals to block flow from those layers, and adding perforations to sections of existing blank casing to increase productions from the upper portions of the aquifer. It is estimated that it will take 14 years to meet remediation goals and remedial action objectives under the Selected Remedy, Alternative 4. The Selected Remedy will rely on targeted pumping using a combination of wells, most likely, CLC Well Nos. 18 and 27 along with a new extraction well located along the plume axis northeast of CLC Well No. 27 to achieve the expedited remediation. For planning purposes it is expected that CLC Well No. 18 will be used for the first five years of operation after which CLC Well No. 18 will be replaced with the new extraction well. CLC Well Nos. 19, 20, 21, 24, 26, and 38 are expected to be shut off to assist in the hydraulic control.

Use of existing municipal supply wells (CLC Well Nos.18 and 27) under the Selected Remedy, will assist in minimizing costs, however, it is recognized that the use of different wells or the installation of new wells may be required to obtain the desired plume capture. A schematic drawing of the selected remedy is presented in **Figure 9-2** but it is subject to revision during remedial design, as explained in the preceding sentence. Operation and maintenance (O&M) of the constructed remedy will take approximately 14 years.

Alternative 5: In-Well Air Stripping in Higher Concentration Areas of the Ground Water Plume

This alternative would provide for in-situ treatment of PCE contaminated ground water in the ground water where the highest detections of contaminants have been detected, coupled with pumping to provide hydraulic containment of the plume. The in-situ treatment option that would be used under this alternative is in-well air stripping.

When treating ground water using in-well air stripping, air is injected into the ground water through a pipe within the treatment well using a gas injection line and a compressor. The resulting bubbles will aerate the water, forming an air-lift pumping system and causing ground-water to flow upward in the well. As the bubbles rise through the contaminated ground water, the PCE will transfer from the dissolved to the vapor phase by this air stripping process. The air/water mixture rises until it encounters the dividing device within the inner well, above the contaminated zone. The dividing device is designed and located to maximize volatilization. The water/air mixture is forced out of the upper screen below this divider. The outer casing is under a vacuum, and vapors are drawn upward through the annular space and are collected at the surface for treatment to meet applicable air emissions standards as necessary, prior to discharge to the atmosphere. The ground water, from which some VOCs have been removed, re-enters the contaminated zone. As a result of rising ground-water lifting at the bottom of the well, additional water enters the well at its base. This water is then lifted via aeration. The partially treated water re-entering the aquifer is eventually cycled back through the process as ground water enters the base of the well. This pattern of ground water movement forms a circulation cell around the well, allowing ground-water to undergo sequential treatment cycles until remedial goals have been met. The area affected by this circulation cell, and within which ground water is being treated, is called the radius of influence of the stripping well.

Based on the Site lithology, it is estimated that the radius of influence would be 150 feet. Under Alternative 5, the stripping wells would be new wells spaced approximately every 300 ft. within the area of highest PCE concentrations (i.e., those areas above 20 μg/L PCE). It is expected that the flow rate needed to develop a circulation pattern within the aquifer would be approximately 10 to 50 gallons per minute in each treatment well. Given the heterogeneity of the subsurface, it is expected that ground water intake would be required in two zones (the UHZ and the upper portion of the LHZ). It is estimated that plume containment could be achieved using one new extraction well located along the plume axis north of CLC Well No. 27, pumped at a flow rate of 300 gpm. The extracted water from this well would be treated using an ex-situ treatment technology (GAC).

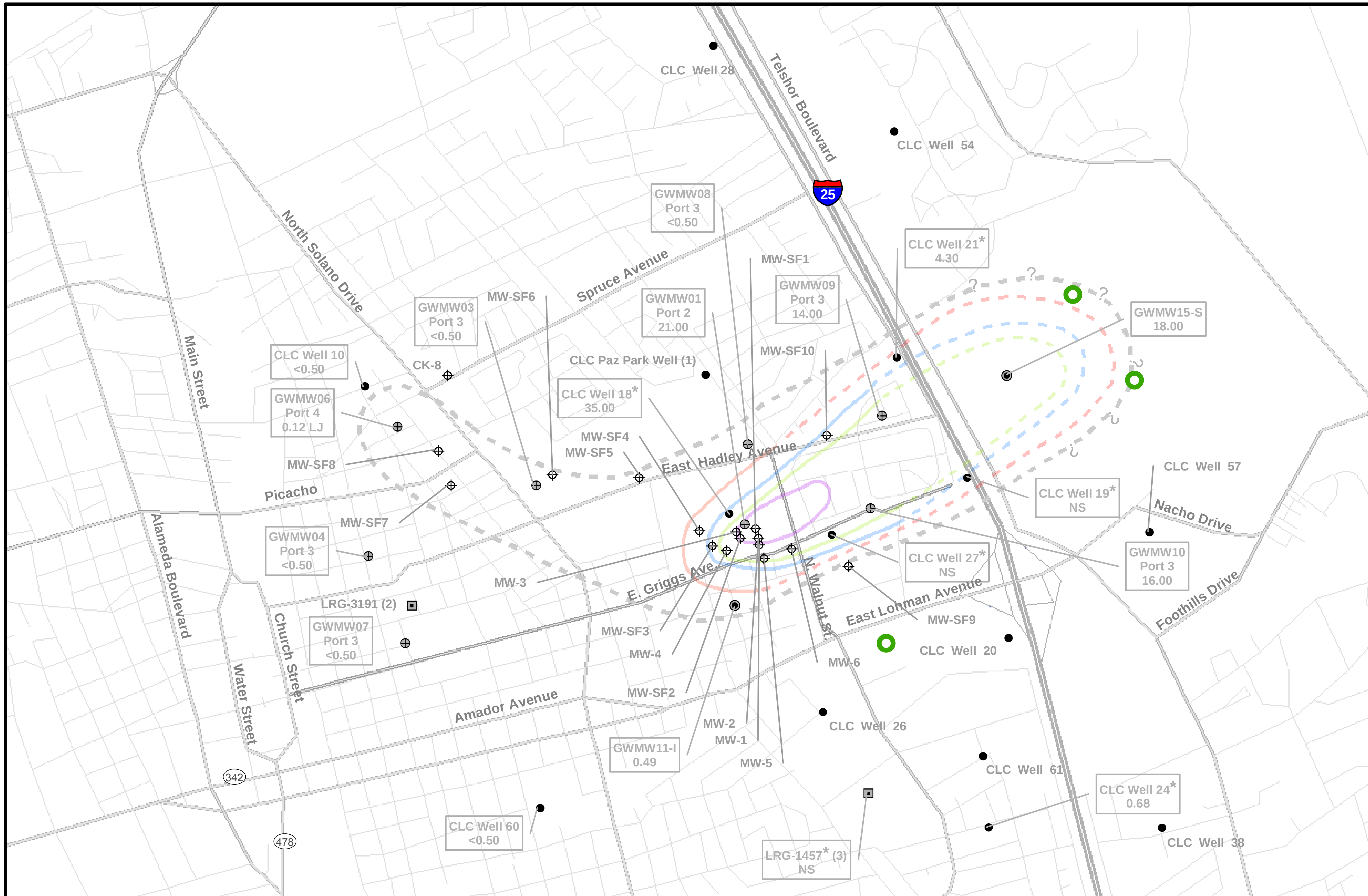
The cost estimate for Alternative 5 was based on the following:

- No free-phase DNAPL is present at the Site.

- A total of 4 new air stripping wells would be installed within the shallow ground water plume (the UHZ).
- 8 new air stripping wells would be installed within the intermediate ground water plume (upper portion of the LHZ).
- One blower would serve 2 in-well air stripping wells. The shallow wells would be co-located with the intermediate wells, so that one blower can serve both wells. Therefore, a total of 8 blower systems would be required (four blowers for the 8 co-located shallow and intermediate zone wells and four blowers for the other 4 intermediate zone wells).
- No off-gas treatment would be required. Air samples would be collected quarterly to verify this assumption.
- One new extraction well would be installed with a screened interval from approximately 250 to 450 bgs.
- Ex-situ treatment would be provided for the ground water extracted from the new extraction well. If water is extracted from other municipal supply wells within the plume for use in the water supply during active remediation, concentrations of contaminants would require monitoring and treatment to below MCLs prior to use.
- Wellhead treatment using a skid-mounted GAC system would be used for treatment of the water extracted from the new extraction well was assumed for cost estimating purposes. The GAC treatment system represents the lowest cost ex-situ treatment option.
- As with the ex-situ air stripping unit, the potential for scaling problems within the wells would exist. Options would include a drip acid treatment system or periodic well cleaning. The costs provided by the vendor include contingencies for these treatment options.
- It is estimated that a minimum of 20 years of annual O&M would be required for the system to achieve MCLs throughout the plume.

Table 9-1
List of Wells Proposed for Ground Water Monitoring
Griggs and Walnut Ground Water Plume
Las Cruces, New Mexico

Monitor Well ID	Monitor Well ID
CK-8	MW-SF10
MW-1	MW-SF11
MW-2	LRG-3191
MW-3	GWMW01 (Ports 01 through 07)
MW-4	GWMW03 (Ports 01 through 07)
MW-5	GWMW06 (Ports 01, 02, 04, 05, 06, 07)
MW-6	GWMW07 (Ports 01 through 67)
MW-SF1	GWMW08 (Ports 01, and 03 through 07)
MW-SF2	GWMW09 (Ports 01 through 08)
MW-SF3	GWMW10 (Ports 01 through 07)
MW-SF5	GWMW11 (3 nested wells)
MW-SF6	GWMW15 (3 nested wells)
MW-SF7	Proposed: GWMW-16 (three nested wells)
MW-SF8	Proposed: GWMW-17 (three nested wells)
MW-SF9	Proposed: GWMW-18 (three nested wells)



Feet
0 750 1,500 3,000

Notes:

PCE Concentrations in micrograms per liter (ug/L).

No Data obtained from GWMW06 Port 3. Data for Port 2 was <0.50 and data for Port 4 was 0.12 LJ. Therefore, PCE contamination is assumed to extend past GWMW06.

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).

2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE

3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

Gas Card Monitor Well and Private Well LRG-7375 have been abandoned and are not shown on figure.

Unit Qualifiers:
J - Estimated
L - Concentration below the reporting limit

Concentration Data Contoured by Hand.

NS - Not Sampled

The municipal supply well concentrations are used for informational purposes only. The PCE concentrations in these wells were not used to prepare the PCE isoconcentration contours shown on this figure.

Upper portion of Lower Zone corresponds to an approximate elevation range of 3675 to 3775 ft MSL.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.

LEGEND

- **Water Table Monitor Well** (screen depths of these wells range from 101 to 204 feet bgs.)
- **City of Las Cruces (CLC) Municipal Water Supply Wells** (screen depths of these wells range from 281 to 1,050 feet bgs.)
- **Private Water Supply Wells** (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- **Multi-Port Monitor Well** (screen depth of these wells range from 90 to 640 feet bgs)
- **Nested Monitor Well Installed During RI** (screen depths of these wells range from 190 to 590 ft bgs)
- GWMW07 Port 3 <0.50 — Monitor Well ID, Port Number & PCE Concentration
- Estimated Extent of GWP-Related PCE Detections
- ? — Indicates Uncertainty of Extent of GWP-Related PCE Detections
- Proposed Location of New Monitoring Well

PCE Concentration Levels (Dashed Where Infered)

- 2.5 ug/L
- 5 ug/L
- 10 ug/L
- 20 ug/L

CH2MHILL

Figure 9-1
Proposed Location of New Ground Water Monitor Wells

Griggs & Walnut Ground Water Plume Site

Las Cruces, New Mexico

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Section 10

Comparative Analysis of Alternatives

Evaluation Criteria

The detailed analysis of alternatives required under 40 CFR § 300.440(e)(9), consists of the analysis and presentation of the relevant information needed to allow decision makers to select a Site remedy. It is not the decision making process itself. During the detailed analysis, each alternative is assessed against each of the nine criteria. The analysis lays out the performance of each alternative in terms of compliance with ARARs, long term effectiveness, and permanence, reduction of toxicity, mobility or volume through treatment, short term effectiveness, implementatbility, and cost. The assessment of overall protection draws on the assessments conducted under other evaluation criteria, especially long term effectiveness and permanence, short term effectiveness and compliance with ARARs, State and community acceptance also are assessed. The analysis criteria are categorized into three groups: threshold criteria, balancing criteria, and modifying criteria. Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria; a particular alternative either meets the threshold criteria, or that alternative is not considered acceptable. The two threshold criteria are overall protection of human health and the environment, and compliance with ARARs. If ARARs cannot be met, a waiver may be obtained when one of the six exceptions listed in the NCP occur (see 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6)). Unlike the threshold criteria, the five balancing criteria assess the advantages and disadvantages among alternatives. The EPA balances the trade offs, identified in the detailed analysis, among alternatives with respect to long term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short term effectiveness, implementability, and cost. This initial balancing determines preliminary conclusions as to the maximum extent to which permanent solutions and treatment can be practicable and utilized in a cost effective manner. The two modifying criteria are community and state acceptance. These criteria are evaluated after the public comment closes and are used to modify the recommended alternative, as appropriate.

The nine evaluation criteria objectives are as follows:

Evaluation Criteria For Superfund Remedial Alternatives

Overall Protectiveness of Human Health and the Environment: determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with ARARs: evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified. Tables 13-1 and Table 13-2 summarize the pertinent ARARs pertaining to the Selected Remedy.

Long-term Effectiveness and Permanence: considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment: evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness: considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Implementability: considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Costs: includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to – 30 percent.

State/Support Agency Acceptance: considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance: considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Individual Analysis of Alternatives

See Table 10-1 at the end of this section.

Comparative Analysis

After making the individual criterion assessments for each alternative, the alternatives are compared to each other. This comparative analysis identified the key tradeoffs (relative advantages and disadvantages) among the alternatives with respect to the nine criteria. The purpose of this comparative analysis is to provide decision makers with sufficient information to balance the trade offs associated with the alternatives, select an appropriate remedy for the Site and demonstrate satisfaction of the CERCLA remedy selection requirements.

The NCP makes clear that overall protection of human health and the environment and compliance with ARARs (unless grounds for invoking a waiver is provided) are threshold criteria that must be satisfied by an alternative before it can be selected. Long term effectiveness and permanence; reduction of toxicity, mobility; and cost are primary balancing criteria. State and community acceptance are modifying criteria that may have significant input in the final remedy selection (see 300.430(f)(4)(i) and, to the degree they are available earlier, may affect the development of alternatives and the selection of the Proposed Plan.

Both the JSP and NMED assisted in the development of the remedial alternatives for the Site. Both NMED and the JSP provided technical assistance for both the RI and FS completion. The JSP provided the modeling results for each of the alternatives, except Alternative 5.

Table 10-1 presents the comparative analysis of alternatives under each of the nine criteria. **Table 10-2** presents a summary of the costs associated with each alternative.

Threshold Criteria

To be eligible for selection, an alternative must meet the two threshold criteria described below, or in the case of ARARs, must justify why a waiver is appropriate.

Overall Protection of Human Health and the Environment

Alternative 1 (No Action) is not protective of human health and the environment because elevated levels of contaminants exist in the ground water at concentration levels that exceed the MCLs. The contaminated ground water plume is expanding, according to the JSP ground water model.

The No Action alternative would do nothing to stop the contaminated ground water plume from expanding to the point where it reached additional wells, and contaminated more ground water. Therefore this alternative will not be discussed further in this comparative analysis.

Of the remaining four alternatives, all provide some measure of protection of human health and the environment. All of these four alternatives provide controlled removal of contaminated ground water in order to provide hydraulic containment and to eventually restore the aquifer to beneficial use (the range of remediation time frames is 14 years [Alternative 4, the selected remedy] to 23 years [Alternative 2]) based on preliminary modeling results

Alternative 2 (Ground Water Extraction with Blending), however, relies on blending, which does not constitute treatment. The contaminant remains in the water and is simply diluted. Maintaining a proper blending program is less reliable than the treatment alternatives due to potential fluctuation in concentrations. More frequent monitoring would be required than for other alternatives to ensure the blending ratio is appropriate and concentrations are consistently maintained below the MCL prior to distribution into the municipal drinking water supply.

The remaining three alternatives use treatment to reduce PCE in the extracted water to concentration levels that are below the MCL prior to distribution to the municipal drinking water supply system. Although monitoring is a requirement for all four of the treatment remedies to confirm the MCL is met, the performance of these alternatives is more certain and predictable than blending.

Alternatives 2 (Ground Water Extraction with Blending), 3 (Ground Water Extraction with Treatment), and 4 (Enhanced Ground Water Extraction with Treatment) are progressively more aggressive in their remediation strategies and the expected time to meet the MCL for PCE in ground water decreases as the extraction effort is increased. Under the selected remedy, Alternative 4, the expected time to meet the MCL/remediation goal is the shortest at 14 years. (The expected duration for the other action alternatives evaluated are 23 years for alternative 2, 21 years for Alternative 3, and 20 years for Alternative 5. Alternative 5 (In-Well Stripping in Higher Concentration Areas of the Ground Water Plume) uses an aggressive in-situ treatment strategy, but does not significantly reduce the remediation time frame (the expected time to achieve the MCL for PCE in ground water under this alternative is still 20 years). It is also the most costly alternative, but not the most efficient alternative.

Alternatives 3 and 4 include three options for treatment (air stripping, GAC, or chemical/UV oxidation). Alternative 5 uses in-situ air stripping in the treatment wells, but includes three options for treatment of water that has been extracted as part of the hydraulic containment effort. Air stripping and GAC transfer contaminants to another medium, presenting a potential risk from residual contamination (i.e., either from air emissions or from the disposal of hazardous waste). Since chemical/UV oxidation is a destructive technology, there is no risk associated with residual contamination.

The selection of the ex-situ treatment technology also involves varying potential risks to workers from the use of chemicals. GAC uses no additional chemicals; therefore the potential risk to the workers from the implementation of this technology is minimal. Air stripping may require the use of scaling pretreatment chemicals and chemical/UV oxidation uses strong oxidants to destroy contaminants. The potential risk to the workers from these two technologies is therefore somewhat higher than if GAC is used.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 (Remedial action will be implemented under each of these “action alternatives”) and are each capable of meeting ARARs. All four of these alternatives extract PCE contaminated ground water from the subsurface in a controlled manner, and are expected to restore the aquifer to its beneficial use as a source of municipal water supply. Alternative 2 uses blending of the extracted ground water to meet the MCL before delivery to the municipal water supply and it is possible, that Alternative 2 might not comply with ARARs through the blending process if the PCE concentrations in extracted ground water exceed the dilution capacity of the blending system. Alternatives 3, 4, and 5 use treatment to reduce PCE in extracted ground water to concentration levels that are below the MCL. All four alternatives require monitoring to ensure MCLs are met prior to distribution. Alternative 2 blending could require more frequent monitoring than the other alternatives.

Also, for options under Alternatives 3, 4, and 5 that include air stripping, controls to remove contaminants from the vapor phase may be required, depending on the concentration of contaminants in the emissions and local requirements. Las Cruces is an attainment area under the CAA. In accordance with the OSWER Directive 9355.0-28 “Control of Air Emissions from

Superfund Air Strippers at Superfund Groundwater Sites," preliminary calculations of air emission rates associated with air stripping of PCE were prepared. The preliminary calculations did not predict a need for controlling air emission from air stripping, because of the low to minimal PCE concentrations expected to be emitted, and because of the distance from human receptors.

Balancing Criteria

The five primary balancing criteria are long term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short term effectiveness; implementability; and cost. Under the NCP, balancing in remedy selection shall emphasize long term effectiveness and reduction of toxicity, mobility, or volume through treatment. The balancing shall also consider the preference for treatment as a principal element.

Long-Term Effectiveness and Permanence

Alternatives 2 through 5 are all expected to use extraction (pumping) to reduce the levels of PCE in the aquifer to meet the MCL, and restore the aquifer to its beneficial use. The time to restoration varies depending on the remedy (14 years [Alternative 4] to 23 years [Alternative 2]). For all four action alternatives, the potential for plume expansion is minimized through the use of hydraulic containment. The higher pumping rates under Alternatives 3 and 4 provide higher likelihood of success in maintaining hydraulic containment and should restore the aquifer more quickly. The targeted pumping under Alternative 4 decreases the time period for remediation most efficiently.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2 (Ground Water Extraction with Blending) provides no reduction of the TMV of the PCE through treatment, as blending does not constitute treatment.

Alternatives 3 (Ground Water Extraction with Treatment), 4 (Enhanced Ground Water Extraction with Treatment; the selected remedy), and 5 (In-Well Stripping in Higher Concentration Areas of the Ground Water Plume) provide overall reduction in TMV of the PCE within contaminated ground water through treatment. Alternative 4 provides the most aggressive reduction of TMV in the contaminated ground water through the use of targeted pumping (estimated to be about 14 years to achieve the MCL for PCE in ground water). Alternative 5 is also aggressive, but the in-situ treatment is less controlled than extraction and ex-situ treatment, and is anticipated to take longer (estimated to be about 20 years to achieve the MCL for PCE in ground water) than the targeted pumping and ex-situ treatment of Alternative 4.

Short-Term Effectiveness

Alternative 2 (Ground Water Extraction with Blending) adds no infrastructure, therefore there are no risks to the community, workers, or the environment during the implementation of this alternative. The immediate risk to human health receptors would be reduced by blending the water supply to meet MCLs. Alternatives 3 (Ground Water Extraction with Treatment), 4 (Enhanced Ground Water Extraction with Treatment; the selected remedy), and 5 (In-Well Stripping in Higher Concentration Areas of the Ground Water Plume) involve the addition of treatment systems, increasing slightly the risk to workers, the community, and the environment, but the additional risks are expected to be low. OSHA training for workers minimizes risks. The use of a non-destructive treatment technology (i.e., air stripping or GAC) for Alternatives 3, 4, and the hydraulic containment portion of Alternative 5 would transfer the contaminants to another medium, potentially posing a risk to human health and the environment from air emissions or a hazardous waste, that would require proper disposal. The use of chemicals associated with the air stripping and chemical/UV oxidation ex-situ treatment technology options for Alternatives 3, 4, and 5 potentially poses a risk to workers.

The installation of a new extraction well in Alternative 4 and new treatment wells in Alternative 5 poses a risk to workers from the exposure to uncontaminated ground water, but the risks are expected to be low since OSHA-trained workers are required.

The model predicts that Alternative 2 will take approximately 23 years to meet RAOs. Alternative 3 is predicted to take 21 years. Alternative 4 (the Selected Remedy) is predicted to reach RAOs faster (14 years) than Alternative 3 by pumping the layers with the highest contamination. Pumping the stratigraphic layers with the highest contamination is expected to result in more rapid mass removal and a shorter time of remediation. Alternative 5 is estimated to reach RAOs in 20 years, based on Site conditions and experience at similar Sites.

Implementability

Alternative 2 (Ground Water Extraction with Blending) relies on existing infrastructure and therefore is the easiest to implement. This alternative includes hydraulic containment, requiring LTM to ensure that the plume is adequately contained. The potential for mechanical failure as well as control failure in the blending process increases the difficulty of Alternative 2.

Alternatives 3 (Ground Water Extraction with Treatment) and 4 (Enhanced Ground Water Extraction with Treatment; the Selected Remedy) propose a central treatment unit and a conveyance system to carry extracted ground water to the central treatment unit. Construction of a conveyance system to the central treatment unit, and the siting of the treatment unit, could impact populated areas, however, the impacts are expected to be low, since the treatment unit should not be significantly large or excessively noisy. Alternative 5 (In-Well Stripping in Higher Concentration Areas of the Ground Water Plume) includes wellhead treatment; construction of this unit could also impact populated areas.

The technologies used for the removal of PCE from the extracted ground water are commonly used and each requires O&M. GAC is the easiest to implement and maintain, followed by air stripping and chemical/UV oxidation. Scaling buildup within wells and conveyance piping due to mineralization can potentially occur at most Sites over time but can be evaluated and mitigated using bench or pilot tests. Scaling buildup within an air stripper system is more likely than scaling buildup within the wells and conveyance piping due to the removal of CO^2 during the treatment process and due to the subsequent change in pH. Chemical/UV oxidation would require a continuous supply of treatment chemicals and ozone production.

The LTM programs for Alternative 3 and 4 are not expected to be significantly different from one another. Alternative 2 and 5 would require more frequent monitoring.

Alternative 4 (Enhanced Ground Water Extraction with Treatment; the selected remedy) involves the installation of one new extraction well, and modification to existing wells, making this alternative more challenging to implement than Alternative 3 (Ground Water Extraction with Treatment), but once the wells are modified, Alternative 4 provides better efficiency than Alternative 3.

Alternative 5 (In-Well Air Stripping in Higher Concentration Areas of the Ground Water Plume) is expected to be the most technically challenging to implement. The addition of deep treatment wells and a new extraction well is required for this alternative, thereby increasing the difficulty of implementation. Alternative 5 also involves the installation of many new mechanical components, increasing the O&M requirements and the potential for failure. It is anticipated that multiple air stripping wells can be operated with a single blower provided piping connects the treatment wells. The Alternative 5 system could be cumbersome to install in populated areas and requires more space to implement than Alternatives 3 and 4. The treatment of the extracted ground water under Alternative 5 will be the similar to Alternatives 3 and 4.

Cost

All costs are summarized on **Table 10-2.** Aside from Alternative 1 (No Action), the lowest costs are associated with Alternative 2 because the existing infrastructure can be used. The cost estimate for Alternative 2 does not consider well failure or the infrastructure costs for conveying clean water from remote areas for blending and does not account for increases in public water supply demand from the general population.

Initially, annual operating costs for Alternatives 3 and 4 are the same due to the use of the same initial pumping rate. After year five, however, Alternative 4 includes replacement of CLC Well No.18 with a new extraction well at a lower pumping rate, reducing the annual costs. Alternative 3 net present worth costs are somewhat higher than Alternative 4 due to the slightly higher O&M costs after year 5 and the longer remediation time, which offsets the higher capital costs in Alternative 4. The highest costs are associated with Alternative 5 due to the large capital costs associated with the installation of the treatment infrastructure. The annual operating costs are also much higher in Alternative 5.

The need for an acid pretreatment system for options that include air stripping significantly affects the overall costs. An acid pretreatment system adds substantial capital and annual operating costs. For both Alternatives 3 and 4, treatment using GAC is the least costly option if it is determined that a pretreatment system would be required for an air stripper. If no pretreatment system is needed, air stripping and GAC costs are very similar. In addition, the destructive chemical/UV oxidation technology is lower in cost than air stripping if pretreatment is needed. For costing purposes, chemical oxidation was assumed rather than UV oxidation. Capital costs for UV oxidation are anticipated to be lower than for chemical oxidation, but annual O&M costs would be higher.

Modifying Criteria

Once all comments are evaluated, state and community acceptance may prompt modifications to the preferred remedy and are thus designated modifying criteria.

Community Acceptance

Although no formal written comments were received from the public, a few questions were asked during the public meeting held on December 7, 2006, (see Responsiveness Summary). In addition, EPA received a letter of concurrence dated January 22, 2007, from the JSP on behalf of the City and County governments in support of the remedy proposed during the comment period.

State and Local Acceptance

(Reference Appendix C for Concurrence Letters)

Table 10-1

Comparative Analysis of Remedial Alternatives

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Threshold Criteria					
Overall Protection of Human Health & the Environment	NO – No action would be performed and RAOs would not be met. Elevated levels of contaminants exist in ground water at concentration levels that exceed the MCLs. This contamination will continue to threaten human health and the environment through plume migration. PCE contamination will probably spread to other municipal supply wells, and to any domestic wells that may be completed in the contaminated aquifer.	YES--Hydraulic containment will prevent migration of the PCE contaminated plume to other wells; however, ground water is not treated to meet MCLs. Instead ground water is diluted by blending with other water to meet MCLs	YES – Hydraulic containment and reduction in contaminant concentrations in the aquifer by pumping and active treatment will meet RAOs, thereby reducing risk to human health and the environment.	YES – Hydraulic containment and reduction in contaminant concentrations in the aquifer by pumping and active treatment will meet RAOs, thereby reducing risk to human health and the environment.	YES – Hydraulic containment and reduction in contaminant concentrations in the aquifer by active treatment will meet RAOs, thereby reducing risk to human health and the environment.
		Removal of contaminants from the ground water restores the aquifer to its beneficial use. The JSP ground water fate and transport model predicts elevated levels of PCE will persist for about 23 years.	Removal of contaminants from the ground water restores the aquifer to its beneficial use. The JSP ground water fate and transport model predicts elevated levels of PCE will persist for about 21 years.	Removal of contaminants from the ground water restores the aquifer to its beneficial use. The JSP ground water fate and transport model predicts elevated levels of PCE will persist for about 14 years.	Removal of contaminants from the ground water restores the aquifer to its beneficial use. Based on JSP ground water fate and transport modeling of other alternatives, it is anticipated with this alternative that elevated levels of PCE will persist for about 20 years.

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Overall Protection of Human Health & the Environment (Cont'd)		Ground water is not treated to meet MCLs. Instead ground water is diluted by blending with other water to meet MCLs which is not as protective as treatment.	Provides protection of human health through treatment of contaminated ground water to below MCLs prior to distribution into the public drinking water supply.	Provides protection of human health through treatment of contaminated ground water to below MCLs prior to distribution into the public drinking water supply.	Provides protection of human health through treatment of contaminated ground water to below MCLs prior to distribution into the public drinking water supply.
		This alternative relies on above-ground (ex-situ) blending which does not constitute treatment. The contaminant remains in the water and is simply diluted	This alternative relies on above-ground (ex-situ) treatment, which will, depending on the technology chosen, either safely transfer the contaminants from ground water to another medium (e.g. air) or destroy the contaminants (e.g. chemical/UV oxidation).	This alternative relies on above-ground (ex-situ) treatment, which will, depending on the technology chosen, either safely transfer the contaminants from ground water to another medium (e.g. air) or destroy the contaminants (e.g. chemical/UV oxidation).	This alternative relies on a combination of in-well treatment using air stripping and above-ground (ex-situ) treatment using Granular Activated Carbon (GAC), both of which safely transfer the contaminants from ground water to another medium (e.g. air).
		Active long-term monitoring in the aquifer and the blending effluent is required to confirm hydraulic containment and compliance with ARARs (e.g. MCLs). Maintaining a proper blending program is less reliable than treatment alternatives due to the potential fluctuation in concentrations. More frequent monitoring may be	Active long-term monitoring in the aquifer and in the treatment effluent is required to confirm hydraulic containment and compliance with ARARs (e.g. MCLs).	Active long-term monitoring in the aquifer and in the treatment effluent is required to confirm hydraulic containment and compliance with ARARs (e.g. MCLs).	Active long-term monitoring in the aquifer and the treatment effluent is required to confirm hydraulic containment and compliance with ARARs (e.g. MCLs).

