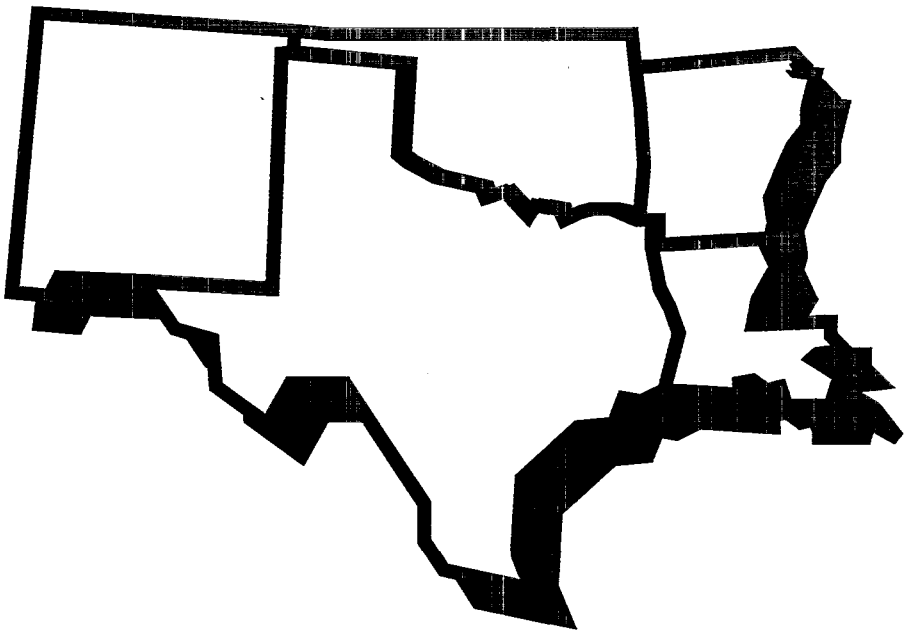
RESPONSE ACTION CONTRACT

United States Environmental Protection Agency Region VI

Contract No. 68-W6-0036



CH2MHILL

In Association With:

Science Applications International Corporation

Geomarine, Inc.

000252

Engineering Evaluation/Cost Analysis
City of Perryton Well No. 2 Site
Perryton, Texas

Work Assignment No. 034-NSEE-06DH
DCN 99-1411

000253

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EPA Work Assignment No. 034-NSEE-06DH
CH2M HILL Project No. 151498
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Prepared for:
U.S. Environmental Protection Agency

Prepared by:

CH2M HILL, Inc.
July 28, 1999

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Acronyms

ARAR	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
AL	action limits
ATM	atmosphere
bgs	below ground surface
CAS	Columbia Analytical Services Laboratory
CERCLA	Comprehensive Emergency Response and Comprehensive Liability Act
cm/S	centimeters per second
COC	contaminants of concern
COPC	contaminants of potential concern
CTC	carbon tetrachloride
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
GAC	granular activated carbon
GC	