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Overall Protection of Human Health & the Environment (Cont'd)		required than for other alternatives and to ensure that the blending ratio is appropriate and concentrations are consistently maintained below the MCL prior to distribution into the public drinking water supply.			
		This alternative involves low risk to workers from affected ground water or the blending process during active remedial action and O&M.	This alternative involves low risk to workers from affected ground water or the treatment process during active remedial action and O&M.	This alternative involves low risk to workers from affected ground water or the treatment process during active remedial action and O&M.	This alternative involves low risk to workers from affected ground water or the treatment process during active remedial action and O&M.
Compliance with ARARs	NO - Not compliant. Ground water extraction is not sufficiently controlled or targeted under the No Action alternative so parts of the contaminated ground water plume would remain in the subsurface and continue to expand. The JSP model predicts that this expansion will ultimately reach additional municipal supply wells and contaminate more water. Contamination in the ground water will NOT be removed within a time frame that is reasonable. Moreover, MCLs may not	YES–- Ground water extraction would be controlled and targeted in order to ensure that the contaminated plume does not expand. Contamination in the ground water will be removed within a time frame that is reasonable. Ground water would not be treated to meet MCLs, although treatment is practicable, and preferred under CERCLA. Drinking water would continue to meet MCLs but only after PCE concentrations had been diluted by blending Moreover, MCLs may not	YES – Provides treated drinking water that meets MCLs. Also, provides restoration of the aquifer to its beneficial use as a drinking water supply (within about 21 years). Requires monitoring to ensure MCLs are met prior to distribution to the drinking water supply.	YES – Provides treated drinking water that meets MCLs. Also, provides restoration of the aquifer to its beneficial use as a drinking water supply (within about 14 years). Requires monitoring to ensure MCLs are met prior to distribution to the drinking water supply.	YES – Provides drinking water that meets MCLs. Also, provides restoration of the aquifer to its beneficial use as a drinking water supply (within about 20 years). Requires monitoring to ensure MCLs are met prior to distribution to the drinking water supply.

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Compliance with ARARs (cont'd)	be met if the PCE concentrations in extracted ground water should exceed the dilution capacity of the blending system.	be met if the PCE concentrations in extracted ground water should exceed the dilution capacity of the blending system Provides hydraulic containment of the plume, and restoration of the aquifer to its beneficial use as a drinking water supply (within about 23 years). May require more frequent monitoring than other alternatives to ensure MCLs are met prior to distribution to the drinking water supply.			
Balancing Criteria					
Long-term Effectiveness and Permanence	No action would be performed. Contaminants would remain in the aquifer above MCLs for an indefinite period (estimated to be longer than 30 years). The JSP ground water fate and transport model predicts future plume expansion, with impacts to GWMW Well 11 and CLC Well No. 26.	Removal of contaminants from the ground water through pumping and blending will meet RAOs and restore the aquifer to its beneficial use (within the predicted time frame of about 23 years). The potential for plume expansion is minimized through the use of hydraulic containment.	Removal of contaminants from the ground water through pumping and treatment will meet RAOs and restore the aquifer to its beneficial use (within a predicted timeframe of about 21 years). The potential for plume expansion is minimized through the use of hydraulic containment.	Removal of contaminants from the ground water through enhanced pumping and treatment will meet RAOs and restore the aquifer to its beneficial use (within a predicted timeframe of about 14 years). The potential for plume expansion is minimized through the use of hydraulic containment.	Removal of contaminants from the ground water through treatment will meet RAOs and restore the aquifer to its beneficial use (within a predicted timeframe of about 20 years). The potential for plume expansion is minimized through the use of hydraulic containment.

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Long-term Effectiveness and Permanence (cont'd)		Pumping rates set at the minimum long-term average pumping rate is needed to maintain hydraulic containment.	Higher pumping rates than those used under Alternative 2 provides a higher likelihood of success in achieving and maintaining hydraulic containment and restoring the aquifer.	Targeted pumping provides higher likelihood of success in restoring the aquifer in a shorter period compared to Alternative 2 and 3.	Targeted in-situ treatment provides higher likelihood of success in restoring the aquifer compared to Alternatives 2 and 3.
Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment	No action would be performed and no overall reduction of TMV through treatment would occur.	No overall reduction of TMV in the contaminated ground water through treatment would occur (blending does not constitute treatment).	Provides overall reduction of TMV in the contaminated ground water through treatment.	Provides overall reduction of TMV in the contaminated ground water through treatment.	Provides overall reduction of TMV in the contaminated ground water through treatment.
Short-term Effectiveness	No action would be performed, and ground water would not be treated to meet MCLs, although treatment is practicable and preferred under CERCLA.	Low risk to workers, the community, and the environment in the short-term are expected. Low risk to the community associated with the use of the blended ground water for drinking water as long as pumping rates to control bending to below the MCL are maintained and adequate controls re in place to warn of system failure. There is the potential for failures in the blending process, including but not limited to, mechanical failure of	Low risk to workers, the community, and the environment in the short-term are expected. Minimal risk to the community associated with the use of treated ground water for human consumption as long as adequate controls are in place to warn of system failure. There is minimal potential for failure in the treatment process, including but not limited to, mechanical failure of equipment, control logic failures.	Low risk to workers, the community, and the environment in the short-term are expected. Minimal risk to the community associated with the use of treated ground water for human consumption as long as adequate controls re in place to warn of system failure. There is minimal potential for failure in the treatment process, including but not limited to, mechanical failure of equipment, control logic failures.	Low risk to workers, the community, and the environment in the short-term are expected. Minimal risk to the community associated with the use of the treated ground water for human consumption as long as adequate controls re in place to warn of system failure. There is minimal potential for failures in the treatment process, including but not limited to, mechanical failure of equipment, control logic failures.

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Short-term Effectiveness (cont'd)		equipment, control logic failures, or incorrect blending ratios. Low risk to workers and to the environment from affected ground water are anticipated during production and O&M.	Low risk to workers during construction and maintenance of the ex-situ treatment unit. The use of a non-destructive treatment technology (i.e., air stripping or GAC) transfers the contaminants to another medium, posing a short-term risk to human health and the environment by the production of air emissions or a waste that requires proper handling and disposal. The chemicals used for certain treatment units (i.e., air stripper with pretreatment and chemical/UV oxidation) provide a risk to workers if not properly handled and disposed. Meeting ARARs for emissions and waste handling and OSHA-training for workers minimizes short-term risks to workers.	Low risk to workers during construction and maintenance of the ex-situ treatment unit. The use of a non-destructive treatment technology (i.e., air stripping or GAC) transfers the contaminants to another medium, posing a short-term risk to human health and the environment by the production of air emissions or a waste that requires proper handling and disposal. The chemicals used for certain treatment units (i.e., air stripper with pretreatment and chemical/UV oxidation) provide a risk to workers if not properly handled and disposed. Meeting ARARs for emissions and waste handling and OSHA-training for workers minimizes short-term risks to workers.	Low risk to workers during construction and maintenance of the ex-situ treatment unit. The use of a non-destructive treatment technology (i.e., air stripping or GAC) transfers the contaminants to another medium, posing a short-term risk to human health and the environment by the production of air emissions or a waste that requires proper handling and disposal. The chemicals used for certain treatment units (i.e., air stripper with pretreatment and chemical/UV oxidation) provide a risk to workers if not properly handled and disposed. Meeting ARARs for emissions and waste handling and OSHA-training for workers minimizes short-term risks to workers.
			This alternative requires installation of additional wells (for ground water monitoring) that could pose a low risk to workers during installation. OSHA-training for workers	This alternative requires installation of additional wells (for ground water monitoring) that could pose a low risk to workers during installation. OSHA-training for workers	This alternative requires installation of additional wells (for ground water monitoring) that could pose a low risk to workers during installation. OSHA-training for workers minimizes short-term risks to

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
			minimizes short-term risks to workers.	minimizes short-term risks to workers.	workers.
Implementability	No action to implement.	Easy to implement because the majority of the initial infrastructure is already in place. If the availability of sufficient clean water for blending decreases with increasing PCE concentrations in the extracted water, significant changes to infrastructure or the addition of another treatment technology could become necessary over time. Could likely require more frequent monitoring than other alternatives to ensure MCLs are met prior to distribution to the drinking water supply.	The ground water extraction technologies considered under this alternative are commonly used, and are generally easy to install and maintain. Of the three treatment options considered under this alternative: (1) the air stripper may require pretreatment for scaling (preliminary evaluations indicate the potential for scaling is borderline); (2) GAC treatment requires periodic carbon replacement and disposal; and (3) chemical/UV oxidation requires a continuous source of chemicals.	The ground water extraction technologies considered under this alternative are commonly used, and are generally easy to install and maintain. Of the three treatment options considered under this alternative: (1) the air stripper may require pretreatment for scaling (preliminary evaluations indicate the potential for scaling is borderline); (2) GAC treatment requires periodic carbon replacement and disposal; and (3) chemical/UV oxidation requires a continuous source of chemicals.	The ground water extraction technologies considered under this alternative are commonly used, and are generally easy to install and maintain. The in-well air stripping might result in scaling in wells, and some chemical addition may be required. Additional mechanical equipment and infrastructure associated with this alternative increases O&M costs over the other alternatives.
		Pretreatment is not required.	The potential need for pretreatment to address scaling under air stripping option should be considered in more detail during the RD.	The potential need for pretreatment to address scaling under air stripping option should be considered in more detail during the RD.	The potential need for pretreatment to address scaling associated with in-well air stripping should be considered in more detail during the RD.

Remedial Alternative	Alternative 1: No Action	Alternative 2: Ground Water Extraction with Blending	Alternative 3: Ground Water Extraction with Treatment	Alternative 4: Enhanced Ground Water Extraction with Treatment	Alternative 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
Implementability (cont'd)		No modifications to existing wells required, other than the addition of piping between CLC Well Nos. 18 and 27, and O&M.	No modifications to existing wells required, other than the addition of piping between CLC Well Nos. 18 and 27, and O&M.	Modifications to the pumping wells and the addition of new extraction wells somewhat increases the difficulty of this alternative.	Installation of in-situ treatment wells and the addition of an extraction well for containment somewhat increases the difficulty of this alternative.
Costs (Present worth)	**None** – requires no additional expenditure.	**$10.2 M**	**$15.6 – $18.4 M** Air stripping without pretreatment: $16.6 MM[2] GAC: $15.6 M Chemical/UV oxidation: $18.4 M.	**$13.3 - $15.4 M** Air stripping without pretreatment: $13.8 MM[2] GAC: $13.3 M Chemical/UV oxidation: $15.4 M.	**In-well air stripping and GAC for ground water extracted to maintain hydraulic containment: $31.9 M.**
- 30% to +50% range:	**None** – requires no additional expenditure.	**$7.1 to 15.2 M**	**$10.9 to $27.6 M** Air stripping without pretreatment: $11.6-$24.9 M GAC: $10.9-23.5 MM Chemical/UV oxidation: $12.9-27.6 M.	**$9.3 to $23.1 M** Air stripping without pretreatment: $9.6-$20.6 MM[2] GAC: $9.3-20.0 M Chemical/UV oxidation: $10.8-23.1 M.	**$22.3 to 47.8 M**

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Table 10-2

Alternative Cost Summary

Griggs and Walnut Ground Water Plume

Las Cruces, New Mexico

	Alt 1: No Action	Alt. 2: Ground Water Extraction with Blending[1]	Alt. 3: Ground Water Extraction with Treatment[3]			Alt. 4: Enhanced Ground Water Extraction With Treatment[3]			Alt 5: In-Well Stripping in Higher Concentration Areas of the Ground Water Plume
			Air Stripper	GAC	Chemical/ UV Oxidation	Air Stripper	GAC	Chemical/ UV Oxidation	
Capital Cost	$ -	$ 1,122,723	$ 3,946,036	$ 4,504,573	$ 5,211,897	$ 5,151,978	$ 5,710,514	$ 6,340,304	$ 18,403,797
Total Year 1 Operations and Maintenance	$ -	$ 552,472	$ 821,029	$ 764,672	$ 986,991	$ 821,029	$ 764,672	$ 986,991	$ 1,051,260
Total Year 2-5 Operations and Maintenance	$ -	$ 464,797	$ 638,635	$ 571,708	$ 649,457	$ 638,635	$ 571,708	$ 649,457	$ 679,255
Total Year 6-30[2] Operations and Maintenance	$ -	$ 260,906	$ 536,818	$ 460,019	$ 547,640	$ 510,090	$ 433,291	$ 520,912	$ 577,438
Five Year Reviews		$ 3,023	$ 40,804	$ 40,804	$ 40,804	$ 40,804	$ 40,804	$ 40,804	$ 40,804
Total Post Closure Cost	$ -	$ 52,977	$ 553,867	$ 553,867	$ 685,776	$ 580,249	$ 580,249	$ 712,158	$ 1,028,741
TOTAL PRESENT WORTH	$ -	**$ 10,152,542**	**$ 16,627,776**	**$ 15,633,464**	**$ 18,407,955**	**$ 13,780,213**	**$ 13,323,493**	**$ 15,407,101**	**$ 31,882,979**
High Range (+50%)	$ -	$ 15,228,813	$ 24,941,665	$ 23,450,197	$ 27,611,932	$ 20,670,320	$ 19,985,239	$ 23,110,651	$ 47,824,468
Low Range (-30%)	$ -	$ 7,106,779	$ 11,639,443	$ 10,943,425	$ 12,885,568	$ 9,646,149	$ 9,326,445	$ 10,784,970	$ 22,318,085
Treatment Cost per Pound PCE	$ -	$ 30,765.28	$ 50,387.20	$ 47,374.13	$ 55,781.68	$ 41,758.22	$ 40,374.22	$ 46,688.18	$ 96,615.09
Remediation Time Frame (years)	unknown PRG not met in 30 years	23	21	21	21	14	14	14	20

Notes:

1. It is assumed that existing equipment can be used to perform blending and no additional capital costs are included. Only O&M costs included are for routine operation and sampling to document effectiveness of blending system.

2. Costs are through year 30, or through the predicted remediation timeframe if less than 30 years. See bottom of table for predicted remediation timeframe.

3. The costs EXCLUDE provision of a pretreatment system for control of scaling in the air stripping and other process equipment. The costs of pretreatment would be significant and could greatly affect the overall net present worth for those

A preliminary evaluation indicates the potential for scaling is borderline under the ex-situ air stripping treatment option. The Ryznar Stability Index (RSI) calculated for CaCO3 scaling potential at GWP is 6.1; RSI less than 6 indicates higher potential for scaling. The Langlier Index (LI) calculated for CaCO3 scaling potential at GWP is 0.9; LI greater than 1 indicates higher potential for scaling. Because the assumptions used in making these calculations can greatly affect the result, a more detailed evaluation of scaling potential must be performed during the RD.

Pretreatment for scaling under the ex-situ air stripping treatment option would increase the costs of Alternatives 3 and 4 by a net present worth value cost of about $5 to $6 MM for the entire period of operation. The cost estimate with acid pretreatment for Alternatives 3 and 4 is as follows:

	Without Acid Pretreatmen	With Acid Pretreatment
Alternative 3-Air stripping	$ 16,627,776	$ 22,879,028
Alternative 4-Air stripping	$ 13,780,213	$ 18,421,834

Section 11

Principal Threat Waste

Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., concentrations that are several orders of magnitude above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a Site; wherever practicable. Low-level threat wastes are those source materials that generally can be reliably contained and that contain contaminant concentrations not greatly above the acceptable levels. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

The remedy satisfies the statutory preference of treatment, and reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through hydraulic containment and treatment. The Site however, does not have a principal threat waste on Site. The waste is not a principal threat because the ground water contamination is not a source material such as a Dense Nonaqueous Phase Liquid (DNAPL). The waste is not a low-level threat because it cannot be reliably contained in place.

Section 12

Selected Remedy - Enhanced Ground Water Extraction with Treatment

The selected remedy for the Site is Alternative 4, **Enhanced Ground Water Extraction with Treatment.** This selected remedy calls for treatment of ground water and hydraulic control of the PCE contaminated ground water plume relying upon the existing municipal supply wells to the extent possible. The objective of the remedy is to remove PCE from ground water until concentrations that meet MCLs are attained, to contain the plume through hydraulic containment and treatment in order to keep it from migrating, and to reduce the plume size by targeted ground water pumping in areas within the plume boundaries that have higher PCE concentrations. Under the selected remedy extracted ground water will enter a conveyance system that will transport the ground water to a central plant. The remedy will maximize its use of the existing infrastructure already in place with some retrofitting prior to ground water conveyance for treatment. The treatment plant will be located within the plume boundaries and is expected to take minimal space and be centrally located. Treated water will then be available for delivery into the public water supply.

The selected remedy is intended to address the entire ground water plume Site through treatment. The Site is located within a mixed land-use. Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvent), and high concentrations of toxic compounds (e.g., concentrations that are several orders of magnitude above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a Site, wherever practicable. Low-level threat wastes are those source materials that generally can be reliable contained and that contain contaminant concentrations not greatly above the acceptable levels. The waste is not a principal threat because the ground water contamination is not a source material such as a Dense Nonaqueous Phase Liquid (DNAPL). The waste is not a low-level threat because it cannot be reliably contained in place. The remedy will incorporate treatment and the use of engineering controls for purposes of plume containment. The remedy will also use institutional controls to augment the remedy. The reason for such action is because the contaminant plume affects a primary drinking water supply source. The remedy expectation is to return the ground water to its beneficial use in an expeditious manner.

Major Components of the Selected Remedy:

Under the selected remedy for the GWP Site, water will be pumped from municipal supply wells (CLC Well Nos. 18 and 27, or other wells as appropriate with selection of wells to be determined during remedial design and remedial action). Based on modeling results it is expected that within approximately five years one new extraction well location will be necessary to continue treating and reducing the PCE contaminated ground water in order to reduce concentrations of PCE in the entire ground water plume to concentrations that are below the MCL. The new extraction well would probably be used to replace CLC Well No. 18 after the first five years of operation. This new well would replace CLC Well No. 18 because the fate and transport model predicts that over time, CLC Well No. 18 will draw more clean water than PCE affected water and it also predicts that over time CLC Well No. 18 will extract contaminated ground water less efficiently. PCE plume containment will rely on hydraulic control, and on discontinuing the use of CLC Wells 19, 20, 21, 24, 26, and 38 during remediation. Hydraulic control, treatment, and plume reduction will be further evaluated and refined during remedial design and remedial action to determine the appropriate locations and pumping rates for full-scale operation. The remedy will be supported by the following activities:

Institutional Controls

Long-Term Monitoring Program

Annual Reviews and Reporting

The Remedial Action Objectives (RAOs) are expected to be reached in approximately 14 years.

Summary of the Rationale for the Selected Remedy

Based upon consideration of requirements of CERCLA, and based on consideration of the requirements of the NCP including without limitation a detailed analysis of the remdial action alternatives using the nine NCP criteria [40 CFR § 300.430(e)(9)] that included, among other things, an analysis of public comments, EPA has determined that Alternative 4 (Enhanced Ground Water Extraction with Treatment), is the most appropriate remedy for the GWP Site. The selected remedy provides adequate protection of human health and the environment, complies with ARARs, and is cost-effective. The selected remedy represents the best balance of trade-offs among the nine criteria in the NCP. Several options and treatment technologies were evaluated but the Selected Remedy provides the most efficiency, cost effectiveness, and reliability, through treatment and plume containment in the least amount of time. The remedy provides the necessary treatment to protect human health and the environment and is expected to meet the remedial action objectives and remediation goals.

Alternative 4: Enhanced Ground Water Extraction with Treatment- Selected for the Following Reasons:

- The Selected Remedy provides best overall protection of human health and the environment;

- The Selected Remedy provides treatment by conveying extracted ground water to a central treatment facility to meet the PCE MCL before it is distributed to consumers. The remedy will most likely require modifications to existing CLC supply wells and an additional extraction well. The remedy will also most likely include targeted pumping in the most contaminated areas of the aquifer, based on the results of modeled performance . The model results indicated targeted pumping will provide the most expeditious time frame for reaching the RAOs as compared to performing a more traditional pump and treat remedy.

- While Alternative 5 also provides total PCE destruction, additional infrastructure would have to be installed under Alternative 5, than under the Selected Remedy. In addition, with

Alternative 5, more complexity is involved in obtaining the same remediation goals as the selected remedy. Moreover, Alternative 5 has a higher probability of mechanical failure and higher maintenance costs.

- The Selected Remedy maximizes use of the existing infrastructure to the extent possible and thereby reducing costs associated with remedy construction.
- Under the Selected Remedy, existing supply wells CLC Well Nos. 18 and 27 would be modified and a new extraction well installed will maximize hydraulic containment of ground water containing PCE concentrations that exceed the MCL.
- Under the Selected Remedy, CLC Wells Nos. 18 and 27 will be redesigned to extract water from targeted ground water intervals that contain higher PCE concentrations. By targeting these higher PCE concentrations, the Selected Remedy will realize efficiencies that could not be attained by any of the other remedial alternatives, including Alternative 3.
- Unlike Alternatives 1 and 2 the Selected Remedy will treat ground water to reduce the PCE concentrations in extracted ground water to concentration levels that are below the MCL before distribution to the public water supply system. This would reduce the human health risk to residents who obtain their potable water from this municipal supply.
- The Selected Remedy provides the most active hydraulic containment of the PCE plume, both vertically and laterally within the plume boundaries. This means that the Selected Remedy will do the most to prevent plume migration, thereby protecting other wells.
- Under the Selected Remedy, the RAOs will be reached in the shortest period of time, compared to the other remedial alternatives.
- Under the Selected Remedy, LTM would provide data trends on PCE concentrations and would also confirm hydraulic containment of the plume. Treatment of the entire plume permanently reduces TMV of PCE within the aquifer providing protection of human health and the environment.
- The Selected Remedy involves low risk to workers involved in the remedial action or O&M. Neither the treatment process nor exposure to the extracted ground water poses significant risks to workers.

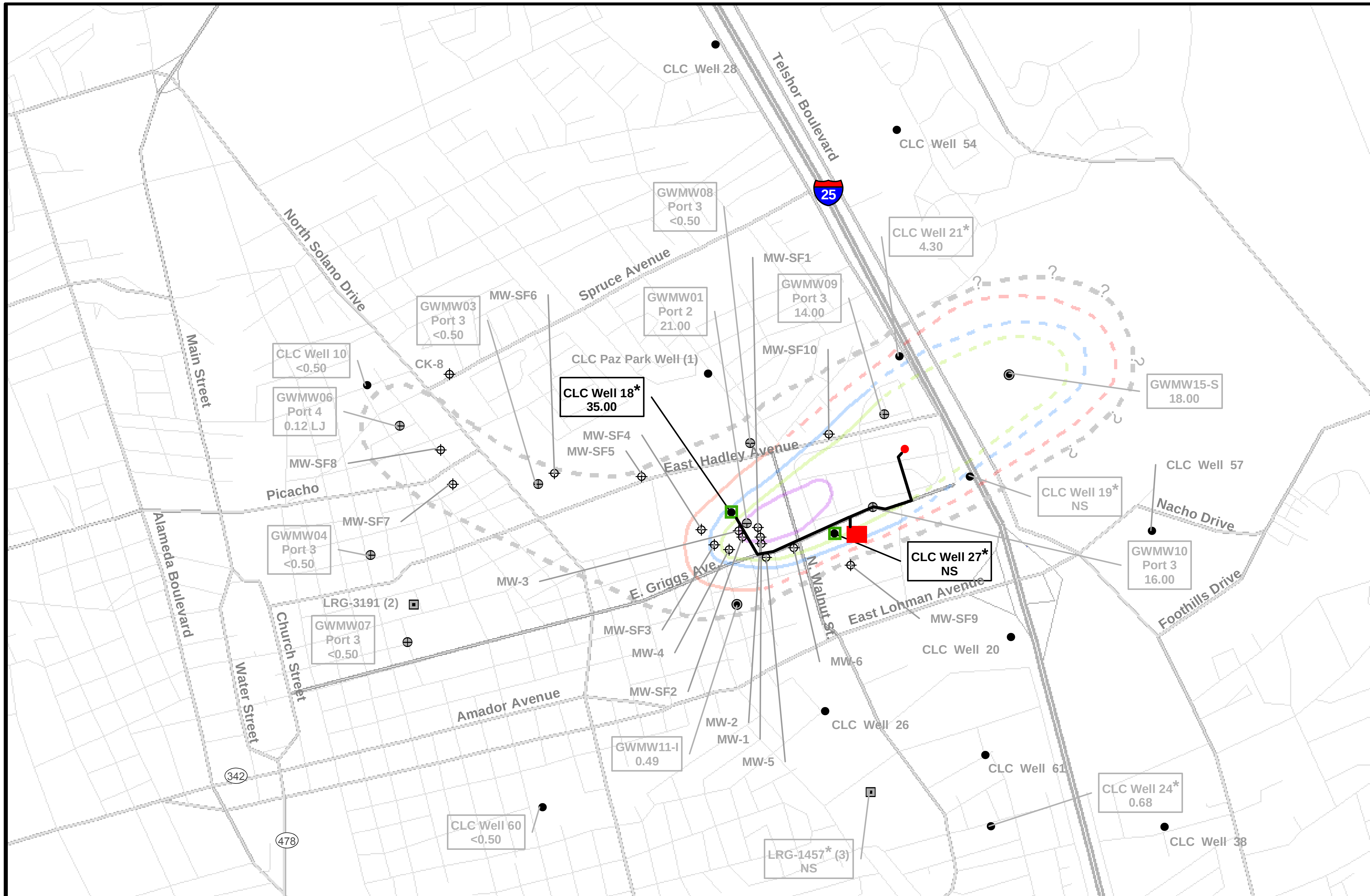
- Operation of the extraction well network under the Selected Remedy would adequately contain and treat the PCE plume to meet the remediation goals, and the remedial action objectives.
- The extraction and treatment of ground water under the Selected Remedy would provide reduction in the TMV of the PCE in the contaminated ground water through treatment. The entire plume would be both hydraulically contained and treated.
- Treatment of the entire plume under the selected remedy increases the likelihood that the RAOs will be permanently met and that the remedy will have long-term success. The aquifer would be restored to its beneficial use as a municipal water supply within about 14 years.
- Air stripping is the preferred option for treating ground water, prior to conveyance into the public water supply. It is expected to be the most cost effective treatment, options will be further refined during remedy design.
- Air stripping, or a combination of air stripping with any other treatment (i.e., GAC) will provide treatment of PCE as well as other contaminants identified within the plume boundaries (such as the COPCs) and will ensure ground water continues to meet the drinking water standards, at or below the MCL.
- Under the Selected Remedy, the removal of the mass of PCE from the ground water would reduce the toxicity and volume of PCE within the aquifer, and plume containment would reduce the contaminant mobility.

Las Cruces is an attainment area under the CAA. In accordance with the OSWER Directive 9355.0-28 “Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites,” preliminary calculations of air emission rates associated with air stripping of PCE were prepared. Air emission estimates are provided in the calculations in Appendix B, of the Feasibility Study and are estimated to be well below National Institute for Occupational Safety and Health (NIOSH) exposure limits as well as permitting thresholds.

Cost

Total Present Worth Estimated Costs:

Capital Cost:	$ 5.2 M
Annual O&M Cost (Year 1):	$ 0.8 M
Annual O&M Cost (Years 2-5):	$ 0.6 M
Annual O&M Cost (Year 6-14):	$ 0.5 M
Total Present Worth Cost:	**$ 13.8 M**



N

Approximate location of new ground water extraction well.

New Below Grade Piping

Notes:

PCE Concentrations in micrograms per liter (ug/L).

No Data obtained from GWMW06 Port 3. Data for Port 2 was <0.50 and data for Port 4 was 0.12 LJ. Therefore, PCE contamination is assumed to extend past GWMW06.

1. The CLC Paz Park Well is used for irrigation. The other CLC wells illustrated on this map are designated for drinking water supply (not all are used).

2. Samples from LRG-3191 have demonstrated the presence of PCE, but samples collected since August 2002 have been non-detect for PCE

3. LRG-1457 is an irrigation well for the Lynn Middle School. It is not currently in service.

Gas Card Monitor Well and Private Well LRG-7375 have been abandoned and are not shown on figure.

Unit Qualifiers:
J - Estimated
L - Concentration below the reporting limit

Concentration Data Contoured by Hand.

NS - Not Sampled

The municipal supply well concentrations are used for informational purposes only. The PCE concentrations in these wells were not used to prepare the PCE isoconcentration contours shown on this figure.

Upper portion of Lower Zone corresponds to an approximate elevation range of 3675 to 3775 ft MSL.

* Indicates Private and CLC Municipal Supply Wells where PCE is detected.

Feet
0 750 1,500 3,000

LEGEND

- Water Table Monitor Well (screen depths of these wells range from 101 to 204 feet bgs.)
- City of Las Cruces (CLC) Municipal Water Supply Wells (screen depths of these wells range from 281 to 1,050 feet bgs.)
- Private Water Supply Wells (screen depths of these wells range from 150 to 290 feet bgs, depth of screen information is not available for LRG-1457)
- Multi-Port Monitor Well (screen depth of these wells range from 90 to 640 feet bgs)
- Nested Monitor Well Installed During RI (screen depths of these wells range from 190 to 590 ft bgs)
- GWMW07 Port 3 <0.50 — Monitor Well ID, Port Number & PCE Concentration
- Estimated Extent of GWP-Related PCE Detections
- ? Indicates Uncertainty of Extent of GWP-Related PCE Detections
- Existing municipal supply wells to be used for ground water extraction.
- Central Treatment System

PCE Concentration Levels (Dashed Where Infered)

- 2.5 ug/L
- 5 ug/L
- 10 ug/L
- 20 ug/L

CH2MHILL

Figure 12-1
Alternative 4 Conceptual Layout:
Enhanced Ground Water Extraction
with Treatment
Griggs & Walnut Ground Water Plume Site
Las Cruces, New Mexico

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Section 13

Statutory Determinations

Applicable or Relevant and Appropriate Requirements (ARARs)

The NCP requires a selected response action to attain ARARs under Federal and State environmental laws 40 CFR 300.430(e)(2)(i)(A). RAOs and remediation goals established for a Site must consider ARARs.

Under CERCLA, a requirement may be either “applicable” or “relevant and appropriate” to a specific response action, but not both. The NCP (40 CFR Section 300.5) defines “applicable” and “relevant and appropriate” requirements as follows:

- **Applicable requirements** are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA Site. Only the state standards that are more stringent than federal requirements may be applicable.

- **Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA Site, address problems or situations sufficiently similar to those encountered at the CERCLA Site so that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Typically, ARARs are compiled in the following three categories:

- Chemical-specific
- Action-specific
- Location-specific

The primary factor that influenced selection of the ARARs for the GWP Site was the elevated contaminant concentration levels of PCE found in CLC municipal water supply wells. **Tables 13-1** and **13-2** present the Federal and State of New Mexico ARARs, respectively. The

ARARs listed on the tables are grouped by type of regulation (i.e., air, water, solid and hazardous waste, transportation).

Chemical-Specific ARARs

Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies used to determine acceptable concentrations of chemicals that may be found in or discharged to the environment, for example, MCLs that establish safe levels in drinking water. The chemical-specific ARARs most pertinent to the GWP Site are the federal SDWA MCLs, the State of New Mexico drinking water standards (NMAC 20.7), and the New Mexico Water Quality Control Commission Regulations (NMAC 20.6.2). These standards are important in establishing remediation goals for ground water.

Action-Specific ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions or conditions involving specific substances. The action-specific ARARs presented in this document for the GWP Site have been selected based on potential remedial action alternatives. The following potential action-specific requirements may be applicable or relevant and appropriate: (1) design standards affecting the construction of a remedy; (2) performance standards affecting operation of a remedy, specifically, treatment requirements and management of residuals; and (3) discharge standards for a particular process.

The action-specific ARARs most pertinent to the response actions discussed later in this report are the federal and state laws pertaining to the management of solid and hazardous waste, and those pertaining to air emissions, including the New Mexico Air Pollution Control Regulations (NMAC 20.2). For all CERCLA remedies, the remedial action is exempt from having to obtain permits for on-Site activities. However, any substantial requirements of applicable permits, such as discharge limitations, must be met in the remedy. Any improvements to the system must comply with all applicable state rules and regulations. Such requirements are usually set by the state, if the state is authorized to administer the federal program.

Location-Specific ARARs

Location-specific ARARs restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present.

To-Be-Considered Criteria

To-be-considered (TBC) criteria are nonpromulgated, nonenforceable guidelines, or criteria that may be useful for developing a remedial action or that are necessary for evaluating what is protective to human health and/or the environment. Examples of TBC criteria include EPA drinking water health advisories, reference doses, and cancer slope factors.

Remediation Goals

The target contaminant defined for ground water at the GWP Site is PCE. The New Mexico Water Quality Control Commission Regulations (20.6.2.3103 of the New Mexico Administrative Code [NMAC]) include ground water standards for PCE based on human health (0.02 mg/L). The MCL for PCE established under the SDWA is lower (0.005 mg/L) and therefore the MCL, an ARAR, will be used as the remediation goal for the selected remedy.

Occurrence and Volume of Affected Media with Concentrations of PCE that Exceed Remediation Goals

PCE contamination is observed in ground water in the UHZ, in the upper portion of the LHZ, and in the lower portion of the LHZ, as shown in **Figures 5-2 through 5-7**. The approximate volume of contaminated ground water at the GWP Site was estimated by the JSP as part of the ground water modeling activity. The estimated volume was estimated by the JSP at between 1,928 and 2,892 acre-feet (6.82 to 9.42 billion gallons). The approximate volume of ground water to be remediated, i.e. with PCE concentrations greater than 5 µg/L, was estimated at between 735 and 1,102 acre-feet (2.39 to 3.59 billion gallons).

The total contaminant mass of PCE at the Site was estimated (based on the volume of contaminated ground water provided above) at between 150 and 225 kilograms (between 330 and 496 pounds). The contaminant mass of PCE to be remediated, (i.e. the contaminant mass that could potentially be extracted from ground water with PCE concentrations greater than 5 µg/L), was estimated at between 110 and 160 kilograms (between 242 and 357 pounds).

Federal Applicable or Relevant and Appropriate Requirements for Remedial Action Table 13-1			
Citation	Requirement/Purpose	Applicability	ARAR Category
Control of air emissions from Superfund air strippers at Superfund ground water sites, 1989, OSWER Directive 9355.0-28. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response	The directive establishes guidance on control of air emissions from air strippers used at Superfund sites for groundwater treatment. The joint memorandum from Office Directors, OERR, and Air Quality Planning and Standards, establishes procedures for implementation.	Las Cruces, is in an attainment of the National Air Quality Standards. This directive does not apply to the City, unless it can be demonstrated emissions from the remedy can lead toward non-attainment for one of the standards.	Chemical-specific, TBC
40 CFR 122.26 - EPA Administered Permit Programs: The National Pollutant Discharge Elimination System; Storm Water Discharges	Requires obtaining an NPDES permit for discharge of storm water from specified industrial and construction activities, developing a storm water pollution prevention plan, implementing best management practices to prevent discharge of pollutants to storm water, and monitoring storm water discharges.	Although NPDES permit coverage is not required for on-site discharges of storm water, substantive requirements, including implementing best management practices to prevent discharge of pollutants to storm water, are applicable to construction activities disturbing one acre or more. These requirements may be applicable to construction of a central groundwater treatment plant.	Action-specific
40 CFR 141.61–National Primary Drinking Water Regulations; Maximum Contaminant Levels for Organic Compounds; 40 CFR 141.66–National Primary Drinking Water Regulations; Maximum Contaminant Levels for Radionuclides	Establishes maximum contaminant levels (MCLs) for specific chemicals to protect drinking water quality.	MCLs for contaminants, including PCE degradation products are applicable if the water will be supplied directly to a drinking water distribution system with a specified number of consumers or connections. MCLs are relevant and appropriate if the water could be used for human consumption.	Chemical-specific
Reference Doses (RfDs), EPA Office	Presents non-enforceable toxicity data for specific	"To be considered" criterion used to	Chemical-

Federal Applicable or Relevant and Appropriate Requirements for Remedial Action Table 13-1			
Citation	Requirement/Purpose	Applicability	ARAR Category
of Research and Development	chemicals for use in public health assessments.	assess risk associated with soil and ground water; not an ARAR.	specific TBC
Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Methyl Tertiary-Butyl Ether (MtBE) (*EPA-822-F-97-009*); EPA Office of Water Risk-Specific Doses (RSDs), EPA Carcinogen Assessment Group and EPA Environmental Criteria and Assessment Office	Presents non-enforceable guidance for drinking water suppliers recommending a level of contamination for MTBE in drinking water to protect consumer acceptance of the water resource and provide a margin of safety from toxic effects. Represents the dose of a chemical in mg per kg of body weight per day associated with a specific risk level (i.e., 10_6). RSDs are determined by dividing the selected risk level by the cancer potency factor (slope factor).	"To be considered" criterion used in setting an acceptable MTBE level in drinking water; not an ARAR. Applicable standard used to assess risk associated with soil and groundwater.	Chemical-specific TBC
Solid and Hazardous Waste Regulations			
40 CFR §§ 261.20, and 261.30, RCRA Waste Analysis Requirements, RCRA, 40 CFR §262.30	RCRA waste analysis requirements found at 40 CFR §§ 261.20 and 261.30, RCRA manifesting requirements found at 40 CFR § 262.20, and RCRA packaging and labeling requirements found at 40 CFR § 262.30 are relevant and appropriate requirements for off-site disposal of contaminated personal protective equipment (PPE) and other contaminated material generated during this removal action.	Because on-site storage of wastes is not expected to exceed ninety (90) days, specific storage requirements found at 40 CFR Part 265 are neither applicable nor relevant nor appropriate. See 40 CFR § 262.34.	Action-specific
40 CFR 268- Land Disposal Restrictions	The land disposal restrictions prohibit land-based disposal of listed and characteristic hazardous wastes that do not meet specified treatment standards.	Applicable to off-site land disposal of listed or characteristic hazardous wastes, and to on-site remedies that include placement of these wastes.	Action-specific
Historical Preservation Regulations			
National Historical Preservation Act 16 USC Section 431-433 - Antiquities Act of 1906 16 U.S.C. Section 470 et seq. 16 USC Section	Establishes procedures for the preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or federally licensed activity or program. If scientific,	Will be applicable during remedial activities if scientific, historical, and archaeological artifacts are identified during the implementation	Location-specific

Federal Applicable or Relevant and Appropriate Requirements for Remedial Action Table 13-1			
Citation	Requirement/Purpose	Applicability	ARAR Category
470aa-470ll – Archaeological Resources Protection Act of 1979 36 CFR Part 65 – National Historic Landmarks Program 36 CFR Part 800 –Protection of Historic Properties 40 CFR 6.301 (c) - Landmarks, Historical, and Archaeological Sites (Historic, prehistoric and archeological data)	historical, and archaeological artifacts are discovered at the site, work in the area of the site affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the act and its implementing regulations.	of the remedy.	
Flood Plain Regulations			
Flood Control Act of 1944 16 U.S.C. Section 460	Provides the public with knowledge of flood hazards and promotes prudent use and management of flood plains.	Applicable if the site is located on a designated flood plain.	Location-specific

New Mexico Applicable or Relevant and Appropriate Requirements for Remedial Action Table 13-2			
Citation	Requirement/Purpose	Applicability	ARAR Category
20.7 NMAC - New Mexico Regulations for Public Drinking Water Systems	Provides the state primary drinking water regulations based on MCLs for public water systems.	These requirements are applicable. When the MCLGs are zero, groundwater will be treated to meet MCLs. The MCLs PCE is 5 ppb.	Chemical-specific
20.6.2 NMAC – New Mexico Regulations for protection of ground water quality	20.6.2.3101 and 3103 provides concentration standards for ground water of 10,000 mg/L Total Dissolved Solids concentration or less 206.2.4101 and 4103 provide abatement standards and requirements for vadose zone and ground water.	These requirements are applicable. NMWQCC regulations will apply where PCE or its degradation products where the NMWQCC regulated concentration is lower than Federal MCL. Abatement requirements apply where vadose zone and ground water concentrations exceed applicable NMWQCC standards.	Chemical and Action specific
20.2 NMAC New Mexico Air Quality Regulation	20.2.73 Notice of Intent to discharge 20.2.78 Emission Standards for Hazardous Pollutants	These requirements may be applicable depending on treatment technologies used and emission discharge rates.	Chemical - specific
Hazardous Waste Management	RCRA waste analysis requirements found at 20.4.1.300 NMAC (40 CFR §§ 261.20 and 261.30), RCRA manifesting requirements found at 20.4.1.300 NMAC (40 CFR § 262.20), and RCRA packaging and labeling requirements also found at 20.4.1.300 NMAC (40 CFR § 262.30) are relevant and appropriate requirements for off-site disposal of contaminated personal protective equipment (PPE) and other contaminated material generated during this remedial action.	Applies to actions involving treatment, storage, and disposal of hazardous waste. Incorporates Federal Hazardous Waste Regulations by reference, with specified exceptions. Because on-site storage of wastes is not expected to exceed ninety (90) days, specific storage requirements found at NMAC 20.4.1.600 (40 CFR Part 265) are neither applicable nor relevant nor appropriate. See NMAC 20.4.1.600 (40 CFR § 262.34).	Action-specific
New Mexico Cultural Properties Act (NMSA 1978)	Requires the identification of cultural resources, assessment of impact on those resources that may be caused by the proposed remedy, and consultation with the State Historic Preservation Officer.	This requirement may become applicable if cultural resources are identified during remedial activities.	Location-specific
New Mexico	The purpose of the New Mexico Prehistoric and Historic Sites	This requirement may become applicable if	Location-

Prehistoric and Historic Sites Preservation Act 18-8 et seq. (NMSA 1989)	Preservation Act is the acquisition, stabilization, restoration or protection of significant prehistoric and historic sites by the state of New Mexico and corporations.	prehistoric or historic sites are identified during and affected by remedial activities.	specific

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Section 14
Documentation of Significant Changes

Based on the review of comments, no significant changes were made to the preferred alternative identified in the Proposed Plan.

PART 3: RESPONSIVENESS SUMMARY

Part 3: Responsiveness Summary

The Responsiveness Summary serves the dual purpose of: (1) presenting stakeholder concerns about the Site and preferences regarding the Site and the remedial alternatives; and (2) explaining how those stakeholder concerns and preferences are addressed in the preferences factored in to the remedy selection process.

Comments were received from the public during the Public Meeting held on December 7, 2006, at the Sierra Middle School on East Spruce Avenue in Las Cruces, New Mexico. Responses to each comment are provided in the following paragraphs.

Comment: I'd like to know why you're going to take 14 years to clean it up?

Response: Calculations on the flow of ground water in the Las Cruces area show that about 14 years will be required to extract the contaminated ground water from the aquifer.

Comment: My question is the mailings that I've got in the past is drilling wells around different spots has been tested. Well, do all these wells go into the tank there off of I-25? And if so, why has that not been tested? I haven't seen anything on that.

Response: The tank referred to in the comment is the Upper Griggs Reservoir. The only well associated with the Griggs and Walnut Ground Water Plume Site that provides water to the Upper Griggs Reservoir is CLC Well No. 21. Other clean wells in the area also supply water to the Upper Griggs Reservoir. The water in the Upper Griggs Reservoir is tested by the City for compliance with the Safe Drinking Water Act.

Comment: I wasn't planning on speaking, but, Mr. Williams, would you, for the benefit of the couple of people who this may be their first time here, tell us how did the water become contaminated in the first place and how was it found.

Response: The original source of the PCE is uncertain. The data collected from the soil vapor and ground water at the Site suggests that the PCE was released at the ground surface at several locations in the area of the plume and migrated through the unsaturated zone to the ground water. The contamination was originally identified by NMED during the investigation of fuel-related releases associated with Underground Storage Tanks in the area. In routine sampling for the fuel-related constituents, PCE was also detected at some locations. Those detections alerted NMED and EPA to look further into the distribution of PCE.

Comment: I want to know when you clean up this water situation, are you going to clean up the air, too? Because they say with the swamp coolers that we do get contaminated air. Is this possible?

Response: The potential for PCE contamination to occur in the air associated with swamp cooler operation was considered in the Remedial Investigation. The ATSDR also evaluated the risk of inhalation of PCE in air from swamp coolers. Because the concentrations in the taps are negligible (nondetectable in tap samples) and the water that is distributed to the homes meet drinking water standards, there is no risk associated with inhalation of water vapor.

The treatment process associated with the selected remedy is air stripping of the contaminated ground water removed from the aquifer. During this treatment process, monitoring to evaluate the magnitude of emissions from the process will be performed. Preliminary calculations indicate any emissions will be negligible, but if the actual measured concentrations are high enough to warrant attention, a component will be added to the system to capture those emissions.

Stakeholder Comments and Lead Agency Responses (see Appendix C for State and Local Concurrence Letters)

Technical and Legal Issues (none)

APPENDIX A

RAGS D Tables

Table A1-1

SELECTION OF EXPOSURE PATHWAYS

Griggs and Walnut Ground Water Plume Site

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Groundwater	Groundwater	Tap Water	Resident	Adult	Ingestion, Dermal, Inhalation	Qual	Residents obtain potable water from the municipal water supply. Currently, volatile chemical concentrations are below MCLs due to the municipality's well management program. Radioactivity is naturally-occuring in groundwater above MCLs and is being addressed under the Safe Drinking Water Act. Future concentrations may exceed MCLs if additional wells are installed in the Rio Grande Alluvium or if existing wells become impacted by ground water migration and the well management program is not continued.
					Child	Ingestion, Dermal, Inhalation	Qual	
		Indoor Air (Vapor Intrusion)	Indoor Air (Vapor Intrusion)	Resident, Industrial Worker, Recreational Center User, Boxing Facility User	Adult	Inhalation	Quant	Residents could potentially be exposed to volatile chemicals in groundwater through inhalation of indoor air from soil vapor intrusion.
					Child	Inhalation	Quant	
					Adult/Child	Inhalation	Quant	
		Indoor Air (Swamp Cooler)	Indoor Air (Swamp Cooler)	Resident	Adult	Inhalation	Qual	Residents use the municipal water supply in swamp coolers. ATSDR quantified this pathway and concluded insignificant risk with current municipal water at the MCLs (ATSDR, 2005). Future concentrations may exceed MCLs if additional wells are installed in the Rio Grande Alluvium or if existing wells become impacted by ground water migration and the well management program is not continued.
					Child	Inhalation	Qual	
		Irrigation Water	Homegrown Produce	Resident	Adult	Ingestion	Qual	The municipal water supply is used for irrigating homegrown produce, flower gardens, lawns, and city parks. Volatile chemical concentrations are currently below MCLs, and PCE does not bioaccumulate in plants. Therefore, exposures are insignificant (ATSDR, 2005).
					Child	Ingestion	Qual	
		Groundwater	Tap Water, Process Water	Industrial/Commercial Worker	Adult	Ingestion, Dermal, Inhalation	Qual	Industrial and commercial facilities use the municipal water supply for potable and process water. However, volatile chemical concentrations are currently below MCLs. Radioactivity is naturally-occuring in groundwater above MCLs and is being addressed under the Safe Drinking Water Act. Future concentrations may exceed MCLs if additional wells are installed in the Rio Grande Alluvium or if existing wells become impacted by ground water migration and the well management program is not continued.

Note:

Qual - Qualitative Analysis

Quant - Quantitative Analysis

Table A1-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Indoor Air (Vapor Intrusion)															
Property A	127-18-4	TETRACHLOROETHYLENE (PCE)	34	460	ppbv	Property A - South	9 / 9	10 - 10	460	NA	120 C	NA	--	Yes	ASL
Property B	127-18-4	TETRACHLOROETHYLENE (PCE)	25	644	ppbv	Property B - East	8 / 8	10 - 10	644	NA	120 C	NA	--	Yes	ASL
Property C	127-18-4	TETRACHLOROETHYLENE (PCE)	165	578	ppbv	Property C - North	7 / 7	10 - 20	578	NA	120 C	NA	--	Yes	ASL
Property D	127-18-4	TETRACHLOROETHYLENE (PCE)	107	443	ppbv	Property D - West	8 / 8	10 - 10	443	NA	120 C	NA	--	Yes	ASL
Property E	127-18-4	TETRACHLOROETHYLENE (PCE)	57	248	ppbv	Property E - East and South	8 / 8	10 - 10	248	NA	120 C	NA	--	Yes	ASL
Property F	127-18-4	TETRACHLOROETHYLENE (PCE)	84	411	ppbv	Property F - West	4 / 4	10 - 10	411	NA	120 C	NA	--	Yes	ASL
Property G	127-18-4	TETRACHLOROETHYLENE (PCE)	126	228	ppbv	Property G - South	3 / 3	10 - 10	228	NA	120 C	NA	--	Yes	ASL

(1) Maximum concentration is used for screening.
(2) Background level is not available
(3) EPA draft generic screening levels for deep soil vapor concentration for indoor air vapor intrusion, based on a residential scenario, a target excess lifetime cancer risk (ELCR) of 1 x 10^{5} (EPA, 2002).
(4) Rationale Codes
Selection Reason: Above Screening Level (ASL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
C = Carcinogenic
NA = Not available
ppbv = parts per billion by volume

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Table A1-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Indoor Air (Vapor Intrusion) PAL Boxing Facility	127-18-4	TETRACHLOROETHYLENE (PCE)	29	206	ppbv	Boxing Fac. W	8 / 8	10 - 10	206	NA	120 C	NA	--	Yes	ASL

(1) Maximum concentration is used for screening.
(2) Background level is not available
(3) EPA draft generic screening levels for deep soil vapor concentration for indoor air vapor intrusion, based on a residential scenario, a target excess lifetime cancer risk (ELCR) of 1 x 10^{5} (EPA, 2002).
(4) Rationale Codes
Selection Reason: Above Screening Level (ASL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
C = Carcinogenic
NA = Not available
ppbv = parts per billion by volume

Table A1-2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Indoor Air (Vapor Intrusion) Meerscheidt Recreational Center	127-18-4	TETRACHLOROETHYLENE (PCE)	21 X	21 X	ppbv	Meerscheidt N, Meerscheidt SE, Meerscheidt So	3 / 6	10 - 10	21	NA	120 C	NA	--	No	BSL

(1) Maximum concentration is used for screening.
Qualifier: X=Biased high due to matrix interference
(2) Background level is not available
(3) EPA draft generic screening levels for deep soil vapor concentration for indoor air vapor intrusion, based on a residential scenario, a target excess lifetime cancer risk (ELCR) of 1 x 10^{5} (EPA, 2002).
(4) Rationale Codes
Deletion Reason: Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
C = Carcinogenic
NA = Not available
ppbv = parts per billion by volume

Table A1-2.4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Tap Water (Upper Griggs Reservoir [UGRES] and CLC Wells excluding CLC Wells blended in the UGRES and CLC Wells 18 and 19).	12587-46-1	ALPHA, GROSS	2.2	21.1	pCi/L	CLC20	14 / 15	1 - 1	21.1	NA	15 MCL	NA	--	No	RAD
	7440-61-1	URANIUM, TOTAL	1	132	UG/L	CLC24	65 / 66	1 - 1	132	NA	30 MCL	NA	--	No	RAD
	127-18-4	TETRACHLOROETHYLENE (PCE)	0.67	3.2	UG/L	UGRES	46 / 62	0.5 - 0.5	3.2	NA	5 MCL	NA	--	No	BSL
	79-01-6	TRICHLOROETHYLENE (TCE)	0.1 L,J	0.1 L,J	UG/L	CLC24	1 / 1	0.5 - 0.5	0.1	NA	5 MCL	NA	--	No	BSL

(1) Maximum concentration is used for screening.

Qualifier: L,J = Result is between the MDL and the CRQL and is estimated because of outlying quality control parameters.

(2) Background level is not available

(3) Federal Maximum Contaminant Levels (EPA, 2002).

(4) Rationale Codes

Deletion Reason: Below Screening Level (BSL)

Naturally-occurring radioactive chemicals will be addressed under the Safe Drinking Water Act (RAD).

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
MCL = Maximum Contaminant Level
NA = Not available

Table A1-2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Tap Water Private Well (LRG-3139)	107-06- 2	1,2-DICHLOROETHANE	1.1	1.1	UG/L	LRG-3191	1 / 2	0.5 - 0.5	1.1	NA	5 MCL	NA	--	No	BSL

(1) Maximum concentration is used for screening.
(2) Background level is not available
(3) Federal Maximum Contaminant Levels (EPA, 2002).
(4) Rationale Codes
Deletion Reason: Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
MCL = Maximum Contaminant Level
NA = Not available

Table A1-2.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
5 Wells blended into the	12587-46-1	ALPHA, GROSS	2.4	5.6	pCi/L	CLC21	4 / 4	1 - 1	5.6	NA	15 MCL	NA	--	No	BSL, RAD
Upper Griggs Reservoir	7440-61-1	URANIUM, TOTAL	3	50	UG/L	CLC10	28 / 28	1 - 1	50	NA	30 MCL	NA	--	No	RAD
(CLC Wells 10, 21, 29,	1634-04-4	tert-BUTYL METHYL ETHER	0.38 L,J	0.38 L,J	UG/L	CLC21	1 / 5	0.5 - 0.5	0.38	NA	6.2 C/R6	NA	--	No	BSL
32, and 60)	127-18-4	TETRACHLOROETHYLENE (PCE)	1.61	4.9	UG/L	CLC21	28 / 36	0.5 - 0.5	4.9	NA	5 MCL	NA	--	No	BSL

(1) Maximum concentration is used for screening.

Qualifier: L,J = Result is between the MDL and the CRQL and is estimated because of outlying quality control parameters.

(2) Background level is not available

(3) Federal Maximum Contaminant Levels (EPA, 2002).
EPA Region 6 MSSL (Tap Water) (EPA R6, 2005).

(4) Rationale Codes

Deletion Reason: Below Screening Level (BSL)
Naturally-occurring radioactive chemicals will be addressed under the Safe Drinking Water Act (RAD).

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

MCL = Maximum Contaminant Level
C = Carcinogenic
NA = Not available

Table A1-2.7
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
CLC Wells 18 and 19	12587-46-1	ALPHA, GROSS	10.8	10.8	pCi/L	CLC19	1 / 1	1 - 1	10.8	NA	15 MCL	NA	--	No	BSL, RAD
	7440-61-1	URANIUM, TOTAL	51	54	UG/L	CLC19	2 / 2	1 - 1	54	NA	30 MCL	NA	--	No	RAD
	127-18-4	TETRACHLOROETHYLENE (PCE)	2	45	UG/L	CLC18	19 / 20	0.5 - 1.3	45	NA	5 MCL	NA	--	Yes	ASL
	79-01-6	TRICHLOROETHYLENE (TCE)	0.63 L,J	0.63 L,J	UG/L	CLC18	1 / 1	1.3 - 1.3	0.63	NA	5 MCL	NA	--	No	BSL

(1) Maximum concentration is used for screening.
Qualifier: L,J = Result is between the MDL and the CRQL and is estimated because of outlying quality control parameters.
(2) Background level is not available
(3) Federal Maximum Contaminant Levels (EPA, 2002).
(4) Rationale Codes
Selection Reason: Above Screening Level (ASL)
Deletion Reason: Below Screening Level (BSL)
Naturally-occurring radioactive chemicals will be addressed under the Safe Drinking Water Act (RAD).

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
MCL = Maximum Contaminant Level
NA = Not available

Table A1-2.8
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration Qualifier	Maximum Concentration Qualifier (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Selection or Deletion (4)
Rio Grande Alluvium	75-35-4	1,1-DICHLOROETHENE	0.1 L,J	0.1 L,J	UG/L	GWMW06	1 / 79	0.0749 - 2.5	0.1	NA	7 MCL	NA	--	No	FOD, BSL
	95-63-6	1,2,4-TRIMETHYLBENZENE	0.12 J	0.27 J	UG/L	GWMW11	2 / 2	0.0461 - 0.0461	0.27	NA	12 N/R6	NA	--	No	BSL
	107-06-2	1,2-DICHLOROETHANE	0.1 L,J	1.7	UG/L	MW-1	3 / 79	0.0866 - 2.5	1.7	NA	5 MCL	NA	--	No	FOD, BSL
	108-67-8	1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.06 J	0.06 J	UG/L	GWMW11	1 / 2	0.0595 - 0.0595	0.06	NA	12 N/R6	NA	--	No	BSL
	67-64-1	ACETONE	1.49	48 B	UG/L	GWMW06	3 / 79	0.471 - 25	48	NA	5,475 N/R6	NA	--	No	FOD, BSL
	71-43-2	BENZENE	0.12 L,J	22 J	UG/L	MW-1	44 / 79	0.0622 - 2.5	22	NA	5 MCL	NA	--	Yes	ASL
	75-25-2	BROMOFORM	0.59	23 J,v	UG/L	GWMW04	42 / 79	0.0832 - 2.5	23	NA	80 MCL	NA	--	No	BSL
	7440-70-2	CALCIUM	12.7	194	mg/L	MW-SF1	11 / 11	0.2 - 0.2	194	NA	NA	NA	--	No	NUT
	75-15-0	CARBON DISULFIDE	0.24 L,J	0.44 L,J	UG/L	GWMW09	2 / 77	0.5 - 2.5	0.44	NA	1,043 N/R6	NA	--	No	FOD, BSL
	67-66-3	CHLOROFORM	0.87 J	11 J,v	UG/L	GWMW03	16 / 79	0.0871 - 2.5	11	NA	80 MCL	NA	--	No	BSL
	74-87-3	CHLOROMETHANE	0.15 L,J	0.15 L,J	UG/L	GWMW11	1 / 79	0.0406 - 2.5	0.15	NA	2.1 C/R6	NA	--	No	FOD, BSL
	156-59-2	cis-1,2-DICHLOROETHYLENE	0.1 L,J	0.21 L,J	UG/L	GWMW01	3 / 79	0.0575 - 2.5	0.21	NA	70 MCL	NA	--	No	FOD, BSL
	10061-01-5	cis-1,3-DICHLOROPROPENE	0.41 L,J	0.41 L,J	UG/L	GWMW03	1 / 79	0.0703 - 2.5	0.41	NA	0.40 C/R6	NA	--	No	FOD
	110-82-7	CYCLOHEXANE	0.11 L,J	0.59	UG/L	MW-1	13 / 77	0.5 - 2.5	0.59	NA	12,514 N/R6	NA	--	No	BSL
	75-71-8	DICHLORODIFLUOROMETHANE	0.1 L,J	1.5 J	UG/L	MW-SF10	9 / 79	0.0536 - 2.5	1.5	NA	395 N/R6	NA	--	No	BSL
	100-41-4	ETHYLBENZENE	0.11 L,J	1.2 J	UG/L	MW-1	2 / 79	0.0558 - 2.5	1.2	NA	700 MCL	NA	--	No	FOD, BSL
	98-82-8	ISOPROPYLBENZENE (CUMENE)	0.25 L,J	0.25 L,J	UG/L	MW-1	1 / 79	0.0495 - 2.5	0.25	NA	658 N/R6	NA	--	No	FOD, BSL
	7439-95-4	MAGNESIUM	7.09	43	mg/L	GWMW01	9 / 11	0.05 - 0.05	43	NA	NA	NA	--	No	NUT
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	1 L,J	23	UG/L	GWMW06	15 / 79	0.286 - 25	23	NA	7,065 N/R6	NA	--	No	BSL
	95-47-6	O-XYLENE (1,2-DIMETHYLBENZENE)	0.07 J	0.07 J	UG/L	GWMW11	1 / 2	0.0603 - 0.0603	0.07	NA	10,000 MCL	NA	--	No	BSL
	1634-04-4	tert-BUTYL METHYL ETHER	0.12 L,J	130 J,^	UG/L	GWMW08	6 / 79	0.057 - 5	130	NA	6.2 C/R6	NA	--	Yes	ASL
	127-18-4	TETRACHLOROETHYLENE(PCE)	0.09 J	25	UG/L	MW-SF1	53 / 79	0.0771 - 2.5	25	NA	5 MCL	NA	--	Yes	ASL
	108-88-3	TOLUENE	0.22 J	95 J	UG/L	GWMW09	49 / 79	0.0566 - 4.2	95	NA	1,000 MCL	NA	--	No	BSL
	156-60-5	trans-1,2-DICHLOROETHENE	0.17 L,J	0.17 L,J	UG/L	GWMW10	1 / 79	0.0726 - 2.5	0.17	NA	100 MCL	NA	--	No	FOD, BSL
	79-01-6	TRICHLOROETHYLENE (TCE)	0.13 L,J	2.8	UG/L	GWMW01	25 / 79	0.0714 - 2.5	2.8	NA	5 MCL	NA	--	No	BSL
	75-69-4	TRICHLOROFLUOROMETHANE	0.14 L,J	0.17 L,J	UG/L	MW-3	2 / 79	0.0648 - 2.5	0.17	NA	1,288 N/R6	NA	--	No	FOD, BSL
	1330-20-7	XYLENES, TOTAL	0.15 L,J	0.21 L,J	UG/L	GWMW07	2 / 77	0.5 - 2.5	0.21	NA	10,000 MCL	NA	--	No	FOD, BSL

(1) Maximum concentration is used for screening.
Qualifier: B = Indicates that this result may be biased high because of laboratory or field contamination.
J = Estimated. This qualifier indicates that the analyte was detected, but the reported concentration should be considered estimated.
J,^ = Indicates that this result is an estimated concentration and may be biased high due to QA/QC issues. Actual concentration may be lower than the concentration reported.
J,v = Indicates that this result is an estimated concentration and may be biased low due to QA/QC issues. Actual concentration may be higher than the concentration reported.
L,J = Indicates that the reported concentration is below the CRQL and should be considered an estimated value.
(2) Background level is not available
(3) Federal Maximum Contaminant Levels (MCL; EPA, 2002).
When MCL is not available, EPA Region 6 Medium-Specific Screening Levels (MSSL) for Tap Water adjusted by HQ=1 (EPA R6, 2005) is used.
(4) Rationale Codes
Selection Reason: Above Screening Level (ASL)
Deletion Reason: Below Screening Level (BSL)
Essential Nutrient (NUT)
Frequency of Detection (FOD)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
MCL = Maximum Contaminant Level
NA = Not available
R6 = EPA Region 6 MSSL
C = Carcinogenic
N = Non-Carcinogenic

Table A1-3.1 RME
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T/NP/G)	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Indoor Air (Vapor Intrusion)										
Property A	TETRACHLOROETHYLENE (PCE)	ppbv	157	--	460	=	460	ppbv	Maximum	(1)
Property B	TETRACHLOROETHYLENE (PCE)	ppbv	236	--	644	=	644	ppbv	Maximum	(1)
Property C	TETRACHLOROETHYLENE (PCE)	ppbv	313	--	578	=	578	ppbv	Maximum	(1)
Property D	TETRACHLOROETHYLENE (PCE)	ppbv	207	--	443	=	443	ppbv	Maximum	(1)
Property E	TETRACHLOROETHYLENE (PCE)	ppbv	167	--	248	=	248	ppbv	Maximum	(1)
Property F	TETRACHLOROETHYLENE (PCE)	ppbv	282	--	411	=	411	ppbv	Maximum	(1)
Property G	TETRACHLOROETHYLENE (PCE)	ppbv	174	--	228	=	228	ppbv	Maximum	(1)
PAL Boxing Facility	TETRACHLOROETHYLENE (PCE)	ppbv	88.9	--	206	=	206	ppbv	Maximum	(1)

(1) Maximum detected concentration was used as the Upper-Bound Case EPC.

ppbv = parts per billion by volume

Table A1-3.1 CTE
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T/NP/G)	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Indoor Air (Vapor Intrusion)										
Property A	TETRACHLOROETHYLENE (PCE)	ppbv	157	--	460	=	157	ppbv	Mean	(1)
Property B	TETRACHLOROETHYLENE (PCE)	ppbv	236	--	644	=	236	ppbv	Mean	(1)
Property C	TETRACHLOROETHYLENE (PCE)	ppbv	313	--	578	=	313	ppbv	Mean	(1)
Property D	TETRACHLOROETHYLENE (PCE)	ppbv	207	--	443	=	207	ppbv	Mean	(1)
Property E	TETRACHLOROETHYLENE (PCE)	ppbv	167	--	248	=	167	ppbv	Mean	(1)
Property F	TETRACHLOROETHYLENE (PCE)	ppbv	282	--	411	=	282	ppbv	Mean	(1)
Property G	TETRACHLOROETHYLENE (PCE)	ppbv	174	--	228	=	174	ppbv	Mean	(1)

(1) Average concentration was used as the EPC.

ppbv = parts per billion by volume

Table A1-3 - Supplement A

Parameters Used in the Johnson and Ettinger Model, Residential Land Use

Griggs and Walnut Groundwater Plume Site

Las Cruces, NM

Symbol	Parameter	Description	Selected Value	Units	Sources
T_S	Average Soil Temperature		20	°C	Based on Figure 8 from the User's Guide (USEPA, 2004)
L_F	Depth Below Grade to Bottom of Enclosed Space Floor	This is the depth from soil surface to the bottom of the floor in contact with soil	15	cm	Represents 6 inch thick concrete slab. Considered representative of structures at the residential development.
L_t	Depth Below Grade to Top of Contamination	This is the depth from soil surface to the top of VOC-contaminated soil. It represents the depth of a VOC contaminant source in soil, or the “dry zone” between the surface and VOC contaminant source	152	cm	Based on the depth of shallow soil gas sampling (5 feet).
h_A	Thickness of Soil Stratum A		152	cm	Thickness of soil stratum A is assumed consistent with average depth to top of soil contamination.
h_B	Thickness of Soil Stratum B		NA	cm	Not Used
h_C	Thickness of Soil Stratum C		NA	cm	Not Used
	Soil Stratum A SCS Soil Type	Used to estimate soil vapor permeability	LS	unitless	Assumed to be loamy sand, based on soil classification results the U.S. Geological Survey.
k_v	User-defined Effective Soil Vapor Permeability	A parameter associated with convective transport of vapors within the zone of influence of a building. It is related to the size and shape of connected soil pores	1.00E-07	cm^2	Soil permeability consistent with a sand. Represents a drainage layer underneath the foundation.
ρ_b^A	Stratum A Soil Dry Bulk Density		NA	g/cm^3	Not used - conversion to soil gas concentration not required.
n^A	Stratum A Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity	0.39	unitless	Default porosity provided in the model (USEPA, 2004).
θ_w^A	Stratum A Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity	0.076	cm^3/cm^3	Default moisture content provided in the model (USEPA, 2004).
ρ_b^B	Stratum B Soil Dry Bulk Density		NA	g/cm^3	Not Used
n^B	Stratum B Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used
θ_w^B	Stratum B Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity	NA	cm^3/cm^3	Not Used
ρ_b^C	Stratum C Soil Dry Bulk Density		NA	g/cm^3	Not Used
n^C	Stratum C Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used

Table A1-3 - Supplement A

Parameters Used in the Johnson and Ettinger Model, Residential Land Use

Griggs and Walnut Groundwater Plume Site

Las Cruces, NM

Symbol	Parameter	Description	Selected Value	Units	Sources
θ_{w}^{C}	Stratum C Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity (see below)	NA	cm^3/cm^3	Not Used
L_{crack}	Enclosed Space Floor Thickness		15	cm	Represents 6 inch thick concrete slab
Δ_P	Soil-Building Pressure Differential		40	$g/cm\text{-}s^2$	Default in the User's Guide (USEPA, 2004).
L_B	Enclosed Space Floor Length		1180	cm	Length and width is based on the assumption of a 1,500 square foot home
W_B	Enclosed Space Floor Width		1180	cm	
H_B	Enclosed Space Height		244	cm	Indoor ceiling is assumed to be 8 feet
w	Floor-Wall Seam Crack Width	This assumed to be a gap present at the junction between the floor and the foundation perimeter. This gap is due to building design or concrete shrinkage. It represents the route for soil gas intrusion into a building. The crack-to-total area ratio (used to calculate vapor flow into the building) is proportional to the value of this parameter.	0.5	cm	Crack width and vapor permeability estimate produces a $Q_{soil}/Q_{building}$ ratio consistent with values published in the literature (Johnson, 2002). Calculated soil gas flow into structures (Qsoil) of 9.7 L/min) is higher than USEPA's default value for Q_{soil} of 5 L/min.
ER	Indoor air exchange rate	Building ventilation rate, expressed in units of air changes per hour (ACH)	0.25	(1/h)	USEPA, 2004
AT_C	Averaging Time for Carcinogens		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
AT_{NC}	Averaging Time for Noncarcinogens		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
ED	Exposure Duration		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
EF	Exposure Frequency		NA	days/yr	Not Used. Exposure parameters presented in Table 4.1 RME.
TR	Target Risk for Carcinogens	Used to calculate risk-based concentration	NA	unitless	Not Used. Exposure parameters presented in Table 4.1 RME.
THQ	Target Hazard Quotient for Noncarcinogens	Used to calculate risk-based concentration	NA	days/yr	Not Used. Exposure parameters presented in Table 4.1 RME.

Table A1-3 - Supplement B
Parameters Used in the Johnson and Ettinger Model, Non-Residential Land Use (PAL)
Griggs and Walnut Groundwater Plume Site
Las Cruces, NM

Symbol	Parameter	Description	Selected Value	Units	Sources
T_S	Average Soil Temperature		20	°C	Based on Figure 8 from the User's Guide (USEPA, 2004)
L_F	Depth Below Grade to Bottom of Enclosed Space Floor	This is the depth from soil surface to the bottom of the floor in contact with soil	15	cm	Represents 6 inch thick concrete slab. Considered representative of structures at the residential development.
L_t	Depth Below Grade to Top of Contamination	This is the depth from soil surface to the top of VOC-contaminated soil. It represents the depth of a VOC contaminant source in soil, or the “dry zone” between the surface and VOC contaminant source	152	cm	Based on the depth of shallow soil gas sampling (5 feet).
h_A	Thickness of Soil Stratum A		152	cm	Thickness of soil stratum A is assumed consistent with average depth to top of soil contamination.
h_B	Thickness of Soil Stratum B		NA	cm	Not Used
h_C	Thickness of Soil Stratum C		NA	cm	Not Used
	Soil Stratum A SCS Soil Type	Used to estimate soil vapor permeability	LS	unitless	Assumed to be loamy sand, based on soil classification results the U.S. Geological Survey.
k_v	User-defined Effective Soil Vapor Permeability	A parameter associated with convective transport of vapors within the zone of influence of a building. It is related to the size and shape of connected soil pores	1.00E-07	cm^2	Soil permeability consistent with a sand. Represents a drainage layer underneath the foundation.
ρ_b^A	Stratum A Soil Dry Bulk Density		NA	g/cm^3	Not used - conversion to soil gas concentration not required.
n^A	Stratum A Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	0.39	unitless	Default porosity provided in the model (USEPA, 2004).
θ_w^A	Stratum A Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity	0.076	cm^3/cm^3	Default moisture content provided in the model (USEPA, 2004).
ρ_b^B	Stratum B Soil Dry Bulk Density		NA	g/cm^3	Not Used
n^B	Stratum B Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used
θ_w^B	Stratum B Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity	NA	cm^3/cm^3	Not Used
ρ_b^C	Stratum C Soil Dry Bulk Density		NA	g/cm^3	Not Used
n^C	Stratum C Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used

Table A1-3 - Supplement B

Parameters Used in the Johnson and Ettinger Model, Non-Residential Land Use (PAL)

Griggs and Walnut Groundwater Plume Site

Las Cruces, NM

Symbol	Parameter	Description	Selected Value	Units	Sources
$\theta_{w\backslash}^{C}$	Stratum C Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity (see below)	NA	cm^3/cm^3	Not Used
L_{crack}	Enclosed Space Floor Thickness		15	cm	Represents 6 inch thick concrete slab.
Δ_P	Soil-Building Pressure Differential		40	$g/cm\text{-}s^2$	Default in the User's Guide (USEPA, 2004).
L_B	Enclosed Space Floor Length		3048	cm	Length and width is based on the assumption of a 10,000 square foot building
W_B	Enclosed Space Floor Width		3048	cm	
H_B	Enclosed Space Height		366	cm	Indoor ceiling is assumed to be 12 feet.
w	Floor-Wall Seam Crack Width	This assumed to be a gap present at the junction between the floor and the foundation perimeter. This gap is due to building design or concrete shrinkage. It represents the route for soil gas intrusion into a building. The crack-to-total area ratio (used to calculate vapor flow into the building) is proportional to the value of this parameter.	0.5	cm	Crack width and vapor permeability produce a Q_{soil} of 25 L/min. It is uncertain if these assumptions overstate or understate vapor intrusion. Soil vapor flow has been reported only for residences, not commercial/municipal buildings.
ER	Indoor air exchange rate	Building ventilation rate, expressed in units of air changes per hour (ACH)	0.8	(1/h)	Estimated using outside air requirements presented in ASHRAE, 2001.
AT_C	Averaging Time for Carcinogens		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
AT_{NC}	Averaging Time for Noncarcinogens		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
ED	Exposure Duration		NA	yrs	Not Used. Exposure parameters presented in Table 4.1 RME.
EF	Exposure Frequency		NA	days/yr	Not Used. Exposure parameters presented in Table 4.1 RME.
TR	Target Risk for Carcinogens	Used to calculate risk-based concentration	NA	unitless	Not Used. Exposure parameters presented in Table 4.1 RME.
THQ	Target Hazard Quotient for Noncarcinogens	Used to calculate risk-based concentration	NA	days/yr	Not Used. Exposure parameters presented in Table 4.1 RME.

Table A1-3 - Supplement C
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Griggs and Walnut Groundwater Plume Site
Las Cruces, NM

Exposure Point Concentration (RME) - Maximum					
Exposure Point	PCE in Soil Gas (ppbv)	PCE in Soil Gas (ug/L)	PCE in Soil Gas (ug/m^3)	Modeled Indoor Air Concentration (ug/m^3)	Modeled Indoor Air Concentration (mg/m^3)
Property A	460	3.17	3,173	8.41	0.00841
Property B	644	4.44	4,442	11.77	0.01177
Property C	578	3.99	3,987	10.56	0.01056
Property D	443	3.06	3,056	8.10	0.00810
Property E	248	1.71	1,711	4.53	0.00453
Property F	411	2.84	2,835	7.51	0.00751
Property G	228	1.57	1,573	4.17	0.00417

Exposure Point Concentration (CTE) - Average					
Exposure Point	PCE in Soil Gas (ppbv)	PCE in Soil Gas (ug/L)	PCE in Soil Gas (ug/m^3)	Modeled Indoor Air Concentration (ug/m^3)	Modeled Indoor Air Concentration (mg/m^3)
Property A	157	1.08	1,083	2.87	0.00287
Property B	236	1.62	1,624	4.30	0.00430
Property C	313	2.16	2,158	5.72	0.00572
Property D	207	1.42	1,425	3.77	0.00377
Property E	167	1.15	1,155	3.06	0.00306
Property F	282	1.94	1,944	5.15	0.00515
Property G	174	1.20	1,200	3.18	0.00318

Notes:

Attenuation Factor from Johnson and Ettinger Model (Residential)	2.65E-03
Molecular Weight (MW) - PCE	165.83
Molar Volume (MV) @ 20 oC and 1 atm	24

Unit Conversion Equations:
PCE (ug/L) = PCE (ppbv) x MW (g/mol) / MV (L/mol) / 1000
PCE (ug/m3) = PCE (ug/L) x 1000 (L/m3)
PCE (mg/m3) = PCE (ug/m3) / 1000 (mg/ug)

PCE - perchloroethylene

Table A1-3 - Supplement D
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Griggs and Walnut Groundwater Plume Site
Las Cruces, NM

Exposure Point Concentration (RME) - Maximum					
Exposure Point	PCE in Soil Gas (ppbv)	PCE in Soil Gas (ug/L)	PCE in Soil Gas (ug/m^3)	Modeled Indoor Air Concentration (ug/m^3)	Modeled Indoor Air Concentration (mg/m^3)
PAL Boxing Facility	206	1.42	1,421	0.49	0.00049

Notes:

Attenuation Factor from Johnson and Ettinger Model (Residential)	3.43E-04
Molecular Weight (MW) - PCE	165.83
Molar Volume (MV) @ 20 oC and 1 atm	24

Unit Conversion Equations:
PCE (ug/L) = PCE (ppbv) x MW (g/mol) / MV (L/mol) / 1000
PCE (ug/m3) = PCE (ug/L) x 1000 (L/m3)
PCE (mg/m3) = PCE (ug/m3) / 1000 (mg/ug)

PCE - perchloroethylene

Table A1-4.1 RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Indoor Air	CA	Chemical Concentration in Air	See Table 3.1.RME	mg/m^3	See Table 3.1.RME	CDI (mg/kg-day) =
			(Vapor Intrusion)	IN	Inhalation Rate	20	m^3/day	EPA, 1991	CA x IN x EF x ED x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	CA calculated using Johnson and Ettinger Model
				ED	Exposure Duration	24	years	EPA, 1991	based on measured soil vapor concentrations.
				BW	Body Weight	70	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Indoor Air	CA	Chemical Concentration in Air	See Table 3.1.RME	mg/m^3	See Table 3.1.RME	CDI (mg/kg-day) =
			(Vapor Intrusion)	IN	Inhalation Rate	10	m^3/day	EPA R6 (1)	CA x IN x EF x ED x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	CA calculated using Johnson and Ettinger Model
				ED	Exposure Duration	6	years	EPA, 1991	based on measured soil vapor concentrations.
				BW	Body Weight	15	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Indoor Air	CA	Chemical Concentration in Air	See Table 3.1.RME	mg/m^3	See Table 3.1.RME	CDI (mg/kg-day) =
			(Vapor Intrusion)	IN-A	Inhalation Rate, Adult	20	m^3/day	EPA, 1991	CA x IN-Adj x EF x 1/AT
				IN-C	Inhalation Rate, Child	10	m^3/day	EPA R6 (1)	CA calculated using Johnson and Ettinger Model
				IN-Adj	Inhalation Rate, Age-adjusted	10.9	m^3/hour	calculated	based on measured soil vapor concentrations.
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED-A	Exposure Duration, Adult	24	years	EPA, 1991	IN-Adj (m^3-year/kg-day) =
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	(ED-C x IN-C / BW-C) + (ED-A x IN-A / BW-A)
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

Table A1-4.1 RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion)

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Industrial Worker	Adult	Indoor Air	CA	Chemical Concentration in Air	See Table 3.1.RME	mg/m^3	See Table 3.1.RME	CDI (mg/kg-day) =
(cont.)	(PAL Boxing Facility)		(Vapor Intrusion)	IN	Inhalation Rate	20	m^3/8 hr work day	EPA, 1991	CA x IN x EF x ED x 1/BW x 1/AT
				EF	Exposure Frequency	250	days/year	EPA, 1991	CA calculated using Johnson and Ettinger Model
				ED	Exposure Duration	25	years	EPA, 1991	based on measured soil vapor concentrations.
				BW	Body Weight	70	kg	EPA, 1991	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
	Recreational User	Adolescent	Indoor Air	CA	Chemical Concentration in Air	See Table 3.1.RME	mg/m^3	See Table 3.1.RME	CDI (mg/kg-day) =
	(PAL Boxing Facility)		(Vapor Intrusion)	IN	Inhalation Rate	20	m^3/day	EPA, 1991	CA x IN x EF x ED x 1/BW x 1/AT
				EF	Exposure Frequency	120	days/year	(2)	CA calculated using Johnson and Ettinger Model
				ET	Exposure Time	4	hours/day	(2)	based on measured soil vapor concentrations.
				ED	Exposure Duration	12	years	(2)	
				BW	Body Weight	45	kg	(3)	
				AT-N	Averaging Time (Non-Cancer)	4,380	days	EPA, 1989	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

(1) EPA Region 6, Undated: Memorandum, Central Tendency and RME Exposure Parameters.

(2) Best Professional Judgement.

(3) Recreational use scenario body weight assumption is an averaged value for a child ranging between 6 and 18 years of age.

Table A1-5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
Griggs and Walnut Ground Water Plume Site

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Benzene	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Blood	300/1	IRIS	3/22/2006
Benzene	Subchronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day	Blood, Immune	3000	NCEA	7/2/1996
Methyl tertiary butyl ether (MTBE)	Chronic/Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	IRIS	3/29/2004
Tetrachloroethylene	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	1000/1	IRIS	3/22/2006
Tetrachloroethylene	Subchronic	1.0E-01	mg/kg-day	1	1.0E-01	mg/kg-day	Liver	100	HEAST	7/1/1997

Footnote Instructions:

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evalution Manual (Part E, Supplemetnal Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed RfD for Dermal"

Definitions:
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NCEA = National Center for Environmental Assessment

Table A1-5.2
NON-CANCER TOXICITY DATA -- INHALATION
Griggs and Walnut Ground Water Plume Site

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Benzene	Chronic	3.0E-02	mg/m^3	8.6E-03	mg/kg/day	Blood	300/1	IRIS	3/22/2006
Benzene	Subchronic	6.0E-02	mg/m^3	1.7E-02	mg/kg/day	Blood	100	NCEA	7/2/1996
Methyl tertiary butyl ether (MTBE)	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Liver, Kidney	100/1	IRIS	3/22/2006
Tetrachloroethylene	Chronic/Subchronic	4.0E-01	mg/m3	1.1E-01	mg/kg-day	Liver, Kidney	N/A	NCEA	6/20/1997

(1) Inhalation RfC value was converted to a corresponding RfD value, assuming human body weight of 70 kg and inhalation rate of 20 m^3/day, as follows:

RfD [mg/kg/day] = RfC [mg/m3] x 20 [m3/day] / 70 [kg]

Definitions: IRIS = Integrated Risk Information System
NA = Not Available
NCEA = National Center for Environmental Assessment

Table A1-6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
Griggs and Walnut Ground Water Plume Site

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzene	5.5E-02	$(mg/kg\text{-}day)^{-1}$	1	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	3/22/2006
Methyl tertiary butyl ether (MTBE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1	5.4E-01	$(mg/kg\text{-}day)^{-1}$	C - B2	OSWER	6/12/2003

(1) Source: Risk Assessment Guidance for Superfund: Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for derivation of the "Absorbed Cancer Slope Factor for Dermal".

Definitions:
OSWER = Office of Solid Waste and Emergency Response
IRIS = Integrated Risk Information System

Weight of Evidence definitions:

Group A chemicals (human carcinogens) are agents for which there is sufficient evidence of carcinogenicity based on evidence from epidemiological studies.

Group B2 chemicals (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.

Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and inadequate or a lack of human data.

Table A1-6.2
CANCER TOXICITY DATA -- INHALATION
Griggs and Walnut Ground Water Plume Site

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzene	7.8E-06	$(\mu g/m^3)^{-1}$	2.7E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	3/22/2006
Methyl tertiary butyl ether (MTBE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene	5.9E-06	$(\mu g/m^3)^{-1}$	2.1E-02	$(mg/kg\text{-}day)^{-1}$	C - B2	OSWER	6/12/2003

Weight of Evidence definitions:

Group A chemicals (human carcinogens) are agents for which there is sufficient evidence of carcinogenicity based on evidence from epidemiological studies.

Group B2 chemicals (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.

Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and inadequate or a lack of human data.

Definitions: OSWER = Office of Solid Waste and Emergency Response

IRIS = Integrated Risk Information System

Table A1-7.1 RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				Hazard Quotient
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (Property A)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.4E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.3E-03	mg/kg/day	1.1E-01	mg/kg/day	2.1E-02
			Exp. Route Total								0.0E+00					2.1E-02
		Exposure Point Total									0.0E+00					2.1E-02
	Exposure Medium Total										0.0E+00					2.1E-02
Ground Water and Total											0.0E+00					2.1E-02
Ground Water	Indoor Air	Indoor Air (Property B)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.2E-02	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	3.2E-03	mg/kg/day	1.1E-01	mg/kg/day	2.9E-02
			Exp. Route Total								0.0E+00					2.9E-02
		Exposure Point Total									0.0E+00					2.9E-02
	Exposure Medium Total										0.0E+00					2.9E-02
Ground Water and Total											0.0E+00					2.9E-02
Ground Water	Indoor Air	Indoor Air (Property C)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.1E-02	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.9E-03	mg/kg/day	1.1E-01	mg/kg/day	2.6E-02
			Exp. Route Total								0.0E+00					2.6E-02
		Exposure Point Total									0.0E+00					2.6E-02
	Exposure Medium Total										0.0E+00					2.6E-02
Ground Water and Total											0.0E+00					2.6E-02
Ground Water	Indoor Air	Indoor Air (Property D)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.1E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.2E-03	mg/kg/day	1.1E-01	mg/kg/day	2.0E-02
			Exp. Route Total								0.0E+00					2.0E-02
		Exposure Point Total									0.0E+00					2.0E-02
	Exposure Medium Total										0.0E+00					2.0E-02
Ground Water and Total											0.0E+00					2.0E-02
Ground Water	Indoor Air	Indoor Air (Property E)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.5E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	1.2E-03	mg/kg/day	1.1E-01	mg/kg/day	1.1E-02
			Exp. Route Total								0.0E+00					1.1E-02
		Exposure Point Total									0.0E+00					1.1E-02
	Exposure Medium Total										0.0E+00					1.1E-02
Ground Water and Total											0.0E+00					1.1E-02
Ground Water	Indoor Air	Indoor Air (Property F)	Inhalation	TETRACHLOROETHYLENE (PCE)	7.5E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.0E-03	mg/kg/day	1.1E-01	mg/kg/day	1.9E-02
			Exp. Route Total								0.0E+00					1.9E-02
		Exposure Point Total									0.0E+00					1.9E-02
	Exposure Medium Total										0.0E+00					1.9E-02
Ground Water and Total											0.0E+00					1.9E-02
Ground Water	Indoor Air	Indoor Air (Property G)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.2E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	1.1E-03	mg/kg/day	1.1E-01	mg/kg/day	1.0E-02
			Exp. Route Total								0.0E+00					1.0E-02
		Exposure Point Total									0.0E+00					1.0E-02
	Exposure Medium Total										0.0E+00					1.0E-02
Ground Water and Total											0.0E+00					1.0E-02

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Table A1-7.1 RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (Property A)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.4E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	5.4E-03	mg/kg/day	1.1E-01	mg/kg/day	4.9E-02
			Exp. Route Total								0.0E+00					4.9E-02
		Exposure Point Total									0.0E+00					4.9E-02
	Exposure Medium Total										0.0E+00					4.9E-02
Ground Waterand Total											0.0E+00					4.9E-02
Ground Water	Indoor Air	Indoor Air (Property B)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.2E-02	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	7.5E-03	mg/kg/day	1.1E-01	mg/kg/day	6.8E-02
			Exp. Route Total								0.0E+00					6.8E-02
		Exposure Point Total									0.0E+00					6.8E-02
	Exposure Medium Total										0.0E+00					6.8E-02
Ground Waterand Total											0.0E+00					6.8E-02
Ground Water	Indoor Air	Indoor Air (Property C)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.1E-02	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	6.8E-03	mg/kg/day	1.1E-01	mg/kg/day	6.1E-02
			Exp. Route Total								0.0E+00					6.1E-02
		Exposure Point Total									0.0E+00					6.1E-02
	Exposure Medium Total										0.0E+00					6.1E-02
Ground Waterand Total											0.0E+00					6.1E-02
Ground Water	Indoor Air	Indoor Air (Property D)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.1E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	5.2E-03	mg/kg/day	1.1E-01	mg/kg/day	4.7E-02
			Exp. Route Total								0.0E+00					4.7E-02
		Exposure Point Total									0.0E+00					4.7E-02
	Exposure Medium Total										0.0E+00					4.7E-02
Ground Waterand Total											0.0E+00					4.7E-02
Ground Water	Indoor Air	Indoor Air (Property E)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.5E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.9E-03	mg/kg/day	1.1E-01	mg/kg/day	2.6E-02
			Exp. Route Total								0.0E+00					2.6E-02
		Exposure Point Total									0.0E+00					2.6E-02
	Exposure Medium Total										0.0E+00					2.6E-02
Ground Waterand Total											0.0E+00					2.6E-02
Ground Water	Indoor Air	Indoor Air (Property F)	Inhalation	TETRACHLOROETHYLENE (PCE)	7.5E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	4.8E-03	mg/kg/day	1.1E-01	mg/kg/day	4.4E-02
			Exp. Route Total								0.0E+00					4.4E-02
		Exposure Point Total									0.0E+00					4.4E-02
	Exposure Medium Total										0.0E+00					4.4E-02
Ground Waterand Total											0.0E+00					4.4E-02
Ground Water	Indoor Air	Indoor Air (Property G)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.2E-03	mg/m^3	NA	mg/kg/day	NA	1/(mg/kg-day)	NA	2.7E-03	mg/kg/day	1.1E-01	mg/kg/day	2.4E-02
			Exp. Route Total								0.0E+00					2.4E-02
		Exposure Point Total									0.0E+00					2.4E-02
	Exposure Medium Total										0.0E+00					2.4E-02
Ground Waterand Total											0.0E+00					2.4E-02

Table A1-7.1 RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (Property A)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.4E-03	mg/m^3	1.2E-03	mg/kg/day	2.1E-02	1/(mg/kg-day)	2.6E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								2.6E-05					0.0E+00
		Exposure Point Total									2.6E-05					0.0E+00
	Exposure Medium Total										2.6E-05					0.0E+00
Ground Waterand Total											2.6E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property B)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.2E-02	mg/m^3	1.7E-03	mg/kg/day	2.1E-02	1/(mg/kg-day)	3.6E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								3.6E-05					0.0E+00
		Exposure Point Total									3.6E-05					0.0E+00
	Exposure Medium Total										3.6E-05					0.0E+00
Ground Waterand Total											3.6E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property C)	Inhalation	TETRACHLOROETHYLENE (PCE)	1.1E-02	mg/m^3	1.6E-03	mg/kg/day	2.1E-02	1/(mg/kg-day)	3.2E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								3.2E-05					0.0E+00
		Exposure Point Total									3.2E-05					0.0E+00
	Exposure Medium Total										3.2E-05					0.0E+00
Ground Waterand Total											3.2E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property D)	Inhalation	TETRACHLOROETHYLENE (PCE)	8.1E-03	mg/m^3	1.2E-03	mg/kg/day	2.1E-02	1/(mg/kg-day)	2.5E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								2.5E-05					0.0E+00
		Exposure Point Total									2.5E-05					0.0E+00
	Exposure Medium Total										2.5E-05					0.0E+00
Ground Waterand Total											2.5E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property E)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.5E-03	mg/m^3	6.7E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.4E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.4E-05					0.0E+00
		Exposure Point Total									1.4E-05					0.0E+00
	Exposure Medium Total										1.4E-05					0.0E+00
Ground Waterand Total											1.4E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property F)	Inhalation	TETRACHLOROETHYLENE (PCE)	7.5E-03	mg/m^3	1.1E-03	mg/kg/day	2.1E-02	1/(mg/kg-day)	2.3E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								2.3E-05					0.0E+00
		Exposure Point Total									2.3E-05					0.0E+00
	Exposure Medium Total										2.3E-05					0.0E+00
Ground Waterand Total											2.3E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property G)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.2E-03	mg/m^3	6.2E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.3E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.3E-05					0.0E+00
		Exposure Point Total									1.3E-05					0.0E+00
	Exposure Medium Total										1.3E-05					0.0E+00
Ground Waterand Total											1.3E-05					0.0E+00

Table A1-7.1 CTE
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				Hazard Quotient
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (Property A)	Inhalation	TETRACHLOROETHYLENE (PCE)	2.9E-03	mg/m^3	4.3E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	8.8E-06	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								8.8E-06					0.0E+00
		Exposure Point Total									8.8E-06					0.0E+00
	Exposure Medium Total										8.8E-06					0.0E+00
Ground Waterand Total											8.8E-06					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property B)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.3E-03	mg/m^3	6.4E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.3E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.3E-05					0.0E+00
		Exposure Point Total									1.3E-05					0.0E+00
	Exposure Medium Total										1.3E-05					0.0E+00
Ground Waterand Total											1.3E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property C)	Inhalation	TETRACHLOROETHYLENE (PCE)	5.7E-03	mg/m^3	8.5E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.8E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.8E-05					0.0E+00
		Exposure Point Total									1.8E-05					0.0E+00
	Exposure Medium Total										1.8E-05					0.0E+00
Ground Waterand Total											1.8E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property D)	Inhalation	TETRACHLOROETHYLENE (PCE)	3.8E-03	mg/m^3	5.6E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.2E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.2E-05					0.0E+00
		Exposure Point Total									1.2E-05					0.0E+00
	Exposure Medium Total										1.2E-05					0.0E+00
Ground Waterand Total											1.2E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property E)	Inhalation	TETRACHLOROETHYLENE (PCE)	3.1E-03	mg/m^3	4.5E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	9.4E-06	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								9.4E-06					0.0E+00
		Exposure Point Total									9.4E-06					0.0E+00
	Exposure Medium Total										9.4E-06					0.0E+00
Ground Waterand Total											9.4E-06					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property F)	Inhalation	TETRACHLOROETHYLENE (PCE)	5.1E-03	mg/m^3	7.6E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	1.6E-05	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								1.6E-05					0.0E+00
		Exposure Point Total									1.6E-05					0.0E+00
	Exposure Medium Total										1.6E-05					0.0E+00
Ground Waterand Total											1.6E-05					0.0E+00
Ground Water	Indoor Air	Indoor Air (Property G)	Inhalation	TETRACHLOROETHYLENE (PCE)	3.2E-03	mg/m^3	4.7E-04	mg/kg/day	2.1E-02	1/(mg/kg-day)	9.7E-06	NA	mg/kg/day	NA	mg/kg/day	NA
			Exp. Route Total								9.7E-06					0.0E+00
		Exposure Point Total									9.7E-06					0.0E+00
	Exposure Medium Total										9.7E-06					0.0E+00
Ground Waterand Total											9.7E-06					0.0E+00

Table A1-7.2 RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe:	Current/Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (PAL Boxing Facility)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.9E-04	mg/m^3	3.4E-05	mg/kg/day	2.1E-02	1/(mg/kg-day)	7.0E-07	9.5E-05	mg/kg/day	1.1E-01	mg/kg/day	8.6E-04
			Exp. Route Total								7.0E-07					8.6E-04
		Exposure Point Total									7.0E-07					8.6E-04
	Exposure Medium Total										7.0E-07					8.6E-04
Ground Waterand Total											7.0E-07					8.6E-04

009901

Table A1-7.2 RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Recreator (Boxing Facility User)
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Ground Water	Indoor Air	Indoor Air (PAL Boxing Facility)	Inhalation	TETRACHLOROETHYLENE (PCE)	4.9E-04	mg/m^3	2.0E-06	mg/kg/day	2.1E-02	1/(mg/kg-day)	4.2E-08	7.6E-06	mg/kg/day	1.1E-01	mg/kg/day	6.9E-05
			Exp. Route Total								4.2E-08					6.9E-05
		Exposure Point Total									4.2E-08					6.9E-05
	Exposure Medium Total										4.2E-08					6.9E-05
Ground Waterand Total											4.2E-08					6.9E-05

009902

Table A1-9.1 RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (Property A)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.1E-02	NA	2.1E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.1E-02	NA	2.1E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.1E-02	NA	2.1E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	2.1E-02	NA	2.1E-02
Ground Water	Indoor Air	Indoor Air (Property B)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.9E-02	NA	2.9E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.9E-02	NA	2.9E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.9E-02	NA	2.9E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	2.9E-02	NA	2.9E-02
Ground Water	Indoor Air	Indoor Air (Property C)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.6E-02	NA	2.6E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
Ground Water	Indoor Air	Indoor Air (Property D)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.0E-02	NA	2.0E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.0E-02	NA	2.0E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.0E-02	NA	2.0E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	2.0E-02	NA	2.0E-02
Ground Water	Indoor Air	Indoor Air (Property E)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	1.1E-02	NA	1.1E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	1.1E-02	NA	1.1E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	1.1E-02	NA	1.1E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	1.1E-02	NA	1.1E-02
Ground Water	Indoor Air	Indoor Air (Property F)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	1.9E-02	NA	1.9E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	1.9E-02	NA	1.9E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	1.9E-02	NA	1.9E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	1.9E-02	NA	1.9E-02
Ground Water	Indoor Air	Indoor Air (Property G)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	1.0E-02	NA	1.0E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	1.0E-02	NA	1.0E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	1.0E-02	NA	1.0E-02
Ground Water and Total				NA	NA	NA	0.0E+00		NA	1.0E-02	NA	1.0E-02

Total Circulatory HI Across Media = NA

Total Kidney HI Across Media = NA

009903

Table A1-9.1 RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (Property A)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	4.9E-02	NA	4.9E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	4.9E-02	NA	4.9E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	4.9E-02	NA	4.9E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	4.9E-02	NA	4.9E-02
Ground Water	Indoor Air	Indoor Air (Property B)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	6.8E-02	NA	6.8E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	6.8E-02	NA	6.8E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	6.8E-02	NA	6.8E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	6.8E-02	NA	6.8E-02
Ground Water	Indoor Air	Indoor Air (Property C)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	6.1E-02	NA	6.1E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	6.1E-02	NA	6.1E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	6.1E-02	NA	6.1E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	6.1E-02	NA	6.1E-02
Ground Water	Indoor Air	Indoor Air (Property D)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	4.7E-02	NA	4.7E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	4.7E-02	NA	4.7E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	4.7E-02	NA	4.7E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	4.7E-02	NA	4.7E-02
Ground Water	Indoor Air	Indoor Air (Property E)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.6E-02	NA	2.6E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	2.6E-02	NA	2.6E-02
Ground Water	Indoor Air	Indoor Air (Property F)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	4.4E-02	NA	4.4E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	4.4E-02	NA	4.4E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	4.4E-02	NA	4.4E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	4.4E-02	NA	4.4E-02
Ground Water	Indoor Air	Indoor Air (Property G)	TETRACHLOROETHYLENE (PCE)	NA	NA	NA	NA	Liver	NA	2.4E-02	NA	2.4E-02
		Chemical Total		NA	NA	NA	0.0E+00		NA	2.4E-02	NA	2.4E-02
	Exposure Medium Total			NA	NA	NA	0.0E+00		NA	2.4E-02	NA	2.4E-02
Ground Waterand Total				NA	NA	NA	0.0E+00		NA	2.4E-02	NA	2.4E-02

Total Circulatory HI Across Media = NA

Total Kidney HI Across Media = NA

Table A1-9.1 RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (Property A)	TETRACHLOROETHYLENE (PCE)	NA	2.6E-05	NA	2.6E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	2.6E-05	NA	2.6E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	2.6E-05	NA	2.6E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	2.6E-05	NA	2.6E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property B)	TETRACHLOROETHYLENE (PCE)	NA	3.6E-05	NA	3.6E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	3.6E-05	NA	3.6E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	3.6E-05	NA	3.6E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	3.6E-05	NA	3.6E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property C)	TETRACHLOROETHYLENE (PCE)	NA	3.2E-05	NA	3.2E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	3.2E-05	NA	3.2E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	3.2E-05	NA	3.2E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	3.2E-05	NA	3.2E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property D)	TETRACHLOROETHYLENE (PCE)	NA	2.5E-05	NA	2.5E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	2.5E-05	NA	2.5E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	2.5E-05	NA	2.5E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	2.5E-05	NA	2.5E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property E)	TETRACHLOROETHYLENE (PCE)	NA	1.4E-05	NA	1.4E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.4E-05	NA	1.4E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.4E-05	NA	1.4E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.4E-05	NA	1.4E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property F)	TETRACHLOROETHYLENE (PCE)	NA	2.3E-05	NA	2.3E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	2.3E-05	NA	2.3E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	2.3E-05	NA	2.3E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	2.3E-05	NA	2.3E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property G)	TETRACHLOROETHYLENE (PCE)	NA	1.3E-05	NA	1.3E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00

Table A1-9.1 CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (Property A)	TETRACHLOROETHYLENE (PCE)	NA	8.8E-06	NA	8.8E-06	NA	NA	NA	NA	NA
		Chemical Total		NA	8.8E-06	NA	8.8E-06		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	8.8E-06	NA	8.8E-06		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	8.8E-06	NA	8.8E-06		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property B)	TETRACHLOROETHYLENE (PCE)	NA	1.3E-05	NA	1.3E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.3E-05	NA	1.3E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property C)	TETRACHLOROETHYLENE (PCE)	NA	1.8E-05	NA	1.8E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.8E-05	NA	1.8E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.8E-05	NA	1.8E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.8E-05	NA	1.8E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property D)	TETRACHLOROETHYLENE (PCE)	NA	1.2E-05	NA	1.2E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.2E-05	NA	1.2E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.2E-05	NA	1.2E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.2E-05	NA	1.2E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property E)	TETRACHLOROETHYLENE (PCE)	NA	9.4E-06	NA	9.4E-06	NA	NA	NA	NA	NA
		Chemical Total		NA	9.4E-06	NA	9.4E-06		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	9.4E-06	NA	9.4E-06		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	9.4E-06	NA	9.4E-06		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property F)	TETRACHLOROETHYLENE (PCE)	NA	1.6E-05	NA	1.6E-05	NA	NA	NA	NA	NA
		Chemical Total		NA	1.6E-05	NA	1.6E-05		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	1.6E-05	NA	1.6E-05		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	1.6E-05	NA	1.6E-05		NA	NA	NA	0.0E+00
Ground Water	Indoor Air	Indoor Air (Property G)	TETRACHLOROETHYLENE (PCE)	NA	9.7E-06	NA	9.7E-06	NA	NA	NA	NA	NA
		Chemical Total		NA	9.7E-06	NA	9.7E-06		NA	NA	NA	0.0E+00
	Exposure Medium Total			NA	9.7E-06	NA	9.7E-06		NA	NA	NA	0.0E+00
Ground Waterand Total				NA	9.7E-06	NA	9.7E-06		NA	NA	NA	0.0E+00

Table A1-9.2 RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (PAL Boxing Facility)	TETRACHLOROETHYLENE (PCE)	NA	7.0E-07	NA	7.0E-07	Liver	NA	8.6E-04	NA	8.6E-04
		Chemical Total		NA	NA	NA	7.0E-07		NA	8.6E-04	NA	8.6E-04
	Exposure Medium Total			NA	NA	NA	7.0E-07		NA	8.6E-04	NA	8.6E-04
Ground Waterand Total				NA	NA	NA	7.0E-07		NA	8.6E-04	NA	8.6E-04

Table A1-9.2 RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Griggs and Walnut Ground Water Plume Site

Scenario Timeframe: Current/Future
Receptor Population: Recreator (Boxing Facility User)
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Ground Water	Indoor Air	Indoor Air (PAL Boxing Facility)	TETRACHLOROETHYLENE (PCE)	NA	4.2E-08	NA	4.2E-08	Liver	NA	6.9E-05	NA	6.9E-05
		Chemical Total		NA	NA	NA	4.2E-08		NA	6.9E-05	NA	6.9E-05
	Exposure Medium Total			NA	NA	NA	4.2E-08		NA	6.9E-05	NA	6.9E-05
Ground Waterand Total				NA	NA	NA	4.2E-08		NA	6.9E-05	NA	6.9E-05

APPENDIX B

Cost Tables

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE SUMMARY [2]

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Capital Cost		
Construction	$	1,764,781
Project Management	$	141,182
Design	$	264,717
Construction Management	$	264,717
Subcontractor General Requirements	$	88,239
G&A	$	353,309
Overhead	$	126,182
Tax	$	179,809
Contingency	$	630,909
Bonding& Insurance	$	76,277
Fee	$	305,108
Total Capital Cost	**$**	**4,195,230**
Year 1 Operations and Maintenance		
System Startup	$	27,050
Routine System O&M	$	357,127
Reporting (Annual Report and Construction Completion Report)	$	73,500
Professional Services [1]	$	105,266
Subcontractor General Requirements	$	22,884
G&A	$	82,016
Overhead	$	29,291
Tax	$	41,740
Contingency	$	146,457
Bonding& Insurance	$	-
Fee	$	70,826
Total Year 1 Operations and Maintenance	**$**	**956,157**
Annual Operations and Maintenance Cost: Years 2-5		
Routine System O&M	$	304,087
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	74,166
Subcontractor General Requirements	$	16,123
G&A	$	57,785
Overhead	$	20,638
New Mexico Gross Receipts Tax	$	29,409
Contingency	$	103,188
Bonding& Insurance	$	-
Fee	$	49,902
Total Annual Operations and Maintenance Cost: Years 2-5	**$**	**673,672**
Annual Operations and Maintenance Cost: Years 6-14		
Routine System O&M	$	287,711
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	74,166
Subcontractor General Requirements	$	16,123
G&A	$	55,493
Overhead	$	19,819
New Mexico Gross Receipts Tax	$	28,242
Contingency	$	99,094
Bonding& Insurance	$	-
Fee	$	47,922
Total Annual Operations and Maintenance Cost: Years 6-14	**$**	**646,944**
Post Closure Cost		
Closure Reporting	$	18,375
Equipment Demobilization and Well Abandonment	$	184,000
Professional Services [1]	$	66,784
Subcontractor General Requirements	$	10,119
G&A	$	39,099
Overhead	$	13,964
New Mexico Gross Receipts Tax	$	19,899
Contingency	$	69,819
Bonding& Insurance	$	8,441
Fee	$	33,765
Total Post Closure Cost	**$**	**464,264**
TOTAL PRESENT WORTH	**$**	**14,132,838**

NOTES:
1 - Professional Services includes Project Management, Design/Technical Support, and Construction Management.
2 - The cost estimates provided are to an accuracy of +50 percent to -30 percent and are prepared for the sole purpose of alternative comparison. The alternative cost estimates are in 2006 dollars and are based on conceptual design from information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables.

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Site Background Data

Elevation of Site = 4100 ft amsl or 12.68 psia

Volume of Contaminated Ground Water greater than 5 ug/L= 7,350 acre-ft based on JSAI model

Volume of Contaminated Ground Water greater than 1 ug/L= 25,700 acre-ft based on JSAI model

PCE Concentrations in wells sampled December 2005.

Sample Location	PCE (μg/L)
MW-SF1	11
MW-SF10	17
GWMW01 Port 2	21
GWMW01 Port 6	6
	14 μg/L, average concentration

Pumping Rates for Plume Containment and Remediation: 14 Years (per JSAI modeling)

CLC-18 460 gpm

CLC-27 620 gpm

New Well #1 to replace operation of CLC-18 after 5 years per JSAI modeling 300 gpm

Total Annual: Years 1-5 568 MMgal

Total Annual: Years 6-14 484 MMgal

Mass Estimate

Mass of PCE above MCL in ground water = 150 kg of PCE — based on JSAI model - JSAI estimate based on an effective porosity of 20% and does not address potential PCE mass in additional pore space

Conceptual Design

Pumping System Design Parameters

Estimated Number of Pumping Wells = 3 wells

Estimated pumping rate from CLC-18 = 460 gpm (based on JSAI modeling results)

Estimated pumping rate from CLC-27 = 620 gpm (based on JSAI modeling results)

Estimated pumping rate from New Well = 300 gpm (to replace operation of CLC-18 after 5 years)

Total Pumping Rate in Years 1-5= 1,080 gpm (assumes CLC-18 and 27 only)

Total Pumping Rate in Years 6-14= 920 gpm (assumes CLC-27 and new well only)

Depth of new pumping well = 450 ft bgs

System Construction Time

Estimated drilling rate = 125 lf/day based on invoice

Total linear footage drilling = 900 lf

Estimated duration of drilling = 7.2 days or 8 days (rounded up)

Estimated linear footage of field piping per pumping well = 1500 ft per well average of piping required for all wells

Total linear footage of connection piping = 500 lf assumed 500 lf to stub up to treatment system and reconnect to existing CLC-27 line to UGR

Total linear footage of effluent field piping= 1,000 lf connection of CLC-18 to CLC -27 connection to Upper Griggs Reservoir; CLC estimated 1000 lf new piping needed in addition to the approximate length of 500 lf of existing piping.

Total linear footage of effluent field piping= 750 lf estimated connection of new well to CLC -27 connection to Upper Griggs Reservoir

Estimated field piping placing rate = 75 lf/day

Estimated duration of field piping = 30.0 days or 30 days (rounded up)

Total construction timeframe = 38 days

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Air Stripper
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Air Stripper Design Parameters
Stripper design flowrate 1080 gpm
Unit flow rate 540 gpm (NEEP Model 41251 Tray Air stripper) 2 units in series needed for treatment
Governing contaminant PCE at 14 µg/L
Governing contaminant is based on consideration of a combination of low Henry's Constant and highest concentration versus MCL.
Influent temperature 50 °F

Unit Size: 12.5 ft x 7.3 ft NEEP Model 41251 Tray Air stripper

The Henry's Law Constant for PCE (25°C) = 176.5 atm
Converting the Henry's Constant for an actual temperature of 10 °C and using STRIPR Model data (CH2M HILL, 1991)
Actual Henry's Constant is 224 atm which is greater than the 10 atm threshold for effective air stripping.

Assume 100% of PCE is stripped and discharged untreated to the atmosphere. PCE is the controlling contaminant for air stripper design.
Vendor modeling indicates the Tray Air stripper uses a blower airflow rate of 2,400 scfm
PCE emissions 0.007 lbs/hr or 0.18 lbs/day or 65.2 lbs/yr
Average PCE emissions concentration is 0.8 mg/m^3 or 0.2 ppmv

PCE is a hazardous air pollutant and therefore is a regulated air pollutant

The NIOSH PEL (10-hr TWA) for PCE is 25 ppmv or 136.5 mg/m^3 or at 68°F and 1 atm
THEREFORE, NO OFFGAS EMISSIONS CONTROL WILL BE REQUIRED SINCE MASS EMISSIONS IS VERY LOW AND
THE CONCENTRATION IS TWO ORDERS OF MAGNITUDE LOWER THAN THE NIOSH STANDARD WITHOUT CONSIDERING ATMOSPHERIC DISPERSION.

Pretreatment Design Parameters - Langlier Index and Ryznar Stability Index for CaCO3 Scaling Potential

		1 (influent water)	2 (estimate of parameters within the stripper)
Flow	gpm	1080	1080
Temperature	Deg . F	60	77
Alkalinity, Total	mg/l $CaCO_3$	211	211
pH	Std. Units	7.39	8.00
TDS	mg/l	919	919
Calcium	mg/l $CaCO_3$	305	305
Magnesium	mg/l $CaCO_3$	124	123.6
Sulfate	mg/l SO_4^{2-}	243	243
Chloride	mg/l Cl^-	165	165
LSI		**0.170**	**0.936**
RSI		**7.05**	**6.13**

LSI greater than 1 indicates potential for scaling
RSI less than 6 indicates potential for scaling

The LSI is close to the level indicating potential for scaling
The RSI, which is more commonly used, is close to the level that indicates that there is a potential for scaling once the stripping process begins.
Slight changes in parameters affect the results of these calculations.

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments and References**
Construction					
Underground Piping from CLC-18 to CLC-27 connection to Upper Griggs Reservoir	1,000	ft	$ 100.17	$ 100,170	estimated LF from CLC: cost includes 10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Underground Piping from new extraction well to CLC-27 connection to Upper Griggs Reservoir	750	ft	$ 100.17	$ 75,128	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Piping Connection to Treatment System	500	lf	$ 100.17	$ 50,085	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Ground Water Extraction Well Installation	1	well	$ 200,000.00	$ 200,000	JSP Memo 7/8/06
Pumping Well Modifications	2	ea	$ 25,000.00	$ 50,000	JSP Memo 7/8/06
Ground Water Extraction Pumps	3	ea	$ 10,000.00	$ 30,000	assume new + replace city pumps, vendor quote; 100gpm, 15 hp, 3-phase, 230V, 6 inch
Influent Equalization Tank	21,600	gal	$ 1.00	$ 21,600	provides 20-minutes of storage
Tank Effluent Pump	0	ea	$ 4,000.00	$ -	included with air stripper
Influent and Effluent Bag Filters	2	LS	$ 7,500.00	$ 15,000	1080 gpm size filter
Low-Profile Tray Air Stripper Package	2	LS	$ 70,000.00	$ 140,000	Assume 540 gpm NEEP Model 41251 Tray Air stripper (controls, piping, skid, blower, influent and effluent pumps)
Protective Enclosure	1	ea	$ 150,000.00	$ 150,000	Assume 30'x25' building at $200/sf, includes overhead crane, pre-fab metal
Repair discharge line on CLC-27	1	LS	$ 300.00	$ 300	
Sulfuric Acid Bulk Storage Tank - Pretreatment Unit	1	LS	$ 65,663.20	$ 65,663	5,000 gal tank. 1 month supply, prorated costs for similar system, 1,000 gal unit at Fruit Ave, Albuquerque
Dessicant Dryer Unit - Pretreatment Unit	1	LS	$ 39,397.92	$ 39,398	5,000 gal unit. prorated costs for similar system, 1,000 gal unit at Fruit Ave, Albuquerque
Acid Feed Pump System - Pretreatment Unit	1	LS	$ 83,384.29	$ 83,384	Prorated costs for similar system, 100 gpm system at Fruit Ave, Albuquerque.
Acid Feed System Piping - Pretreatment Unit	1	LS	$ 44,923.64	$ 44,924	Prorated costs based on facility size for similar system, 100 gpm at Fruit Ave, Albuquerque
Health and Safety Provisions - Pretreatment Unit	1	LS	$ 8,000.00	$ 8,000	Prorated costs for similar system, 100 gpm at Fruit Ave, Albuquerque
Acid Storage Facility - Pretreatment Unit	1	LS	$ 89,847.27	$ 89,847	Assume 35'x35' for 5,000 gal tank incl. canopy, 2° concrete containment, and fencing. Prorated costs for similar system, 1,000 gal tank system at Fruit Ave, Albuquerque
Well Permits	1	ea	$ 30.00	$ 30	new extraction well
Equipment Rental	26	wk	$ 200.00	$ 5,200	MultiRAE
Subtotal Capital Cost				$ 1,168,729	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Site Work Allowance	7%	of	$ 1,168,728.81	$ 81,811	
Mechanical Allowance	15%	of	$ 1,168,728.81	$ 175,309	
Instrumentation and Controls Allowance	12%	of	$ 1,168,728.81	$ 140,247	including SCADA system
Electrical Allowance	12%	of	$ 1,168,728.81	$ 140,247	
Miscellaneous Equipment Allowance	5%	of	$ 1,168,728.81	$ 58,436	
Subtotal Capital Cost				$ 1,764,781	
Project Management	8%	of	$ 1,764,780.51	$ 141,182	
Design	15%	of	$ 1,764,780.51	$ 264,717	
Construction Management	15%	of	$ 1,764,780.51	$ 264,717	
Subcontractor General Requirements	5%	of	$ 1,764,780.51	$ 88,239	
Subtotal Capital Cost				$ 2,523,636	
G&A	14%	of	$ 2,523,636.12	$ 353,309	
Overhead	5%	of	$ 2,523,636.12	$ 126,182	
New Mexico Gross Receipts Tax	7.125%	of	$ 2,523,636.12	$ 179,809	
Contingency	25%	of	$ 2,523,636.12	$ 630,909	
Subtotal Capital Cost				$ 3,813,845	
Bonding& Insurance	2%	of	$ 3,813,845.09	$ 76,277	
Fee	8%	of	$ 3,813,845.09	$ 305,108	
TOTAL CAPITAL COST				**$ 4,195,230**	

YEAR 1 OPERATIONS AND MAINTENANCE

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
System Startup					
Labor - Technician	150	hr	$ 75.00	$ 11,250	Assume 15 days for startup, 10 hrs/day
Labor - Engineer	100	hr	$ 120.00	$ 12,000	Assume 10 days for startup, 10 hrs/day
Air Sample Analysis	6	sample	$ 150.00	$ 900	quarterly sampling to prove de minimis VOC emissions, plus 2 QA/QC
Water Sample Analysis	6	sample	$ 150.00	$ 900	3 sets, VOC analysis for infl/effl, incl data valid.
Startup Equipment Rental	2	week	$ 1,000.00	$ 2,000	water quality monitoring for pretreatment effectiveness
Total *System Startup*				$ 27,050	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed: 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Routine System O&M					
Labor - Technician	416	hr	$ 75.00	$ 31,200	8 hours/week
Labor - Engineer	416	hr	$ 120.00	$ 49,920	100% of the Tech time for first year
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Air Sample Analysis	0	sample	$ 100.00	$ -	none needed after startup
Acid Supply - Pretreatment Unit	1	LS	$ 110,067.27	$ 110,067	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$ 4,000.00	$ 4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$ 0.08	$ 47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$ 194.73	$ 110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$ 357,127	
Reporting (Annual Report and Construction Completion Report)					
Labor - Engineer/Hydrogeologist	400	hr	$ 120.00	$ 48,000	
Labor - Editor	200	hr	$ 85.00	$ 17,000	
Labor - CAD Technician	100	hr	$ 85.00	$ 8,500	
Total *Annual Reporting*				$ 73,500	
Subtotal Year 1 Operations and Maintenance				$ 457,677	
Project Management	8%	of	$ 457,677.09	$ 36,614	
Technical Support	15%	of	$ 457,677.09	$ 68,652	
Construction Management	0%	of	$ 457,677.09	$ -	
Subcontractor General Requirements	5%	of	$ 457,677.09	$ 22,884	
Subtotal Year 1 Operations and Maintenance				$ 585,827	
G&A	14%	of	$ 585,826.67	$ 82,016	
Overhead	5%	of	$ 585,826.67	$ 29,291	
New Mexico Gross Receipts Tax	7.125%	of	$ 585,826.67	$ 41,740	
Contingency	25%	of	$ 585,826.67	$ 146,457	
Subtotal Year 1 Operations and Maintenance				$ 885,331	
Bonding& Insurance	0%	of	$ 885,330.56	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$ 885,330.56	$ 70,826	
TOTAL YEAR 1 OPERATIONS AND MAINTENANCE COST				**$ 956,157**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References

ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 2-5 (ANNUAL COST)

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Routine System O&M					
Labor - Technician	208	hr	$ 75.00	$ 15,600	4 hours/week
Labor - Engineer	104	hr	$ 120.00	$ 12,480	50% of the Tech time
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Acid Supply - Pretreatment Unit	1	LS	$ 110,067.27	$ 110,067	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$ 4,000.00	$ 4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$ 0.08	$ 47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$ 194.73	$ 110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$ 304,087	
Reporting (Annual Reports)					
Labor - Engineer/Hydrogeologist	100	hr	$ 120.00	$ 12,000	
Labor - Editor	50	hr	$ 85.00	$ 4,250	
Labor - CAD Technician	25	hr	$ 85.00	$ 2,125	
Total *Reporting*				$ 18,375	
Subtotal Year 2-5 Operations and Maintenance				$ 322,462	
Project Management	8%	of	$ 322,462.09	$ 25,797	
Technical Support	15%	of	$ 322,462.09	$ 48,369	
Construction Management	0%	of	$ 322,462.09	$ -	
Subcontractor General Requirements	5%	of	$ 322,462.09	$ 16,123	
Subtotal Year 2-5 Operations and Maintenance				$ 412,751	
G&A	14%	of	$ 412,751.47	$ 57,785	
Overhead	5%	of	$ 412,751.47	$ 20,638	
New Mexico Gross Receipts Tax	7.125%	of	$ 412,751.47	$ 29,409	
Contingency	25%	of	$ 412,751.47	$ 103,188	
Subtotal Year 2-5 Operations and Maintenance				$ 623,771	
Bonding& Insurance	0%	of	$ 623,770.67	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$ 623,770.67	$ 49,902	
TOTAL ANNUAL COST: YEARS 2-5 OPERATIONS AND MAINTENANCE COST				**$ 673,672**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Air Stripper
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST						
Item/Activity	**Qty**	**Unit**	**Unit Cost**		**Cost**	**Comments and References**
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 6-14 (ANNUAL COST)						
Item/Activity	**Qty**	**Unit**	**Unit Cost**		**Cost**	**Comments**
Routine System O&M						
Labor - Technician	208	hr	$ 75.00	$	15,600	4 hours/week
Labor - Engineer	104	hr	$ 120.00	$	12,480	50% of the Tech time
Water Sample Analysis	29	sample	$ 150.00	$	4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Acid Supply - Pretreatment Unit	1	LS	$ 110,067.27	$	110,067	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$ 4,000.00	$	4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$ 0.08	$	47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	484	MMGal	$ 194.73	$	94,162	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$	287,711	
Reporting (Annual Reports)						
Labor - Engineer/Hydrogeologist	100	hr	$ 120.00	$	12,000	
Labor - Editor	50	hr	$ 85.00	$	4,250	
Labor - CAD Technician	25	hr	$ 85.00	$	2,125	
Total *Reporting*				$	18,375	
Subtotal Year 6-14 Operations and Maintenance				$	306,086	
Project Management	8%	of	$ 322,462.09	$	25,797	
Technical Support	15%	of	$ 322,462.09	$	48,369	
Construction Management	0%	of	$ 322,462.09	$	-	
Subcontractor General Requirements	5%	of	$ 322,462.09	$	16,123	
Subtotal Year 6-14 Operations and Maintenance				$	396,375	
G&A	14%	of	$ 396,375.46	$	55,493	
Overhead	5%	of	$ 396,375.46	$	19,819	
New Mexico Gross Receipts Tax	7.125%	of	$ 396,375.46	$	28,242	
Contingency	25%	of	$ 396,375.46	$	99,094	
Subtotal Year 6-14 Operations and Maintenance				$	599,022	
Bonding& Insurance	0%	of	$ 599,022.41	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$ 599,022.41	$	47,922	
TOTAL ANNUAL COST: YEARS 6-14 OPERATIONS AND MAINTENANCE COST				**$**	**646,944**	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
CAPITAL COST					
POST CLOSURE COST					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Closure Reporting					
Labor - Engineer/Hydrogeologist	100	hr	$120.00	$ 12,000	
Labor - Editor	50	hr	$85.00	$ 4,250	
Labor - CAD Technician	25	hr	$85.00	$ 2,125	
Total *Closure Reporting*				$ 18,375	
Equipment Demobilization and Well Abandonment					
Well Abandonment	1	well	$ 10,000.00	$ 10,000	new extraction wells only, others included under ground water monitoring
Equipment Demobilization	1	LS	$ 150,000.00	$ 150,000	
Subtotal Equipment Demobilization and Well Abandonment				$ 160,000	
Site Work Allowance	10%	of	$ 160,000.00	$ 16,000	
Mechanical Allowance	0%	of	$ 160,000.00	$ -	
Instrumentation and Controls Allowance	0%	of	$ 160,000.00	$ -	
Electrical Allowance	5%	of	$ 160,000.00	$ 8,000	
Miscellaneous Equipment Allowance	0%	of	$ 160,000.00	$ -	
Total *Equipment Demobilization and Well Abandonment*				$ 184,000	
Subtotal Post-Closure Cost				$ 202,375	
Project Management	8%	of	$ 202,375.00	$ 16,190	
Technical Support	15%	of	$ 202,375.00	$ 30,356	
Construction Management	10%	of	$ 202,375.00	$ 20,238	
Subcontractor General Requirements	5%	of	$ 202,375.00	$ 10,119	
Subtotal Post-Closure Cost				$ 279,278	
G&A	14%	of	$ 279,277.50	$ 39,099	
Overhead	5%	of	$ 279,277.50	$ 13,964	
New Mexico Gross Receipts Tax	7.125%	of	$ 279,277.50	$ 19,899	
Contingency	25%	of	$ 279,277.50	$ 69,819	
Subtotal Post-Closure Cost				$ 422,058	
Bonding& Insurance	2%	of	$ 422,058.12	$ 8,441	
Fee	8%	of	$ 422,058.12	$ 33,765	
TOTAL POST CLOSURE COST				**$ 464,264**	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

PRESENT WORTH ANALYSIS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Air Stripper
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. Real Discount Rate 3.00% Source: OMB Ciruclar No. A-94, Jan. 2007 version of Appendix C obtained from http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html
2. Assumes Total PV earns interest for an entire year (12 months), compound annually.
3. Escalation factor is 3.00%

Present Worth Analysis

		E	A	B	C=A+B	A*E	B*E	C*E	
Elapsed Time	**Year**	**Discount Factor at 3%**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Total PV Capital Costs at 3%**	**Total PV O&M Costs at 3%**	**Total PV Costs at 3%**	**Balance of Interest Bearing Account at 3%**
0	2007	1.000	$ 4,195,230		$ 4,195,230	$ 4,195,230	$ -	$ 4,195,230	$ 10,235,736
1	2008	0.971		$ 984,842	$ 984,842	$ -	$ 956,157	$ 956,157	$ 9,528,421
2	2009	0.943		$ 714,699	$ 714,699	$ -	$ 673,672	$ 673,672	$ 9,078,134
3	2010	0.915		$ 736,140	$ 736,140	$ -	$ 673,672	$ 673,672	$ 8,592,254
4	2011	0.888		$ 758,224	$ 758,224	$ -	$ 673,672	$ 673,672	$ 8,069,051
5	2012	0.863		$ 780,971	$ 780,971	$ -	$ 673,672	$ 673,672	$ 7,506,722
6	2013	0.837		$ 772,485	$ 772,485	$ -	$ 646,944	$ 646,944	$ 6,936,264
7	2014	0.813		$ 795,660	$ 795,660	$ -	$ 646,944	$ 646,944	$ 6,324,823
8	2015	0.789		$ 819,530	$ 819,530	$ -	$ 646,944	$ 646,944	$ 5,670,452
9	2016	0.766		$ 844,115	$ 844,115	$ -	$ 646,944	$ 646,944	$ 4,971,126
10	2017	0.744		$ 869,439	$ 869,439	$ -	$ 646,944	$ 646,944	$ 4,224,738
11	2018	0.722		$ 895,522	$ 895,522	$ -	$ 646,944	$ 646,944	$ 3,429,093
12	2019	0.701		$ 922,388	$ 922,388	$ -	$ 646,944	$ 646,944	$ 2,581,906
13	2020	0.681		$ 950,059	$ 950,059	$ -	$ 646,944	$ 646,944	$ 1,680,802
14	2021	0.661	$ 702,241	$ 978,561	$ 1,680,802	$ 464,264	$ 646,944	$ 1,111,208	$ 0
Total Alternative 4 Enhanced Ground Water E			**$ 4,897,470**	**$ 11,822,635**	**$ 16,720,105**	**$ 4,659,494**	**$ 9,473,344**	**$ 14,132,838**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE SUMMARY [2]

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Capital Cost		
Construction	$	1,763,925
Project Management	$	141,114
Design	$	264,589
Construction Management	$	264,589
Subcontractor General Requirements	$	88,196
G&A	$	353,138
Overhead	$	126,121
Tax	$	179,722
Contingency	$	630,603
Bonding& Insurance	$	76,240
Fee	$	304,960
Total Capital Cost	**$**	**4,193,197**
Year 1 Operations and Maintenance		
System Startup	$	53,400
Routine System O&M	$	252,240
Reporting (Annual Report and Construction Completion Report)	$	73,500
Professional Services [1]	$	87,202
Subcontractor General Requirements	$	18,957
G&A	$	67,942
Overhead	$	24,265
Tax	$	34,578
Contingency	$	121,325
Bonding& Insurance	$	-
Fee	$	58,673
Total Year 1 Operations and Maintenance	**$**	**792,081**
Annual Operations and Maintenance Cost: Years 2-5		
Routine System O&M	$	199,200
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	50,042
Subcontractor General Requirements	$	10,879
G&A	$	38,989
Overhead	$	13,925
New Mexico Gross Receipts Tax	$	19,843
Contingency	$	69,624
Bonding& Insurance	$	-
Fee	$	33,670
Total Annual Operations and Maintenance Cost: Years 2-5	**$**	**454,547**
Annual Operations and Maintenance Cost: Years 6-14		
Routine System O&M	$	182,824
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	50,042
Subcontractor General Requirements	$	10,879
G&A	$	36,697
Overhead	$	13,106
New Mexico Gross Receipts Tax	$	18,676
Contingency	$	65,530
Bonding& Insurance	$	-
Fee	$	31,690
Total Annual Operations and Maintenance Cost: Years 6-14	**$**	**427,819**
Post Closure Cost		
Closure Reporting	$	18,375
Equipment Demobilization and Well Abandonment	$	184,000
Professional Services [1]	$	66,784
Subcontractor General Requirements	$	10,119
G&A	$	39,099
Overhead	$	13,964
New Mexico Gross Receipts Tax	$	19,899
Contingency	$	69,819
Bonding& Insurance	$	8,441
Fee	$	33,765
Total Post Closure Cost	**$**	**464,264**
TOTAL PRESENT WORTH	**$**	**11,118,104**

NOTES:
1 - Professional Services includes Project Management, Design/Technical Support, and Construction Management.
2 - The cost estimates provided are to an accuracy of +50 percent to -30 percent and are prepared for the sole purpose of alternative comparison. The alternative cost estimates are in 2006 dollars and are based on conceptual design from information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables.

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Site Background Data

Elevation of Site =	4100	ft amsl or	12.68	psia	
Volume of Contaminated Ground water greater than 5 ug/L=			7,350	acre-ft	based on JSAI model
Volume of Contaminated Ground water greater than 1 ug/L=			25,700	acre-ft	based on JSAI model

PCE Concentrations in wells sampled December 2005.

Sample Location	PCE (μg/L)	
MW-SF1	11	
MW-SF10	17	
GWMW01 Port 2	21	
GWMW01 Port 6	6	
	14	μg/L, average concentration

Pumping Rates for Plume Containment and Remediation <20 Years (per JSAI modeling)

CLC-18	460	gpm
CLC-27	620	gpm

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
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PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

New Well #1 to replace operation of CLC-18 after 5 years per JSAI modeling 300 gpm

Total Annual: Years 1-5	568	MMgal
Total Annual: Years 6-14	484	MMgal

Mass Estimate

Mass of PCE above MCL in ground water = 150 kg of PCE — based on JSAI model - JSAI estimate based on an effective porosity of 20% and does not address potential PCE mass in additional pore space

Conceptual Design

Pumping System Design Parameters

Estimated Number of Pumping Wells =		3	wells
Estimated pumping rate from CLC-18 =		460	gpm (based on JSAI modeling results)
Estimated pumping rate from CLC-27 =		620	gpm (based on JSAI modeling results)
Estimated pumping rate from New Well =		300	
Total Pumping Rate in Years 1-5=		1,080	gpm (assumes CLC-18 and 27 only)
Total Pumping Rate in Years 6-14=		920	gpm (assumes CLC-27 and new well only)
Depth of new pumping wells =	450 ft bgs		

System Construction Time

Estimated drilling rate =	125	lf/day		based on invoice	
Total linear footage drilling =	900	lf			
Estimated duration of drilling =	7.2	days or		8	days (rounded up)
Estimated linear footage of field piping per pumping well =				1500	ft per well — average of piping required for all wells
Total linear footage of connection piping =			500	lf	assumed 500 lf to stub up to treatment system and reconnect to existing CLC-27 line to UGR
Total linear footage of effluent field piping=			1,000	lf	connection of CLC-18 to CLC -27 connection to Upper Griggs Reservoir; CLC estimated 1000 lf new piping needed in addition to the approximate length of 500 lf of existing piping.
Total linear footage of effluent field piping=			750	lf	estimated connection of new well to CLC -27 connection to Upper Griggs Reservoir
Estimated field piping placing rate =			75	lf/day	
Estimated duration of field piping =			30.0	days or	30 days (rounded up)
Total construction timeframe =	38	days			

HiPOx Treatment System Components (1080 gpm system)

System Costs:		$	531,250	(Vendor quote [Applied Process Technology] of $425,000 plus 25% uncertainty factor, plus FOB and taxes)
Operating Costs (per year - Vendor Quote				
	Oxygen Generator	$	8,760	
	Hydrogen Peroxide	$	6,389	Assumes NSF grade
	O3 Generator Electricity	$	4,739	
	Consumable Costs	$	19,888	
	TOTAL ANNUAL COST	$	39,776	

Note: HiPOx is a specific patented ex-situ chemical oxidation process that combines ozone and hydrogen peroxide to destroy contaminants in the influent ground water

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Construction					
Underground Piping from CLC-18 to CLC-27 connection to Upper Griggs Reservoir	1,000	ft	$ 100.17	$ 100,170	estimated LF from CLC: cost includes 10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Underground Piping from new extraction well to CLC-27 connection to Upper Griggs Reservoir	750	ft	$ 100.17	$ 75,128	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Piping Connection to Treatment System	500	lf	$ 100.17	$ 50,085	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Pumping Well Modifications	2	ea	$ 25,000.00	$ 50,000	JSP Memo 7/8/06
Ground Water Extraction Well Installation	1	well	$ 200,000.00	$ 200,000	JSP Memo 7/8/06
Ground Water Extraction Pumps	3	ea	$ 10,000.00	$ 30,000	assume new + replace city pumps, vendor quote; 100gpm, 15 hp, 3-phase, 230V, 6 inch
Influent Equalization Tank	0	gal	$ 1.00	$ -	provides 20 of storage
Tank Effluent Pump	2	ea	$ 4,000.00	$ 8,000	Assumes two 10 hp units (Pump with motor controls for 540 GPM @ 50'TDH)
Influent and Effluent Bag Filters	2	LS	$ 7,500.00	$ 15,000	gpm size filter
HiPOx Treatment System	1	LS	$ 531,250.00	$ 531,250	Equipment is skid mounted, pre-assembled, pre-tested, and fully automated. Equipment includes reactor, instruments, controls, H2O2 storage, O3 generator/chiller, and on-site O2 generation system
HiPOx Bench Test	1	LS	$ 3,000.00	$ 3,000	1-time bench test to accurately determine dosing requirements and equipment sizing
Protective Enclosure	1	ea	$ 100,000.00	$ 100,000	Vendor quote: 8' x 40' climate-controlled enclosure
Repair discharge line on CLC-27	1	LS	$ 300.00	$ 300	
Well Permits	1	ea	$ 30.00	$ 30	new extraction well
Equipment Rental	26	wk	$ 200.00	$ 5,200	MultiRAE
Subtotal Capital Cost				$ 1,168,163	
Site Work Allowance	7%	of	$ 1,168,162.50	$ 81,771	
Mechanical Allowance	15%	of	$ 1,168,162.50	$ 175,224	
Instrumentation and Controls Allowance	12%	of	$ 1,168,162.50	$ 140,180	including SCADA system
Electrical Allowance	12%	of	$ 1,168,162.50	$ 140,180	
Miscellaneous Equipment Allowance	5%	of	$ 1,168,162.50	$ 58,408	
Subtotal Capital Cost				$ 1,763,925	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells included under ground water monitoring
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7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Project Management	8%	of	$ 1,763,925.38	$ 141,114	
Design	15%	of	$ 1,763,925.38	$ 264,589	
Construction Management	15%	of	$ 1,763,925.38	$ 264,589	
Subcontractor General Requirements	5%	of	$ 1,763,925.38	$ 88,196	
Subtotal Capital Cost				$ 2,522,413	
G&A	14%	of	$ 2,522,413.29	$ 353,138	
Overhead	5%	of	$ 2,522,413.29	$ 126,121	
New Mexico Gross Receipts Tax	7.125%	of	$ 2,522,413.29	$ 179,722	
Contingency	25%	of	$ 2,522,413.29	$ 630,603	
Subtotal Capital Cost				$ 3,811,997	
Bonding& Insurance	2%	of	$ 3,811,997.08	$ 76,240	
Fee	8%	of	$ 3,811,997.08	$ 304,960	
TOTAL CAPITAL COST				**$ 4,193,197**	

YEAR 1 OPERATIONS AND MAINTENANCE

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
System Startup					
Labor - Technician	300	hr	$ 75.00	$ 22,500	Assume 30 days for startup, 10 hrs/day
Labor - Engineer	200	hr	$ 120.00	$ 24,000	Assume 20 days for startup, 10 hrs/day
Water Sample Analysis	6	sample	$ 150.00	$ 900	3 sets, VOC analysis for infl/effl, incl data valid.
Air Sample Analysis	0	sample	$ 150.00	$ -	no air emissions from HiPOx
Startup Equipment Rental	6	week	$ 1,000.00	$ 6,000	intensive water quality monitoring
Total *System Startup*				$ 53,400	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit		Unit Cost		Cost	Comments and References
Routine System O&M							
Labor - Technician	416	hr	$	75.00	$	31,200	8 hours/week
Labor - Engineer	416	hr	$	120.00	$	49,920	100% of the Tech time for first year
Water Sample Analysis	29	sample	$	150.00	$	4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Air Sample Analysis	0	sample	$	100.00	$	-	no air emissions from HiPOx
O&M Supplies	1	LS	$	6,000.00	$	6,000	
Electricity	130,699	kw-hr	$	0.08	$	10,456	Assumes continuous operation of the tank effleunt pumps
HiPOx System O&M	1	LS	$	39,776.00	$	39,776	chemical and O3 generator electrical costs per vendor
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$	194.73	$	110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*					$	252,240	
Reporting (Annual Report and Construction Completion Report)							
Labor - Engineer/Hydrogeologist	400	hr	$	120.00	$	48,000	
Labor - Editor	200	hr	$	85.00	$	17,000	
Labor - CAD Technician	100	hr	$	85.00	$	8,500	
Total *Annual Reporting*					$	73,500	
Subtotal Year 1 Operations and Maintenance					$	379,140	
Project Management	8%	of	$	379,140.05	$	30,331	
Technical Support	15%	of	$	379,140.05	$	56,871	
Construction Management	0%	of	$	379,140.05	$	-	
Subcontractor General Requirements	5%	of	$	379,140.05	$	18,957	
Subtotal Year 1 Operations and Maintenance					$	485,299	
G&A	14%	of	$	485,299.26	$	67,942	
Overhead	5%	of	$	485,299.26	$	24,265	
New Mexico Gross Receipts Tax	7.125%	of	$	485,299.26	$	34,578	
Contingency	25%	of	$	485,299.26	$	121,325	
Subtotal Year 1 Operations and Maintenance					$	733,409	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

Item/Activity	Qty	Unit		Unit Cost	Cost	Comments and References
CAPITAL COST						
Bonding& Insurance	0%	of	$	733,408.51	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$	733,408.51	$ 58,673	
TOTAL YEAR 1 OPERATIONS AND MAINTENANCE COST					**$ 792,081**	
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 2-5 (ANNUAL COST)						
Item/Activity	**Qty**	**Unit**		**Unit Cost**	**Cost**	**Comments**
Routine System O&M						
Labor - Technician	208	hr	$	75.00	$ 15,600	4 hours/week
Labor - Engineer	104	hr	$	120.00	$ 12,480	50% of the Tech time
Water Sample Analysis	29	sample	$	150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
O&M Supplies	1	LS	$	6,000.00	$ 6,000	
Electricity	130,699	kw-hr	$	0.08	$ 10,456	Assumes continuous operation of the tank effleunt pumps
HiPOx System O&M	1	LS	$	39,776.00	$ 39,776	chemical and O3 generator electrical costs per vendor
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$	194.73	$ 110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*					$ 199,200	
Reporting (Annual Reports)						
Labor - Engineer/Hydrogeologist	100	hr	$	120.00	$ 12,000	
Labor - Editor	50	hr	$	85.00	$ 4,250	
Labor - CAD Technician	25	hr	$	85.00	$ 2,125	
Total *Reporting*					$ 18,375	
Subtotal Year 2-5 Operations and Maintenance					$ 217,575	
Project Management	8%	of	$	217,575.05	$ 17,406	
Technical Support	15%	of	$	217,575.05	$ 32,636	
Construction Management	0%	of	$	217,575.05	$ -	
Subcontractor General Requirements	5%	of	$	217,575.05	$ 10,879	
Subtotal Year 2-5 Operations and Maintenance					$ 278,496	
G&A	14%	of	$	278,496.06	$ 38,989	
Overhead	5%	of	$	278,496.06	$ 13,925	
New Mexico Gross Receipts Tax	7.125%	of	$	278,496.06	$ 19,843	
Contingency	25%	of	$	278,496.06	$ 69,624	
Subtotal Year 2-5 Operations and Maintenance					$ 420,877	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
Bonding& Insurance	0%	of	$	420,877.17	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$	420,877.17	$	33,670	
TOTAL ANNUAL COST: YEARS 2-5 OPERATIONS AND MAINTENANCE COST					**$**	**454,547**	

ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 6-14 (ANNUAL COST)							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments**
Routine System O&M							
Labor - Technician	208	hr	$	75.00	$	15,600	4 hours/week
Labor - Engineer	104	hr	$	120.00	$	12,480	50% of the Tech time
Water Sample Analysis	29	sample	$	150.00	$	4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
O&M Supplies	1	LS	$	6,000.00	$	6,000	
Electricity	130,699	kw-hr	$	0.08	$	10,456	Assumes continuous operation of the tank effleunt pumps
HiPOx System O&M	1	LS	$	39,776.00	$	39,776	chemical and O3 generator electrical costs per vendor
Annual Extraction Well and Distribution Operating Cost	484	MMGal	$	194.73	$	94,162	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*					$	182,824	
Reporting (Annual Reports)							
Labor - Engineer/Hydrogeologist	100	hr	$	120.00	$	12,000	
Labor - Editor	50	hr	$	85.00	$	4,250	
Labor - CAD Technician	25	hr	$	85.00	$	2,125	
Total *Reporting*					$	18,375	
Subtotal Year 6-14 Operations and Maintenance					$	201,199	
Project Management	8%	of	$	217,575.05	$	17,406	
Technical Support	15%	of	$	217,575.05	$	32,636	
Construction Management	0%	of	$	217,575.05	$	-	
Subcontractor General Requirements	5%	of	$	217,575.05	$	10,879	
Subtotal Year 6-14 Operations and Maintenance					$	262,120	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed | 0 | wells | included under ground water monitoring
4. Number of new ground water extraction wells to be installed = | 1 | wells
5. Number of piezometers to be installed = | 0 | piezometers | included under ground water monitoring
6. Number of reinjection wells to be installed= | 0 | wells
7. Assume that the duration of construction is | 129 | working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is | 0 | wells per round | included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is | 1 | wells | includes only new extraction well(s)
10. The G&A rate is | 14%
11. The overhead rate is | 5%
12. The Bonding & Insurance rate is | 2%
13. The fee rate is | 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit		Unit Cost		Cost	Comments and References
G&A	14%	of	$	262,120.04	$	36,697	
Overhead	5%	of	$	262,120.04	$	13,106	
New Mexico Gross Receipts Tax	7.125%	of	$	262,120.04	$	18,676	
Contingency	25%	of	$	262,120.04	$	65,530	
Subtotal Year 6-14 Operations and Maintenance					$	396,129	
Bonding& Insurance	0%	of	$	396,128.92	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$	396,128.92	$	31,690	
TOTAL ANNUAL COST: YEARS 6-14 OPERATIONS AND MAINTENANCE COST					**$**	**427,819**	

POST CLOSURE COST

Item/Activity	Qty	Unit		Unit Cost		Cost	Comments
Closure Reporting							
Labor - Engineer/Hydrogeologist	100	hr		$120.00	$	12,000	
Labor - Editor	50	hr		$85.00	$	4,250	
Labor - CAD Technician	25	hr		$85.00	$	2,125	
Total *Closure Reporting*					$	18,375	
Equipment Demobilization and Well Abandonment							
Well Abandonment	1	well	$	10,000.00	$	10,000	new extraction wells only, others included under ground water monitoring
Equipment Demobilization	1	LS	$	150,000.00	$	150,000	
Subtotal Equipment Demobilization and Well Abandonment					$	160,000	
Site Work Allowance	10%	of	$	160,000.00	$	16,000	
Mechanical Allowance	0%	of	$	160,000.00	$	-	
Instrumentation and Controls Allowance	0%	of	$	160,000.00	$	-	
Electrical Allowance	5%	of	$	160,000.00	$	8,000	
Miscellaneous Equipment Allowance	0%	of	$	160,000.00	$	-	
Subtotal Well Abandonment					$	184,000	
Subtotal Post-Closure Cost					$	202,375	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed: 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 129 working days (includes 90 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments and References**
Project Management	8%	of	$ 202,375.00	$ 16,190	
Technical Support	15%	of	$ 202,375.00	$ 30,356	
Construction Management	10%	of	$ 202,375.00	$ 20,238	
Subcontractor General Requirements	5%	of	$ 202,375.00	$ 10,119	
Subtotal Post-Closure Cost				$ 279,278	
G&A	14%	of	$ 279,277.50	$ 39,099	
Overhead	5%	of	$ 279,277.50	$ 13,964	
New Mexico Gross Receipts Tax	7.125%	of	$ 279,277.50	$ 19,899	
Contingency	25%	of	$ 279,277.50	$ 69,819	
Subtotal Post-Closure Cost				$ 422,058	
Bonding& Insurance	2%	of	$ 422,058.12	$ 8,441	
Fee	8%	of	$ 422,058.12	$ 33,765	
TOTAL POST CLOSURE COST				**$ 464,264**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

PRESENT WORTH ANALYSIS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Chemcial/UV Oxidation
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. Real Discount Rate 3.00% Source: OMB Ciruclar No. A-94, Jan. 2007 version of Appendix C obtained from http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html
2. Assumes Total PV earns interest for an entire year (12 months), compound annually.
3. Escalation factor is 3.00%

Present Worth Analysis

		E	A	B	C=A+B	A*E	B*E	C*E	
Elapsed Time	Year	Discount Factor at 3%	Capital Cost	O&M Cost	Total Cost	Total PV Capital Costs at 3%	Total PV O&M Costs at 3%	Total PV Costs at 3%	Balance of Interest Bearing Account at 3%
0	2007	1.000	$ 4,193,197		$ 4,193,197	$ 4,193,197	$ -	$ 4,193,197	$ 7,132,655
1	2008	0.971		$ 815,844	$ 815,844	$ -	$ 792,081	$ 792,081	$ 6,506,316
2	2009	0.943		$ 482,229	$ 482,229	$ -	$ 454,547	$ 454,547	$ 6,204,809
3	2010	0.915		$ 496,696	$ 496,696	$ -	$ 454,547	$ 454,547	$ 5,879,356
4	2011	0.888		$ 511,597	$ 511,597	$ -	$ 454,547	$ 454,547	$ 5,528,792
5	2012	0.863		$ 526,945	$ 526,945	$ -	$ 454,547	$ 454,547	$ 5,151,902
6	2013	0.837		$ 510,839	$ 510,839	$ -	$ 427,819	$ 427,819	$ 4,780,296
7	2014	0.813		$ 526,164	$ 526,164	$ -	$ 427,819	$ 427,819	$ 4,381,756
8	2015	0.789		$ 541,949	$ 541,949	$ -	$ 427,819	$ 427,819	$ 3,955,001
9	2016	0.766		$ 558,207	$ 558,207	$ -	$ 427,819	$ 427,819	$ 3,498,698
10	2017	0.744		$ 574,953	$ 574,953	$ -	$ 427,819	$ 427,819	$ 3,011,457
11	2018	0.722		$ 592,202	$ 592,202	$ -	$ 427,819	$ 427,819	$ 2,491,833
12	2019	0.701		$ 609,968	$ 609,968	$ -	$ 427,819	$ 427,819	$ 1,938,321
13	2020	0.681		$ 628,267	$ 628,267	$ -	$ 427,819	$ 427,819	$ 1,349,356
14	2021	0.661	$ 702,241	$ 647,115	$ 1,349,356	$ 464,264	$ 427,819	$ 892,083	$ 0
Total Alternative 4 Enhanced Ground Water E			**$ 4,895,438**	**$ 8,022,974**	**$ 12,918,412**	**$ 4,657,461**	**$ 6,460,644**	**$ 11,118,104**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE SUMMARY [2]

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Capital Cost		
Construction	$	1,498,996
Project Management	$	119,920
Design	$	224,849
Construction Management	$	224,849
Subcontractor General Requirements	$	74,950
G&A	$	300,099
Overhead	$	107,178
Tax	$	152,729
Contingency	$	535,891
Bonding& Insurance	$	64,789
Fee	$	259,157
Total Capital Cost	**$**	**3,563,407**
Year 1 Operations and Maintenance		
System Startup	$	17,200
Routine System O&M	$	182,024
Reporting (Annual Report and Construction Completion Report)	$	73,500
Professional Services [1]	$	62,727
Subcontractor General Requirements	$	13,636
G&A	$	48,872
Overhead	$	17,454
Tax	$	24,872
Contingency	$	87,272
Bonding& Insurance	$	-
Fee	$	42,205
Total Year 1 Operations and Maintenance	**$**	**569,762**
Annual Operations and Maintenance Cost: Years 2-5		
Routine System O&M	$	161,984
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	41,483
Subcontractor General Requirements	$	9,018
G&A	$	32,320
Overhead	$	11,543
New Mexico Gross Receipts Tax	$	16,449
Contingency	$	57,715
Bonding& Insurance	$	-
Fee	$	27,911
Total Annual Operations and Maintenance Cost: Years 2-5	**$**	**376,797**
Annual Operations and Maintenance Cost: Years 6-14		
Routine System O&M	$	139,560
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	41,483
Subcontractor General Requirements	$	9,018
G&A	$	29,181
Overhead	$	10,422
New Mexico Gross Receipts Tax	$	14,851
Contingency	$	52,109
Bonding& Insurance	$	-
Fee	$	25,200
Total Annual Operations and Maintenance Cost: Years 6-14	**$**	**340,198**
Post Closure Cost		
Closure Reporting	$	18,375
Well Abandonment and Equipment Demobilization	$	126,500
Professional Services [1]	$	47,809
Subcontractor General Requirements	$	7,244
G&A	$	27,990
Overhead	$	9,996
New Mexico Gross Receipts Tax	$	14,245
Contingency	$	49,982
Bonding& Insurance	$	6,043
Fee	$	24,171
Total Post Closure Cost	**$**	**332,354**
TOTAL PRESENT WORTH	**$**	**9,034,497**

NOTES:
1 - Professional Services includes Project Management, Design/Technical Support, and Construction Management.
2 - The cost estimates provided are to an accuracy of +50 percent to -30 percent and are prepared for the sole purpose of alternative comparison. The alternative cost estimates are in 2006 dollars and are based on conceptual design from information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables.

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Site Background Data

Elevation of Site =	4100	ft amsl or	12.68 psia	
Volume of Contaminated Ground Water greater than 5 ug/L=	7,350	acre-ft		based on JSAI model
Volume of Contaminated Ground Water greater than 1 ug/L=	25,700	acre-ft		based on JSAI model

PCE Concentrations in wells sampled December 2005.

Sample Location	PCE (μg/L)
MW-SF1	11
MW-SF10	17
GWMW01 Port 2	21
GWMW01 Port 6	6
	14 μg/L, average concentration

Pumping Rates for Plume Containment and Remediation <20 Years (per JSAI modeling)

CLC-18	460	gpm
CLC-27	620	gpm

New Well #1 to replace operation of CLC-18 after 5 years per JSAI modeling 300 gpm

Total Annual: Years 1-5	568	MMgal
Total Annual: Years 6-14	484	MMgal

Mass Estimate

Mass of PCE above MCL in ground water = 150 kg of PCE — based on JSAI model - JSAI estimate based on an effective porosity of 20% and does not address potential PCE mass in additional pore space

Conceptual Design

Pumping System Design Parameters

Estimated Number of Pumping Wells =	3	wells
Estimated pumping rate from CLC-18 =	460	gpm (based on JSAI modeling results)
Estimated pumping rate from CLC-27 =	620	gpm (based on JSAI modeling results)
Estimated pumping rate from New Well =	300	gpm (to replace operation of CLC-18 after 5 years)
Total Pumping Rate in Years 1-5=	1,080	gpm (assumes CLC-18 and 27 only)
Total Pumping Rate in Years 6-14=	920	gpm (assumes CLC-27 and new well only)
Depth of new pumping wells =	450	ft bgs

System Construction Time

Estimated drilling rate =	125	lf/day		based on invoice
Total linear footage drilling =	900	lf		
Estimated duration of drilling =	7.2	days or	8	days (rounded up)
Estimated linear footage of field piping per pumping well =	1500	ft per well		average of piping required for all wells
Total linear footage of connection piping =	500	lf		assumed 500 lf to stub up to treatment system and reconnect to existing CLC-27 line to UGR
Total linear footage of effluent field piping=	1,000	lf		connection of CLC-18 to CLC -27 connection to Upper Griggs Reservoir; CLC estimated 1000 lf new piping needed in addition to the approximate length of 500 lf of existing piping.
Total linear footage of effluent field piping=	750	lf		estimated connection of new well to CLC -27 connection to Upper Griggs Reservoir
Estimated field piping placing rate =	75	lf/day		
Estimated duration of field piping =	30.0	days or	30	days (rounded up)
Total construction timeframe =	38	days		

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Granular Activated Carbon (GAC) Conceptual Design Parameters

All organic contaminants found are adsorbable with GAC.

GAC treatment system design flowrate is 1,080 gpm

Governing contaminant PCE at 14 μg/L

GAC usage rate for PCE only	0.99	lbs GAC/hr or	23.7	lbs GAC/day or	8,640	lbs GAC/yr	based on GAC vendor modeling
Assuming a multiplier of	1.00	for additional organic contaminants that will also adsorb and use carbon (vendor modeling includes other contaminants)					
The total GAC usage rate =	1.0	lbs GAC/hr or	23.7	lbs GAC/day or	8,640	lbs GAC/yr	
Assuming a carbon cost of	$1.75	per lb GAC for supply and changeout -->			$15,120	per GAC changeout per year	per vendor quote

Required changeout period of	0.2	times per year			based on GAC vendor modeling
Assume a carbon vessel size of	10,000	lb and we need	4	vessels in parallel	
	350	gpm			

GAC Unit: QED Model CWS10000, rated for up to 350 gpm

Assuming a	10,000	lb vessel costs	$18,000	with GAC, total cost =	$72,000	for vessels and GAC only	per vendor quote
In addition, there would be an annual recurring cost of			$15,120	per GAC changeout per year			

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Construction					
Underground Piping from CLC-18 to CLC-27 connection to Upper Griggs Reservoir	1,000	ft	$ 100.17	$ 100,170	estimated LF from CLC: cost includes 10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Underground Piping from new extraction well to CLC-27 connection to Upper Griggs Reservoir	750	ft	$ 100.17	$ 75,128	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Piping Connection to Treatment System	500	lf	$ 100.17	$ 50,085	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Pumping Well Modifications	2	ea	$ 25,000.00	$ 50,000	JSP Memo 7/8/06
Ground Water Extraction Well Installation	1	well	$ 200,000.00	$ 200,000	JSP Memo 7/8/06
Ground Water Extraction Pumps	3	ea	$ 10,000.00	$ 30,000	assume new + replace city pumps, vendor quote; 100gpm, 15 hp, 3-phase, 230V, 6 inch
Influent Equalization Tank	21,600	gal	$ 1.00	$ 21,600	provides 20-minutes of storage
Tank Effluent Pump	2	ea	$ 4,000.00	$ 8,000	Assumes 10 hp units - one pump will supply 2 GAC units (Pump with motor controls for 540 GPM @ 50'TDH)
Influent and Effluent Bag Filters	2	LS	$ 7,500.00	$ 15,000	0 gpm size filter
GAC Treatment system	4	vessel	$ 72,000.00	$ 288,000	QED Model CWS10000, rated for up to 350 gpm
Protective Enclosure	1	ea	$ 150,000.00	$ 150,000	Assume 30'x25' building at $200/sf, includes overhead crane, pre-fab metal
Repair discharge line on CLC-27	1	LS	$ 300.00	$ 300	
Well Permits	1	ea	$ 30.00	$ 30	new extraction well
Equipment Rental	22	wk	$ 200.00	$ 4,400	MultiRAE
Subtotal Capital Cost				$ 992,713	
Site Work Allowance	7%	of	$ 992,712.50	$ 69,490	
Mechanical Allowance	15%	of	$ 992,712.50	$ 148,907	
Instrumentation and Controls Allowance	12%	of	$ 992,712.50	$ 119,126	including SCADA system
Electrical Allowance	12%	of	$ 992,712.50	$ 119,126	
Miscellaneous Equipment Allowance	5%	of	$ 992,712.50	$ 49,636	
Subtotal Capital Cost				$ 1,498,996	
Project Management	8%	of	$ 1,498,995.88	$ 119,920	
Design	15%	of	$ 1,498,995.88	$ 224,849	
Construction Management	15%	of	$ 1,498,995.88	$ 224,849	
Subcontractor General Requirements	5%	of	$ 1,498,995.88	$ 74,950	
Subtotal Capital Cost				$ 2,143,564	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed: 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
G&A	14%	of	$ 2,143,564.10	$ 300,099	
Overhead	5%	of	$ 2,143,564.10	$ 107,178	
New Mexico Gross Receipts Tax	7.125%	of	$ 2,143,564.10	$ 152,729	
Contingency	25%	of	$ 2,143,564.10	$ 535,891	
Subtotal Capital Cost				$ 3,239,461	
Bonding& Insurance	2%	of	$ 3,239,461.25	$ 64,789	
Fee	8%	of	$ 3,239,461.25	$ 259,157	
TOTAL CAPITAL COST				**$ 3,563,407**	

YEAR 1 OPERATIONS AND MAINTENANCE

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
System Startup					
Labor - Technician	100	hr	$ 75.00	$ 7,500	Assume 10 days for startup, 10 hrs/day
Labor - Engineer	70	hr	$ 120.00	$ 8,400	Assume 7 days for startup, 10 hrs/day
Water Sample Analysis	6	sample	$ 150.00	$ 900	3 sets, VOC analysis for infl/effl, incl data valid.
Air Sample Analysis	0	sample	$ 150.00	$ -	no air emissions with GAC
Startup Equipment Rental	2	week	$ 200.00	$ 400	
Total *System Startup*				$ 17,200	
Routine System O&M					
Labor - Technician	208	hr	$ 75.00	$ 15,600	4 hours/week
Labor - Engineer	208	hr	$ 120.00	$ 24,960	100% of the Tech time for first year
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Air Sample Analysis	0	sample	$ -	$ -	no air emissions with GAC
O&M Supplies	1	LS	$ 1,000.00	$ 1,000	
GAC Replacement	1	LS	$ 15,120.00	$ 15,120	
Electricity	130,699	kw-hr	$ 0.08	$ 10,456	Assumes continuous operation of the tank effluent pumps
					98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27). Assumes
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$ 194.73	$ 110,538	O&M costs for new well will be the same as for CLC-18.
Total *Routine System O&M*				$ 182,024	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with GAC
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Reporting (Annual Report and Construction Completion Report)					
Labor - Engineer/Hydrogeologist	400	hr	$ 120.00	$ 48,000	
Labor - Editor	200	hr	$ 85.00	$ 17,000	
Labor - CAD Technician	100	hr	$ 85.00	$ 8,500	
Total *Annual Reporting*				$ 73,500	
Subtotal Year 1 Operations and Maintenance				$ 272,724	
Project Management	8%	of	$ 272,724.05	$ 21,818	
Technical Support	15%	of	$ 272,724.05	$ 40,909	
Construction Management	0%	of	$ 272,724.05	$ -	
Subcontractor General Requirements	5%	of	$ 272,724.05	$ 13,636	
Subtotal Year 1 Operations and Maintenance				$ 349,087	
G&A	14%	of	$ 349,086.78	$ 48,872	
Overhead	5%	of	$ 349,086.78	$ 17,454	
New Mexico Gross Receipts Tax	7.125%	of	$ 349,086.78	$ 24,872	
Contingency	25%	of	$ 349,086.78	$ 87,272	
Subtotal Year 1 Operations and Maintenance				$ 527,557	
Bonding& Insurance	0%	of	$ 527,557.40	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$ 527,557.40	$ 42,205	
TOTAL YEAR 1 OPERATIONS AND MAINTENANCE COST				**$ 569,762**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with GAC
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References

ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 2-5 (ANNUAL COST)

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Routine System O&M					
Labor - Technician	208	hr	$ 75.00	$ 15,600	4 hours/week
Labor - Engineer	104	hr	$ 120.00	$ 12,480	50% of the Tech time
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
O&M Supplies	1	LS	$ 1,000.00	$ 1,000	
GAC Replacement	1	LS	$ 7,560.00	$ 7,560	assumes GAC usage rate drops 50% from initial rate
Electricity	130,699	kw-hr	$ 0.08	$ 10,456	Assumes continuous operation of the tank effluent pumps
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$ 194.73	$ 110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$ 161,984	
Reporting (Annual Reports)					
Labor - Engineer/Hydrogeologist	100	hr	$ 120.00	$ 12,000	
Labor - Editor	50	hr	$ 85.00	$ 4,250	
Labor - CAD Technician	25	hr	$ 85.00	$ 2,125	
Total *Reporting*				$ 18,375	
Subtotal Year 2-5 Operations and Maintenance				$ 180,359	
Project Management	8%	of	$ 180,359.05	$ 14,429	
Technical Support	15%	of	$ 180,359.05	$ 27,054	
Construction Management	0%	of	$ 180,359.05	$ -	
Subcontractor General Requirements	5%	of	$ 180,359.05	$ 9,018	
Subtotal Year 2-5 Operations and Maintenance				$ 230,860	
G&A	14%	of	$ 230,859.58	$ 32,320	
Overhead	5%	of	$ 230,859.58	$ 11,543	
New Mexico Gross Receipts Tax	7.125%	of	$ 230,859.58	$ 16,449	
Contingency	25%	of	$ 230,859.58	$ 57,715	
Subtotal Year 2-5 Operations and Maintenance				$ 348,887	
Bonding& Insurance	0%	of	$ 348,886.54	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$ 348,886.54	$ 27,911	
TOTAL ANNUAL COST: YEARS 2-5 OPERATIONS AND MAINTENANCE COST				**$ 376,797**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References

ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 6-10 (ANNUAL COST)

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Routine System O&M					
Labor - Technician	208	hr	$ 75.00	$ 15,600	4 hours/week
Labor - Engineer	104	hr	$ 120.00	$ 12,480	50% of the Tech time
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
O&M Supplies	1	LS	$ 1,000.00	$ 1,000	
GAC Replacement	1	LS	$ 1,512.00	$ 1,512	assumes GAC usage rate drops 90% from initial rate
Electricity	130,699	kw-hr	$ 0.08	$ 10,456	Assumes continuous operation of the tank effluent pumps
Annual Extraction Well and Distribution Operating Cost	484	MMGal	$ 194.73	$ 94,162	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$ 139,560	
Reporting (Annual Reports)					
Labor - Engineer/Hydrogeologist	100	hr	$ 120.00	$ 12,000	
Labor - Editor	50	hr	$ 85.00	$ 4,250	
Labor - CAD Technician	25	hr	$ 85.00	$ 2,125	
Total *Reporting*				$ 18,375	
Subtotal Year 6-10 Operations and Maintenance				$ 157,935	
Project Management	8%	of	$ 180,359.05	$ 14,429	
Technical Support	15%	of	$ 180,359.05	$ 27,054	
Construction Management	0%	of	$ 180,359.05	$ -	
Subcontractor General Requirements	5%	of	$ 180,359.05	$ 9,018	
Subtotal Year 6-10 Operations and Maintenance				$ 208,436	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
G&A	14%	of	$	208,435.56	$	29,181	
Overhead	5%	of	$	208,435.56	$	10,422	
New Mexico Gross Receipts Tax	7.125%	of	$	208,435.56	$	14,851	
Contingency	25%	of	$	208,435.56	$	52,109	
Subtotal Year 6-10 Operations and Maintenance					$	314,998	
Bonding& Insurance	0%	of	$	314,998.25	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$	314,998.25	$	25,200	
TOTAL ANNUAL COST: YEARS 6-10 OPERATIONS AND MAINTENANCE COST					**$**	**340,198**	

POST CLOSURE COST							
Item/Activity	Qty	Unit		Unit Cost		Cost	Comments
Closure Reporting							
Labor - Engineer/Hydrogeologist	100	hr		$120.00	$	12,000	
Labor - Editor	50	hr		$85.00	$	4,250	
Labor - CAD Technician	25	hr		$85.00	$	2,125	
Total *Closure Reporting*					$	18,375	
Well Abandonment and Equipment Demobilization							
Well Abandonment	1	well	$	10,000.00	$	10,000	
Equipment Demobilization	1	LS	$	100,000.00	$	100,000	
Subtotal Well Abandonment and Equipment Demobilization					$	110,000	
Site Work Allowance	10%	of	$	110,000.00	$	11,000	
Mechanical Allowance	0%	of	$	110,000.00	$	-	
Instrumentation and Controls Allowance	0%	of	$	110,000.00	$	-	
Electrical Allowance	5%	of	$	110,000.00	$	5,500	
Miscellaneous Equipment Allowance	0%	of	$	110,000.00	$	-	
Subtotal Equipment Demobilization and Well Abandonment					$	126,500	
Subtotal Post-Closure Cost					$	144,875	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with GAC
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 108 working days (includes 70 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells includes only new extraction well(s)
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Project Management	8%	of	$ 144,875.00	$ 11,590	
Technical Support	15%	of	$ 144,875.00	$ 21,731	
Construction Management	10%	of	$ 144,875.00	$ 14,488	
Subcontractor General Requirements	5%	of	$ 144,875.00	$ 7,244	
Subtotal Post-Closure Cost				$ 199,928	
G&A	14%	of	$ 199,927.50	$ 27,990	
Overhead	5%	of	$ 199,927.50	$ 9,996	
New Mexico Gross Receipts Tax	7.125%	of	$ 199,927.50	$ 14,245	
Contingency	25%	of	$ 199,927.50	$ 49,982	
Subtotal Post-Closure Cost				$ 302,140	
Bonding& Insurance	2%	of	$ 302,140.43	$ 6,043	Bonding only applies to Capital Costs
Fee	8%	of	$ 302,140.43	$ 24,171	
TOTAL POST CLOSURE COST				**$ 332,354**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

PRESENT WORTH ANALYSIS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with GAC
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. Real Discount Rate 3.00% Source: OMB Ciruclar No. A-94, Jan. 2007 version of Appendix C obtained from http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html
2. Assumes Total PV earns interest for an entire year (12 months), compound annually.
3. Escalation factor is 3.00%

Present Worth Analysis

		E	A	B	C=A+B	A*E	B*E	C*E	
Elapsed Time	Year	Discount Factor at 3%	Capital Cost	O&M Cost	Total Cost	Total PV Capital Costs at 3%	Total PV O&M Costs at 3%	Total PV Costs at 3%	Balance of Interest Bearing Account at 3%
0	2007	1.000	$ 3,563,407		$ 3,563,407	$ 3,563,407	$ -	$ 3,563,407	$ 5,635,222
1	2008	0.971		$ 586,855	$ 586,855	$ -	$ 569,762	$ 569,762	$ 5,199,818
2	2009	0.943		$ 399,744	$ 399,744	$ -	$ 376,797	$ 376,797	$ 4,944,076
3	2010	0.915		$ 411,737	$ 411,737	$ -	$ 376,797	$ 376,797	$ 4,668,309
4	2011	0.888		$ 424,089	$ 424,089	$ -	$ 376,797	$ 376,797	$ 4,371,547
5	2012	0.863		$ 436,812	$ 436,812	$ -	$ 376,797	$ 376,797	$ 4,052,778
6	2013	0.837		$ 406,214	$ 406,214	$ -	$ 340,198	$ 340,198	$ 3,755,960
7	2014	0.813		$ 418,401	$ 418,401	$ -	$ 340,198	$ 340,198	$ 3,437,686
8	2015	0.789		$ 430,953	$ 430,953	$ -	$ 340,198	$ 340,198	$ 3,096,935
9	2016	0.766		$ 443,881	$ 443,881	$ -	$ 340,198	$ 340,198	$ 2,732,646
10	2017	0.744		$ 457,198	$ 457,198	$ -	$ 340,198	$ 340,198	$ 2,343,711
11	2018	0.722		$ 470,914	$ 470,914	$ -	$ 340,198	$ 340,198	$ 1,928,981
12	2019	0.701		$ 485,041	$ 485,041	$ -	$ 340,198	$ 340,198	$ 1,487,259
13	2020	0.681		$ 499,592	$ 499,592	$ -	$ 340,198	$ 340,198	$ 1,017,296
14	2021	0.661	$ 502,716	$ 514,580	$ 1,017,296	$ 332,354	$ 340,198	$ 672,553	$ 0
Total Alternative 4 Enhanced Ground Water E			**$ 4,066,123**	**$ 6,386,011**	**$ 10,452,134**	**$ 3,895,762**	**$ 5,138,735**	**$ 9,034,497**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE SUMMARY [2]

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Capital Cost		
Construction	$	1,264,040
Project Management	$	101,123
Design	$	189,606
Construction Management	$	189,606
Subcontractor General Requirements	$	63,202
G&A	$	253,061
Overhead	$	90,379
Tax	$	128,790
Contingency	$	451,894
Bonding& Insurance	$	54,634
Fee	$	218,536
Total Capital Cost	**$**	**3,004,871**
Year 1 Operations and Maintenance		
System Startup	$	19,700
Routine System O&M	$	206,500
Reporting (Annual Report and Construction Completion Report)	$	73,500
Professional Services [1]	$	68,931
Subcontractor General Requirements	$	14,985
G&A	$	53,706
Overhead	$	19,181
Tax	$	27,333
Contingency	$	95,904
Bonding& Insurance	$	-
Fee	$	46,379
Total Year 1 Operations and Maintenance	**$**	**626,118**
Annual Operations and Maintenance Cost: Years 2-5		
Routine System O&M	$	194,020
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	48,851
Subcontractor General Requirements	$	10,620
G&A	$	38,061
Overhead	$	13,593
New Mexico Gross Receipts Tax	$	19,370
Contingency	$	67,966
Bonding& Insurance	$	-
Fee	$	32,869
Total Annual Operations and Maintenance Cost: Years 2-5	**$**	**443,725**
Annual Operations and Maintenance Cost: Years 6-14		
Routine System O&M	$	177,644
Reporting (Annual Reports)	$	18,375
Professional Services [1]	$	48,851
Subcontractor General Requirements	$	10,620
G&A	$	35,769
Overhead	$	12,774
New Mexico Gross Receipts Tax	$	18,204
Contingency	$	63,872
Bonding& Insurance	$	-
Fee	$	30,889
Total Annual Operations and Maintenance Cost: Years 6-14	**$**	**416,997**
Post Closure Cost		
Closure Reporting	$	18,375
Equipment Demobilization and Well Abandonment	$	126,500
Professional Services [1]	$	47,809
Subcontractor General Requirements	$	7,244
G&A	$	27,990
Overhead	$	9,996
New Mexico Gross Receipts Tax	$	14,245
Contingency	$	49,982
Bonding& Insurance	$	6,043
Fee	$	24,171
Total Post Closure Cost	**$**	**332,354**
TOTAL PRESENT WORTH	**$**	**9,491,217**

NOTES:
1 - Professional Services includes Project Management, Design/Technical Support, and Construction Management.
2 - The cost estimates provided are to an accuracy of +50 percent to -30 percent and are prepared for the sole purpose of alternative comparison. The alternative cost estimates are in 2006 dollars and are based on conceptual design from information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables.

009942

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Site Background Data

Elevation of Site = 4100 ft amsl or 12.68 psia

Volume of Contaminated Ground Water greater than 5 ug/L= 7,350 acre-ft based on JSAI model

Volume of Contaminated Ground Water greater than 1 ug/L= 25,700 acre-ft based on JSAI model

PCE Concentrations in wells sampled December 2005.

Sample Location	PCE (μg/L)
MW-SF1	11
MW-SF10	17
GWMW01 Port 2	21
GWMW01 Port 6	6
	14 μg/L, average concentration

Pumping Rates for Plume Containment and Remediation: 14 Years (per JSAI modeling)

CLC-18 460 gpm

CLC-27 620 gpm

New Well #1 to replace operation of CLC-18 after 5 years per JSAI modeling 300 gpm

Total Annual: Years 1-5 568 MMgal

Total Annual: Years 6-14 484 MMgal

Mass Estimate

Mass of PCE above MCL in ground water = 150 kg of PCE — based on JSAI model - JSAI estimate based on an effective porosity of 20% and does not address potential PCE mass in additional pore space

Conceptual Design

Pumping System Design Parameters

Estimated Number of Pumping Wells = 3 wells

Estimated pumping rate from CLC-18 = 460 gpm (based on JSAI modeling results)

Estimated pumping rate from CLC-27 = 620 gpm (based on JSAI modeling results)

Estimated pumping rate from New Well = 300 gpm (to replace operation of CLC-18 after 5 years)

Total Pumping Rate in Years 1-5= 1,080 gpm (assumes CLC-18 and 27 only)

Total Pumping Rate in Years 6-14= 920 gpm (assumes CLC-27 and new well only)

Depth of new pumping well = 450 ft bgs

System Construction Time

Estimated drilling rate = 125 lf/day based on invoice

Total linear footage drilling = 900 lf

Estimated duration of drilling = 7.2 days or 8 days (rounded up)

Estimated linear footage of field piping per pumping well = 1500 ft per well average of piping required for all wells

Total linear footage of connection piping = 500 lf assumed 500 lf to stub up to treatment system and reconnect to existing CLC-27 line to UGR

Total linear footage of effluent field piping= 1,000 lf connection of CLC-18 to CLC -27 connection to Upper Griggs Reservoir; CLC estimated 1000 lf new piping needed in addition to the approximate length of 500 lf of existing piping.

Total linear footage of effluent field piping= 750 lf estimated connection of new well to CLC -27 connection to Upper Griggs Reservoir

Estimated field piping placing rate = 75 lf/day

Estimated duration of field piping = 30.0 days or 30 days (rounded up)

Total construction timeframe = 38 days

Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

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ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
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Air Stripper Design Parameters
Stripper design flowrate 1,080 gpm
Unit flow rate 540 gpm (NEEP Model 41251 Tray Air stripper) 2 units in series needed for treatment
Governing contaminant PCE at 14 µg/L
Governing contaminant is based on consideration of a combination of low Henry's Constant and highest concentration versus MCL.
Influent temperature 50 ^{o}F

Unit Size: 12.5 ft x 7.3 ft NEEP Model 41251 Tray Air stripper

The Henry's Law Constant for PCE (25^{o}C) = 176.5 atm
Converting the Henry's Constant for an actual temperature of 10 ^{o}C and using STRIPR Model data (CH2M HILL, 1991)
Actual Henry's Constant is 224 atm which is greater than the 10 atm threshold for effective air stripping.

Assume 100% of PCE is stripped and discharged untreated to the atmosphere. PCE is the controlling contaminant for air stripper design.
Vendor modeling indicates the Tray Air stripper uses a blower airflow rate of 2,400 scfm
PCE emissions 0.007 lbs/hr or 0.18 lbs/day or 65.2 lbs/yr
Average PCE emissions concentration is 0.8 mg/m^3 or 0.2 ppmv

PCE is a hazardous air pollutant and therefore is a regulated air pollutant

The NIOSH PEL (10-hr TWA) for PCE is 25 ppmv or 136.5 mg/m^3 or at 68^{o}F and 1 atm
THEREFORE, NO OFFGAS EMISSIONS CONTROL WILL BE REQUIRED SINCE MASS EMISSIONS IS VERY LOW AND
THE CONCENTRATION IS TWO ORDERS OF MAGNITUDE LOWER THAN THE NIOSH STANDARD WITHOUT CONSIDERING ATMOSPHERIC DISPERSION.

Pretreatment Design Parameters - Langlier Index and Ryznar Stability Index for CaCO3 Scaling Potential

		1 (influent water)	2 (estimate of parameters within the stripper)
Flow	gpm	1080	1080
Temperature	Deg . F	60	77
Alkalinity, Total	mg/l $CaCO_3$	211	211
pH	Std. Units	7.39	8.00
TDS	mg/l	919	919
Calcium	mg/l $CaCO_3$	305	305
Magnesium	mg/l $CaCO_3$	124	123.6
Sulfate	mg/l SO_4^{2-}	243	243
Chloride	mg/l Cl^-	165	165
LSI		**0.170**	**0.936**
RSI		**7.05**	**6.13**

LSI greater than 1 indicates potential for scaling
RSI less than 6 indicates potential for scaling

The LSI is close to the level indicating potential for scaling
The RSI, which is more commonly used, is close to the level that indicates that there is a potential for scaling once the stripping process begins.
Slight changes in parameters affect the results of these calculations.

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

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DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 119 working days (includes 80 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit		Unit Cost		Cost	Comments and References
Construction							
Underground Piping from CLC-18 to CLC-27 connection to Upper Griggs Reservoir	1,000	ft	$	100.17	$	100,170	estimated LF from CLC: cost includes 10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Underground Piping from new extraction well to CLC-27 connection to Upper Griggs Reservoir	750	ft	$	100.17	$	75,128	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Piping Connection to Treatment System	500	lf	$	100.17	$	50,085	10-inch pipe, trenching, backfill, compacting, asphalt repaving (RS Means)
Pumping Well Modifications	2	ea	$	25,000.00	$	50,000	JSP Memo 7/8/06
Ground Water Extraction Well Installation	1	well	$	200,000.00	$	200,000	JSP Memo 7/8/06
Ground Water Extraction Pumps	3	ea	$	10,000.00	$	30,000	assume new + replace city pumps, vendor quote; 100gpm, 15 hp, 3-phase, 230V, 6 inch
Influent Equalization Tank	21,600	gal	$	1.00	$	21,600	provides 20-minutes of storage
Tank Effluent Pump	0	ea	$	4,000.00	$	-	included with air stripper
Influent and Effluent Bag Filters	2	LS	$	7,500.00	$	15,000	1080 gpm size filter
Low-Profile Tray Air Stripper Package	2	LS	$	70,000.00	$	140,000	Assume 540 gpm NEEP Model 41251 Tray Air stripper (controls, piping, skid, blower, influent and effluent pumps)
Protective Enclosure	1	ea	$	150,000.00	$	150,000	Assume 30'x25' building at $200/sf, includes overhead crane, pre-fab metal
Repair discharge line on CLC-27	1	LS	$	300.00	$	300	
Sulfuric Acid Bulk Storage Tank - Pretreatment Unit	0	LS	$	65,663.20	$	-	5,000 gal tank. 1 month supply, prorated costs for similar system, 1,000 gal unit at Fruit Ave, Albuquerque
Dessicant Dryer Unit - Pretreatment Unit	0	LS	$	39,397.92	$	-	5,000 gal unit. prorated costs for similar system, 1,000 gal unit at Fruit Ave, Albuquerque
Acid Feed Pump System - Pretreatment Unit	0	LS	$	83,384.29	$	-	Prorated costs for similar system, 100 gpm system at Fruit Ave, Albuquerque.
Acid Feed System Piping - Pretreatment Unit	0	LS	$	44,923.64	$	-	Prorated costs based on facility size for similar system, 100 gpm at Fruit Ave, Albuquerque
Health and Safety Provisions - Pretreatment Unit	0	LS	$	8,000.00	$	-	Prorated costs for similar system, 100 gpm at Fruit Ave, Albuquerque
Acid Storage Facility - Pretreatment Unit	0	LS	$	89,847.27	$	-	Assume 35'x35' for 5,000 gal tank incl. canopy, 2 ° concrete containment, and fencing. Prorated costs for similar system, 1,000 gal tank system at Fruit Ave, Albuquerque
Well Permits	1	ea	$	30.00	$	30	new extraction well
Equipment Rental	24	wk	$	200.00	$	4,800	MultiRAE
Subtotal Capital Cost					$	837,113	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 119 working days (includes 80 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
Site Work Allowance	7%	of	$ 837,112.50	$ 58,598	
Mechanical Allowance	15%	of	$ 837,112.50	$ 125,567	
Instrumentation and Controls Allowance	12%	of	$ 837,112.50	$ 100,454	including SCADA system
Electrical Allowance	12%	of	$ 837,112.50	$ 100,454	
Miscellaneous Equipment Allowance	5%	of	$ 837,112.50	$ 41,856	
Subtotal Capital Cost				$ 1,264,040	
Project Management	8%	of	$ 1,264,039.88	$ 101,123	
Design	15%	of	$ 1,264,039.88	$ 189,606	
Construction Management	15%	of	$ 1,264,039.88	$ 189,606	
Subcontractor General Requirements	5%	of	$ 1,264,039.88	$ 63,202	
Subtotal Capital Cost				$ 1,807,577	
G&A	14%	of	$ 1,807,577.02	$ 253,061	
Overhead	5%	of	$ 1,807,577.02	$ 90,379	
New Mexico Gross Receipts Tax	7.125%	of	$ 1,807,577.02	$ 128,790	
Contingency	25%	of	$ 1,807,577.02	$ 451,894	
Subtotal Capital Cost				$ 2,731,701	
Bonding& Insurance	2%	of	$ 2,731,700.77	$ 54,634	
Fee	8%	of	$ 2,731,700.77	$ 218,536	
TOTAL CAPITAL COST				**$ 3,004,871**	

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COST ESTIMATE DETAILS

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Assumptions

1. The accuracy of the cost estimate is +50%/-30%
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8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
CAPITAL COST					
YEAR 1 OPERATIONS AND MAINTENANCE					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments**
System Startup					
Labor - Technician	100	hr	$ 75.00	$ 7,500	Assume 10 days for startup, 10 hrs/day
Labor - Engineer	70	hr	$ 120.00	$ 8,400	Assume 7 days for startup, 10 hrs/day
Air Sample Analysis	6	sample	$ 150.00	$ 900	quarterly sampling to prove de minimis VOC emissions, plus 2 QA/QC
Water Sample Analysis	6	sample	$ 150.00	$ 900	3 sets, VOC analysis for infl/effl, incl data valid.
Startup Equipment Rental	2	week	$ 1,000.00	$ 2,000	water quality monitoring for pretreatment effectiveness
Total *System Startup*				$ 19,700	
Routine System O&M					
Labor - Technician	208	hr	$ 75.00	$ 15,600	4 hours/week
Labor - Engineer	208	hr	$ 120.00	$ 24,960	100% of the Tech time for first year
Water Sample Analysis	29	sample	$ 150.00	$ 4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Air Sample Analysis	0	sample	$ 100.00	$ -	none needed after startup
Acid Supply - Pretreatment Unit	0	LS	$ 110,067.27	$ -	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$ 4,000.00	$ 4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$ 0.08	$ 47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$ 194.73	$ 110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*				$ 206,500	
Reporting (Annual Report and Construction Completion Report)					
Labor - Engineer/Hydrogeologist	400	hr	$ 120.00	$ 48,000	
Labor - Editor	200	hr	$ 85.00	$ 17,000	
Labor - CAD Technician	100	hr	$ 85.00	$ 8,500	
Total *Annual Reporting*				$ 73,500	
Subtotal Year 1 Operations and Maintenance				$ 299,700	
Project Management	8%	of	$ 299,699.82	$ 23,976	
Technical Support	15%	of	$ 299,699.82	$ 44,955	
Construction Management	0%	of	$ 299,699.82	$ -	
Subcontractor General Requirements	5%	of	$ 299,699.82	$ 14,985	
Subtotal Year 1 Operations and Maintenance				$ 383,616	

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3. The number of new nested monitor wells required to be installed	0	wells	included under ground water monitoring
4. Number of new ground water extraction wells to be installed =	1	wells	
5. Number of piezometers to be installed =	0	piezometers	included under ground water monitoring
6. Number of reinjection wells to be installed=	0	wells	
7. Assume that the duration of construction is	119	working days (includes 80 working days for treatment system construction and installation)	
8. The number of wells to be sampled for VOCs is	0	wells per round	included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is	1	wells	includes new extraction wells only
10. The G&A rate is	14%		
11. The overhead rate is	5%		
12. The Bonding & Insurance rate is	2%		
13. The fee rate is	8%		

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
G&A	14%	of	$ 383,615.77	$ 53,706	
Overhead	5%	of	$ 383,615.77	$ 19,181	
New Mexico Gross Receipts Tax	7.125%	of	$ 383,615.77	$ 27,333	
Contingency	25%	of	$ 383,615.77	$ 95,904	
Subtotal Year 1 Operations and Maintenance				$ 579,739	
Bonding& Insurance	0%	of	$ 579,739.34	$ -	Bonding only applies to Capital Costs
Fee	8%	of	$ 579,739.34	$ 46,379	
TOTAL YEAR 1 OPERATIONS AND MAINTENANCE COST				**$ 626,118**	

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7. Assume that the duration of construction is 119 working days (includes 80 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 2-5 (ANNUAL COST)							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments**
Routine System O&M							
Labor - Technician	208	hr	$	75.00	$	15,600	4 hours/week
Labor - Engineer	104	hr	$	120.00	$	12,480	50% of the Tech time
Water Sample Analysis	29	sample	$	150.00	$	4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Acid Supply - Pretreatment Unit	0	LS	$	110,067.27	$	-	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$	4,000.00	$	4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$	0.08	$	47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	568	MMGal	$	194.73	$	110,538	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*					$	194,020	
Reporting (Annual Reports)							
Labor - Engineer/Hydrogeologist	100	hr	$	120.00	$	12,000	
Labor - Editor	50	hr	$	85.00	$	4,250	
Labor - CAD Technician	25	hr	$	85.00	$	2,125	
Total *Reporting*					$	18,375	
Subtotal Year 2-5 Operations and Maintenance					$	212,395	
Project Management	8%	of	$	212,394.82	$	16,992	
Technical Support	15%	of	$	212,394.82	$	31,859	
Construction Management	0%	of	$	212,394.82	$	-	
Subcontractor General Requirements	5%	of	$	212,394.82	$	10,620	
Subtotal Year 2-5 Operations and Maintenance					$	271,865	
G&A	14%	of	$	271,865.37	$	38,061	
Overhead	5%	of	$	271,865.37	$	13,593	
New Mexico Gross Receipts Tax	7.125%	of	$	271,865.37	$	19,370	
Contingency	25%	of	$	271,865.37	$	67,966	
Subtotal Year 2-5 Operations and Maintenance					$	410,857	
Bonding& Insurance	0%	of	$	410,856.55	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$	410,856.55	$	32,869	
TOTAL ANNUAL COST: YEARS 2-5 OPERATIONS AND MAINTENANCE COS'					**$**	**443,725**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 119 working days (includes 80 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 6-14 (ANNUAL COST)							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments**
Routine System O&M							
Labor - Technician	208	hr	$	75.00	$	15,600	4 hours/week
Labor - Engineer	104	hr	$	120.00	$	12,480	50% of the Tech time
Water Sample Analysis	29	sample	$	150.00	$	4,350	monthly infl/effl sampling for permit, plus 20% extra for QA/QC
Acid Supply - Pretreatment Unit	0	LS	$	110,067.27	$	-	Prorated from 100 gpm system at Fruit Ave.
O&M Supplies and Cleaning Subcontractor	1	LS	$	4,000.00	$	4,000	Annual air stripper tray cleaning by subcontractor
Electricity	588,146	kw-hr	$	0.08	$	47,052	Air Stripper: 25 hp blowers + (2) 10 hp pumps per unit, full-time operations
Annual Extraction Well and Distribution Operating Cost	484	MMGal	$	194.73	$	94,162	98-99 avg costs provided by City, 3% inflation factor added per year for 2006 values (used avg. for CLC 19, 21, 27)
Total *Routine System O&M*					$	177,644	
Reporting (Annual Reports)							
Labor - Engineer/Hydrogeologist	100	hr	$	120.00	$	12,000	
Labor - Editor	50	hr	$	85.00	$	4,250	
Labor - CAD Technician	25	hr	$	85.00	$	2,125	
Total *Reporting*					$	18,375	
Subtotal Year 6-14 Operations and Maintenance					$	196,019	
Project Management	8%	of	$	212,394.82	$	16,992	
Technical Support	15%	of	$	212,394.82	$	31,859	
Construction Management	0%	of	$	212,394.82	$	-	
Subcontractor General Requirements	5%	of	$	212,394.82	$	10,620	
Subtotal Year 6-14 Operations and Maintenance					$	255,489	
G&A	14%	of	$	255,489.36	$	35,769	
Overhead	5%	of	$	255,489.36	$	12,774	
New Mexico Gross Receipts Tax	7.125%	of	$	255,489.36	$	18,204	
Contingency	25%	of	$	255,489.36	$	63,872	
Subtotal Year 6-14 Operations and Maintenance					$	386,108	
Bonding& Insurance	0%	of	$	386,108.29	$	-	Bonding only applies to Capital Costs
Fee	8%	of	$	386,108.29	$	30,889	
TOTAL ANNUAL COST: YEARS 6-14 OPERATIONS AND MAINTENANCE COST					**$**	**416,997**	

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested monitor wells required to be installed 0 wells — included under ground water monitoring
4. Number of new ground water extraction wells to be installed = 1 wells
5. Number of piezometers to be installed = 0 piezometers — included under ground water monitoring
6. Number of reinjection wells to be installed= 0 wells
7. Assume that the duration of construction is 119 working days (includes 80 working days for treatment system construction and installation)
8. The number of wells to be sampled for VOCs is 0 wells per round — included under ground water monitoring
9. The number of wells on-site to be abandoned for post-closure is 1 wells — includes new extraction wells only
10. The G&A rate is 14%
11. The overhead rate is 5%
12. The Bonding & Insurance rate is 2%
13. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST

Item/Activity	Qty	Unit	Unit Cost	Cost	Comments and References
POST CLOSURE COST					
Item/Activity	Qty	Unit	Unit Cost	Cost	Comments
Closure Reporting					
Labor - Engineer/Hydrogeologist	100	hr	$120.00	$ 12,000	
Labor - Editor	50	hr	$85.00	$ 4,250	
Labor - CAD Technician	25	hr	$85.00	$ 2,125	
Total *Closure Reporting*				$ 18,375	
Equipment Demobilization and Well Abandonment					
Well Abandonment	1	well	$ 10,000.00	$ 10,000	new extraction wells only, others included under ground water monitoring
Equipment Demobilization	1	LS	$ 100,000.00	$ 100,000	
Subtotal Equipment Demobilization and Well Abandonment				$ 110,000	
Site Work Allowance	10%	of	$ 110,000.00	$ 11,000	
Mechanical Allowance	0%	of	$ 110,000.00	$ -	
Instrumentation and Controls Allowance	0%	of	$ 110,000.00	$ -	
Electrical Allowance	5%	of	$ 110,000.00	$ 5,500	
Miscellaneous Equipment Allowance	0%	of	$ 110,000.00	$ -	
Total *Equipment Demobilization and Well Abandonment*				$ 126,500	
Subtotal Post-Closure Cost				$ 144,875	
Project Management	8%	of	$ 144,875.00	$ 11,590	
Technical Support	15%	of	$ 144,875.00	$ 21,731	
Construction Management	10%	of	$ 144,875.00	$ 14,488	
Subcontractor General Requirements	5%	of	$ 144,875.00	$ 7,244	
Subtotal Post-Closure Cost				$ 199,928	
G&A	14%	of	$ 199,927.50	$ 27,990	
Overhead	5%	of	$ 199,927.50	$ 9,996	
New Mexico Gross Receipts Tax	7.125%	of	$ 199,927.50	$ 14,245	
Contingency	25%	of	$ 199,927.50	$ 49,982	
Subtotal Post-Closure Cost				$ 302,140	
Bonding& Insurance	2%	of	$ 302,140.43	$ 6,043	
Fee	8%	of	$ 302,140.43	$ 24,171	
TOTAL POST CLOSURE COST				**$ 332,354**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

PRESENT WORTH ANALYSIS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Ground Water Extraction and Treatment with Air Stripper without Acid Pretreatment
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. Real Discount Rate 3.00% Source: OMB Ciruclar No. A-94, Jan. 2007 version of Appendix C obtained from http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html
2. Assumes Total PV earns interest for an entire year (12 months), compound annually.
3. Escalation factor is 3.00%

Present Worth Analysis

		E	A	B	C=A+B	A*E	B*E	C*E	
Elapsed Time	**Year**	**Discount Factor at 3%**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Total PV Capital Costs at 3%**	**Total PV O&M Costs at 3%**	**Total PV Costs at 3%**	**Balance of Interest Bearing Account at 3%**
0	2007	1.000	$ 3,004,871		$ 3,004,871	$ 3,004,871	$ -	$ 3,004,871	$ 6,680,936
1	2008	0.971		$ 644,902	$ 644,902	$ -	$ 626,118	$ 626,118	$ 6,217,115
2	2009	0.943		$ 470,748	$ 470,748	$ -	$ 443,725	$ 443,725	$ 5,918,758
3	2010	0.915		$ 484,870	$ 484,870	$ -	$ 443,725	$ 443,725	$ 5,596,905
4	2011	0.888		$ 499,416	$ 499,416	$ -	$ 443,725	$ 443,725	$ 5,250,413
5	2012	0.863		$ 514,399	$ 514,399	$ -	$ 443,725	$ 443,725	$ 4,878,094
6	2013	0.837		$ 497,916	$ 497,916	$ -	$ 416,997	$ 416,997	$ 4,511,583
7	2014	0.813		$ 512,854	$ 512,854	$ -	$ 416,997	$ 416,997	$ 4,118,692
8	2015	0.789		$ 528,239	$ 528,239	$ -	$ 416,997	$ 416,997	$ 3,698,166
9	2016	0.766		$ 544,086	$ 544,086	$ -	$ 416,997	$ 416,997	$ 3,248,702
10	2017	0.744		$ 560,409	$ 560,409	$ -	$ 416,997	$ 416,997	$ 2,768,942
11	2018	0.722		$ 577,221	$ 577,221	$ -	$ 416,997	$ 416,997	$ 2,257,472
12	2019	0.701		$ 594,538	$ 594,538	$ -	$ 416,997	$ 416,997	$ 1,712,822
13	2020	0.681		$ 612,374	$ 612,374	$ -	$ 416,997	$ 416,997	$ 1,133,461
14	2021	0.661	$ 502,716	$ 630,745	$ 1,133,461	$ 332,354	$ 416,997	$ 749,351	$ 0
Total Alternative 4 Enhanced Ground Water E>			**$ 3,507,587**	**$ 7,672,719**	**$ 11,180,306**	**$ 3,337,225**	**$ 6,153,991**	**$ 9,491,217**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE SUMMARY [2]

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Capital Cost		
Construction	$	1,002,005
Project Management	$	80,160
Design	$	50,100
Construction Management	$	100,201
Subcontractor General Requirements	$	50,100
G&A	$	179,559
Overhead	$	64,128
New Mexico Gross Receipts Tax	$	91,383
Contingency	$	320,642
Bonding& Insurance	$	38,766
Fee	$	155,062
Administrative/Legal Fees for IC	$	15,000
Total Capital Cost	**$**	**2,147,107**
Annual Operations and Maintenance Cost: Years 1-5		
Monthly Water Level Measurements (Piezometers)	$	13,750
Annual Ground Water Sampling (Monitor Wells)	$	77,850
Professional Services [1]	$	21,068
Subcontractor General Requirements	$	4,580
G&A	$	16,415
Overhead	$	5,862
New Mexico Gross Receipts Tax	$	8,354
Contingency	$	29,312
Bonding& Insurance	$	3,544
Fee	$	14,175
Total Annual Operations and Maintenance Cost: Years 1-5	**$**	**194,910**
Annual Operations and Maintenance Cost: Years 6-14		
Once Every Two Years Ground Water Sampling	$	43,750
Professional Services [1]	$	10,063
Subcontractor General Requirements	$	2,188
G&A	$	7,840
Overhead	$	2,800
New Mexico Gross Receipts Tax	$	3,990
Contingency	$	14,000
Bonding& Insurance	$	1,693
Fee	$	6,770
Total Annual Operations and Maintenance Cost: Years 6-14	**$**	**93,093**
Five Year Review Cost Per Report		
5-year Review Report	$	25,000
Professional Services [1]	$	-
Subcontractor General Requirements	$	-
G&A	$	3,500
Overhead	$	1,250
New Mexico Gross Receipts Tax	$	1,781
Contingency	$	6,250
Bonding& Insurance	$	-
Fee	$	3,023
Total Five Year Review Cost Per Report	**$**	**40,804**
Post Closure Cost		
Well Abandonment	$	104,280
Professional Services [1]	$	39,626
Subcontractor General Requirements	$	5,214
G&A	$	20,877
Overhead	$	7,456
New Mexico Gross Receipts Tax	$	10,625
Contingency	$	37,280
Bonding& Insurance	$	4,507
Fee	$	18,029
Total Post Closure Cost	**$**	**247,894**
TOTAL PRESENT WORTH	**$**	**4,288,996**

NOTES:
1 - Professional Services includes Project Management, Design/Technical Support, and Construction Management.
2 - The cost estimates provided are to an accuracy of +50 percent to -30 percent and are prepared for the sole purpose of alternative comparison. The alternative cost estimates are based on conceptual design from information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables.

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Alternative 4 - Enhanced Ground Water Extraction with Treatment

SITE DATA AND ALTERNATIVE CONCEPTUAL DESIGN

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

NO DESIGN ACTIVITY FOR INSTITUTIONAL CONTROLS AND MONITORING PORTION OF THIS ALTERNATIVE.
REFER TO COST DETAILS SHEET COST BASIS.

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested MWs to be installed 3 with 3 screens for a total of 4125 ft
4. The number of new single-screen piezometers required to be installed 10 piezometers
5. The number of wells to be sampled for NAIPs is 0 wells not necessary for entire plume treatment
6. The number of wells to be sampled for VOCs only is 84 wells (includes all existing MWs in ground water sampling program plus new monitor wells)
7. The number of wells on-site to be abandoned for post-closure is 94 wells
8. The number of wells to be sampled for PAH is 0
9. The G&A rate is 14%
10. The overhead rate is 5%
11. The Bonding & Insurance rate is 2%
12. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
Construction							
Nested Ground Water Monitor Well Installation	3	well	$	129,409.00	$	388,227	per recent MW installation invoice
Piezometer Installation	10	piezometer	$	56,469.38	$	564,694	Assume 600' deep, with same per-foot cost as nest MWs.
Fencing (Institutional Control)	0	ft	$	10.00	$	-	No treatment unit to protect
Well Permits	19	ea	$	30.00	$	570	For 3 screen nested wells and 10 piezometers
Equipment Rental	4	wk	$	200.00	$	800	MultiRAE
Subtotal Capital Cost					$	954,291	
Site Work Allowance	5%	of	$	954,290.82	$	47,715	
Mechanical Allowance	0%	of	$	954,290.82	$	-	
Instrumentation and Controls Allowance	0%	of	$	954,290.82	$	-	
Electrical Allowance	0%	of	$	954,290.82	$	-	
Miscellaneous Equipment Allowance	0%	of	$	954,290.82	$	-	
Subtotal Capital Cost					$	1,002,005	
Project Management	8%	of	$	1,002,005.36	$	80,160	
Design	5%	of	$	1,002,005.36	$	50,100	
Construction Management	10%	of	$	1,002,005.36	$	100,201	
Subcontractor General Requirements	5%	of	$	1,002,005.36	$	50,100	
Subtotal Capital Cost					$	1,282,567	
G&A	14%	of	$	1,282,566.86	$	179,559	
Overhead	5%	of	$	1,282,566.86	$	64,128	
New Mexico Gross Receipts Tax	7.125%	of	$	1,282,566.86	$	91,383	
Contingency	25%	of	$	1,282,566.86	$	320,642	
Subtotal Capital Cost					$	1,938,279	
Bonding& Insurance	2%	of	$	1,938,279.17	$	38,766	
Fee	8%	of	$	1,938,279.17	$	155,062	
Administrative/Legal Fees for IC	1	LS	$	15,000.00	$	15,000	
TOTAL CAPITAL COST					**$**	**2,147,107**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested MWs to be installed 3 with 3 screens for a total of 4125 ft
4. The number of new single-screen piezometers required to be installed 10 piezometers
5. The number of wells to be sampled for NAIPs is 0 wells not necessary for entire plume treatment
6. The number of wells to be sampled for VOCs only is 84 wells (includes all existing MWs in ground water sampling program plus new monitor wells)
7. The number of wells on-site to be abandoned for post-closure is 94 wells
8. The number of wells to be sampled for PAH is 0
9. The G&A rate is 14%
10. The overhead rate is 5%
11. The Bonding & Insurance rate is 2%
12. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments and References**
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 1-5 (ANNUAL COST)					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments**
Monthly Water Level Measurements (Piezometers)					
Labor - Technician	180	hr	$ 75.00	$ 13,500	30 piezometers per event, 2 people, 4 piezometers per hour
Water Level Measurement Equipment Rental	1	LS	$ 250.00	$ 250	
Total *Water Level Measurement*				$ 13,750	
Annual Ground Water Sampling (Monitor Wells)					
Subcontractor costs for mulitport wells	1	LS	$ 15,200.00	$ 15,200	5 multiport wells: based on Dec 2005 invoice (4 days including mobe/demobe, materials, equipment, labor, per diem)
Labor - Technician	632	hr	$ 75.00	$ 47,400	4 hrs/well, 2 people, not including 5 multiport wells
Ground Water Sample Analysis - VOC only	97	sample	$ 150.00	$ 14,550	Includes all wells plus 15% (on average #) QA/QC samples
Ground Water Sample Analysis - NAIP	0	sample	$ 600.00	$ -	Includes 15% (on average #) QA/QC samples
Sampling Supplies	1	round	$ 200.00	$ 200	
GW Sampling Equipment Rental	1	round	$ 500.00	$ 500	
Total Annual *Ground Water Sampling*				$ 77,850	
Subtotal Years 1-5 Operations and Maintenance				$ 91,600	
Project Management	8%	of	$ 91,600.00	$ 7,328	
Technical Support	15%	of	$ 91,600.00	$ 13,740	
Construction Management	0%	of	$ 91,600.00	$ -	
Subcontractor General Requirements	5%	of	$ 91,600.00	$ 4,580	
Subtotal Years 1-5 Operations and Maintenance				$ 117,248	
G&A	14%	of	$ 117,248.00	$ 16,415	
Overhead	5%	of	$ 117,248.00	$ 5,862	
New Mexico Gross Receipts Tax	7.125%	of	$ 117,248.00	$ 8,354	
Contingency	25%	of	$ 117,248.00	$ 29,312	
Subtotal Years 1-5 Operations and Maintenance				$ 177,191	
Bonding& Insurance	2%	of	$ 177,191.04	$ 3,544	
Fee	8%	of	$ 177,191.04	$ 14,175	
TOTAL ANNUAL COST: YEARS 1-5 OPERATIONS AND MAINTENANCE COST				**$ 194,910**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested MWs to be installed 3 with 3 screens for a total of 4125 ft
4. The number of new single-screen piezometers required to be installed 10 piezometers
5. The number of wells to be sampled for NAIPs is 0 wells not necessary for entire plume treatment
6. The number of wells to be sampled for VOCs only is 84 wells (includes all existing MWs in ground water sampling program plus new monitor wells)
7. The number of wells on-site to be abandoned for post-closure is 94 wells
8. The number of wells to be sampled for PAH is 0
9. The G&A rate is 14%
10. The overhead rate is 5%
11. The Bonding & Insurance rate is 2%
12. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

Item/Activity	Qty	Unit		Unit Cost		Cost	Comments
CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
ANNUAL OPERATIONS AND MAINTENANCE COST - YEARS 6-14 (ANNUAL COST)							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments**
Quarterly Water Level Measurements							
Labor - Technician	60	hr	$	75.00	$	4,500	30 piezometers per event, 2 people, 4 piezometers per hour
Water Level Measurement Equipment Rental	1	LS	$	250.00	$	250	
Total *Water Level Measurement*					$	4,750	
Once Every Two Years Ground Water Sampling							
Subcontractor costs for mulitport wells	1	LS	$	7,600.00	$	7,600	5 multiport wells: based on Dec 2005 invoice (4 days [biennial] including mobe/demobe, materials, equipment, labor, per diem)
Labor - Technician	316	hr	$	75.00	$	23,700	4 hrs/well, 2 people, not including 5 multiport wells
Ground Water Sample Analysis - VOC only	49	sample	$	150.00	$	7,350	Includes all wells plus 15% (on average #) QA/QC samples
Sampling Supplies	0.5	round	$	200.00	$	100	
GW Sampling Equipment Rental	0.5	round	$	500.00	$	250	
Total *Semiannual Ground Water Sampling*					$	39,000	
Subtotal Years 6-14 Operations and Maintenance					$	43,750	
Project Management	8%	of	$	43,750.00	$	3,500	
Technical Support	15%	of	$	43,750.00	$	6,563	
Construction Management	0%	of	$	43,750.00	$	-	
Subcontractor General Requirements	5%	of	$	43,750.00	$	2,188	
Subtotal Years 6-14 Operations and Maintenance					$	56,000	
G&A	14%	of	$	56,000.00	$	7,840	
Overhead	5%	of	$	56,000.00	$	2,800	
New Mexico Gross Receipts Tax	7.125%	of	$	56,000.00	$	3,990	
Contingency	25%	of	$	56,000.00	$	14,000	
Subtotal Years 6-14 Operations and Maintenance					$	84,630	
Bonding& Insurance	2%	of	$	84,630.00	$	1,693	
Fee	8%	of	$	84,630.00	$	6,770	
TOTAL ANNUAL COST: YEARS 6-14 OPERATIONS AND MAINTENANCE COST					**$**	**93,093**	

009957

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested MWs to be installed 3 with 3 screens for a total of 4125 ft
4. The number of new single-screen piezometers required to be installed 10 piezometers
5. The number of wells to be sampled for NAIPs is 0 wells not necessary for entire plume treatment
6. The number of wells to be sampled for VOCs only is 84 wells (includes all existing MWs in ground water sampling program plus new monitor wells)
7. The number of wells on-site to be abandoned for post-closure is 94 wells
8. The number of wells to be sampled for PAH is 0
9. The G&A rate is 14%
10. The overhead rate is 5%
11. The Bonding & Insurance rate is 2%
12. The fee rate is 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments and References**
FIVE YEAR REVIEW COST - PER REPORT					
Item/Activity	**Qty**	**Unit**	**Unit Cost**	**Cost**	**Comments**
5-year Review Report					
5-year Review Report	1	LS	$ 25,000.00	$ 25,000	
Subtotal Five Year Review Cost				$ 25,000	
Project Management	0%	of	$ 25,000.00	$ -	
Technical Support	0%	of	$ 25,000.00	$ -	
Construction Management	0%	of	$ 25,000.00	$ -	
Subcontractor General Requirements	0%	of	$ 25,000.00	$ -	
Subtotal Five Year Review Cost				$ 25,000	
G&A	14%	of	$ 25,000.00	$ 3,500	
Overhead	5%	of	$ 25,000.00	$ 1,250	
New Mexico Gross Receipts Tax	7.125%	of	$ 25,000.00	$ 1,781	
Contingency	25%	of	$ 25,000.00	$ 6,250	
Subtotal Five Year Review Cost				$ 37,781	
Bonding& Insurance	0%	of	$ 37,781.25	$ -	
Fee	8%	of	$ 37,781.25	$ 3,023	
TOTAL FIVE YEAR REVIEW COST - PER REPORT				**$ 40,804**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

COST ESTIMATE DETAILS

PROJECT:	Griggs and Walnut Superfund Site Feasibility Study
SITE:	Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE:	4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION:	Institutional Controls and Monitoring
PREPARED BY:	L.Colella, T.Palaia
PROJECT NUMBER:	346535.FS.01

Assumptions

1. The accuracy of the cost estimate is +50%/-30%
2. See "Conceptual Design" spreadsheet for basis of cost estimate assumptions.
3. The number of new nested MWs to be installed | 3 | with 3 screens for a total of | 4125 | ft
4. The number of new single-screen piezometers required to be installed | 10 | piezometers
5. The number of wells to be sampled for NAIPs is | 0 | wells — not necessary for entire plume treatment
6. The number of wells to be sampled for VOCs only is | 84 | wells (includes all existing MWs in ground water sampling program plus new monitor wells)
7. The number of wells on-site to be abandoned for post-closure is | 94 | wells
8. The number of wells to be sampled for PAH is | 0
9. The G&A rate is | 14%
10. The overhead rate is | 5%
11. The Bonding & Insurance rate is | 2%
12. The fee rate is | 8%

Detailed Capital and Operations and Maintenance Costs

CAPITAL COST							
Item/Activity	**Qty**	**Unit**		**Unit Cost**		**Cost**	**Comments and References**
POST CLOSURE COST							
Item/Activity	Qty	Unit		Unit Cost		Cost	Comments
Well Abandonment							
Well Abandonment	94	well		$ 1,000.00	$	94,000	Assume abandon 5 wells/day
Equipment Rental	4	wk		$ 200.00	$	800	MultiRAE
Total *Well Abandonment*					$	94,800	
Site Work Allowance	10%		of	$ 94,800.00	$	9,480	
Mechanical Allowance	0%		of	$ 94,800.00	$	-	
Instrumentation and Controls Allowance	0%		of	$ 94,800.00	$	-	
Electrical Allowance	0%		of	$ 94,800.00	$	-	
Miscellaneous Equipment Allowance	0%		of	$ 94,800.00	$	-	
Total *Well Abandonment*					$	104,280	
Subtotal Post-Closure Cost					$	104,280	
Project Management	8%		of	$ 104,280.00	$	8,342	
Technical Support	15%		of	$ 104,280.00	$	15,642	
Construction Management	15%		of	$ 104,280.00	$	15,642	
Subcontractor General Requirements	5%		of	$ 104,280.00	$	5,214	
Subtotal Post-Closure Cost					$	149,120	
G&A	14%		of	$149,120.40	$	20,877	
Overhead	5%		of	$149,120.40	$	7,456	
New Mexico Gross Receipts Tax	7.125%		of	$149,120.40	$	10,625	
Contingency	25%		of	$149,120.40	$	37,280	
Subtotal Post-Closure Cost					$	225,358	
Bonding& Insurance	2%		of	$225,358.20	$	4,507	
Fee	8%		of	$225,358.20	$	18,029	
TOTAL POST CLOSURE COST					**$**	**247,894**	

Alternative 4 - Enhanced Ground Water Extraction with Treatment

PRESENT WORTH ANALYSIS

PROJECT: Griggs and Walnut Superfund Site Feasibility Study
SITE: Griggs and Walnut Superfund Site - Las Cruces, New Mexico
ALTERNATIVE: 4 Enhanced Ground Water Extraction with Treatment
DESCRIPTION: Institutional Controls and Monitoring
PREPARED BY: L.Colella, T.Palaia
PROJECT NUMBER: 346535.FS.01

Assumptions

1. Real Discount Rate 3.00% Source: OMB Ciruclar No. A-94, Jan. 2007 version of Appendix C obtained from http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html
2. Assumes Total PV earns interest for an entire year (12 months), compound annually.
3. Escalation factor is 3.00%

Present Worth Analysis

		E	A	B	C=A+B	A*E	B*E	C*E	
Elapsed Time	**Year**	**Discount Factor at 3%**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Total PV Capital Costs at 3%**	**Total PV O&M Costs at 3%**	**Total PV Costs at 3%**	**Balance of Interest Bearing Account at 3%**
0	2007	1.000	$ 2,147,107		$ 2,147,107	$ 2,147,107	$ -	$ 2,147,107	$ 2,206,146
1	2008	0.971		$ 200,757	$ 200,757	$ -	$ 194,910	$ 194,910	$ 2,065,550
2	2009	0.943		$ 206,780	$ 206,780	$ -	$ 194,910	$ 194,910	$ 1,914,533
3	2010	0.915		$ 212,984	$ 212,984	$ -	$ 194,910	$ 194,910	$ 1,752,596
4	2011	0.888		$ 219,373	$ 219,373	$ -	$ 194,910	$ 194,910	$ 1,579,220
5	2012	0.863		$ 273,257	$ 273,257	$ -	$ 235,714	$ 235,714	$ 1,345,141
6	2013	0.837		$ 111,158	$ 111,158	$ -	$ 93,093	$ 93,093	$ 1,271,003
7	2014	0.813		$ 114,493	$ 114,493	$ -	$ 93,093	$ 93,093	$ 1,191,206
8	2015	0.789		$ 117,927	$ 117,927	$ -	$ 93,093	$ 93,093	$ 1,105,477
9	2016	0.766		$ 121,465	$ 121,465	$ -	$ 93,093	$ 93,093	$ 1,013,532
10	2017	0.744		$ 179,946	$ 179,946	$ -	$ 133,897	$ 133,897	$ 858,593
11	2018	0.722		$ 128,862	$ 128,862	$ -	$ 93,093	$ 93,093	$ 751,623
12	2019	0.701		$ 132,728	$ 132,728	$ -	$ 93,093	$ 93,093	$ 637,461
13	2020	0.681		$ 136,710	$ 136,710	$ -	$ 93,093	$ 93,093	$ 515,773
14	2021	0.661	$ 374,962	$ 140,812	$ 515,773	$ 247,894	$ 93,093	$ 340,987	$ -
Total Alternative 4 Enhanced Ground Water E:			**$ 2,522,069**	**$ 2,297,253**	**$ 4,819,322**	**$ 2,395,001**	**$ 1,893,995**	**$ 4,288,996**	

APPENDIX C

State and Local Concurrence Letters

State of New Mexico
ENVIRONMENT DEPARTMENT
Office of the Secretary
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502-6110
Telephone: (505) 827-2855
Fax: (505) 827-2836

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

CINDY PADILLA
DEPUTY SECRETARY

May 29, 2007

Mr. Samuel J. Coleman, P.E.
Director
Superfund Division
USEPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: Concurrence on Record of Decision for the Griggs and Walnut Ground Water Plume Superfund Site, Las Cruces, New Mexico, EPA CERCLIS ID #NM0002271286

Dear Mr. Coleman, Sam

The New Mexico Environment Department (NMED) has reviewed the United States Environmental Protection Agency's (EPA) Draft Record of Decision (ROD) for the Griggs and Walnut Ground Water Plume Superfund Site located in Las Cruces, New Mexico.

NMED concurs with the remedial actions outlined in the draft ROD to address ground water contamination associated with this Site. The selected remedy **Enhanced Ground Water Extraction with Treatment** includes treatment of ground water and hydraulic control relying, to the extent possible, on existing City of Las Cruces municipal wells. Additionally, the remedy will be supported by interim institutional controls, long-term monitoring, and annual reviews and reporting.

Concurrence with the ROD is based on the facts presented in the draft ROD (dated May 24, 2007) and on available data collected to date. NMED understands that any changes to the selected remedy and ROD will require NMED's concurrence. Therefore, as in the past, NMED requests that EPA continue to work closely with NMED project staff on design and implementation of the remedy. NMED also understands that any new information associated with this site, including adverse health risks or data regarding the extent of contamination and migration of contaminants, identified during subsequent design investigations and not presented in this draft ROD will be addressed by EPA as part of this Superfund site.

The plan is a culmination of work conducted by the EPA, the City of Las Cruces, Dona Ana County, and NMED. NMED appreciates the continued supportive working relationship with EPA in these matters. If you have any questions, please call me at (505) 827-2855, or Sabino Rivera of my staff at (505) 827-0387.

Sincerely,

Ron Curry
Secretary

RC:sr

cc: Buddy Parr, EPA Remedial Branch Team Leader
Petra Sanchez, EPA Remedial Project Manager
Jorge Garcia, PhD, PE, JSP Director for City of Las Cruces
Ed Fridenstine, JSP Associate Director for Dona Ana County
Dana Bahar, NMED Superfund Oversight Section Manager
Sabino Rivera, NMED Project Manager

JOINT SUPERFUND PROJECT
CITY OF LAS CRUCES AND DOÑA ANA COUNTY

22 January 2007

RECEIVED BY [signature] DATE 1/26/07

Petra Sanchez, Project Manager
Superfund Division
USEPA Region 6
1445 Ross Ave, Suite 1200 (6SF-LT)
Dallas, TX 75202-2733

Re: **Letter of Concurrence on the Selected Remedy in EPA's Proposed Plan for the Griggs and Walnut Groundwater Plume Site, Las Cruces, NM, November 2006**

Dear Ms. Sanchez:

The Joint Superfund Project with authority from the Amended Memorandum of Understanding signed by Terrence Moore, City Manager, and Brian Haines, County Manager, (effective as of October 2, 2006) concurs with the selection of Enhanced Groundwater Extraction with Treatment (Alternative 4) as the proposed remedy. The JSP Team also agrees with air stripping as the preferred treatment technology to remove PCE, with the understanding that the final treatment process will be determined during the Remedial Design phase of the remediation.

Please contact Dan Santantonio, JSP Manager, if you have questions, or need additional information regarding this matter.

Sincerely,

Jorge Garcia, PhD, PE
JSP Director
for City of Las Cruces

Ed Fridenstine, ARM
JSP Associate Director
for Dona Ana County

cc: Dana Bahar, Superfund Oversight Section, NMED
Dan Santantonio, JSP Manager, CLC

PROJECT DIRECTOR:
JORGE A. GARCIA, PH.D., P.E.,
UTILITIES DIRECTOR
UTILITIES DEPARTMENT
PO 20000, LAS CRUCES, NM 88004
(505)528-3511, FAX:(505)528-3619
jogarcia@las-cruces.org

PROJECT MANAGER:
DAN SANTANTONIO, PH.D.
REGULATORY AND ENVIRONMENTAL SERVICES ADMINISTRATOR
UTILITIES DEPARTMENT
(505)528-3548, FAX:(505)528-3619
dsantantonio@las-cruces.org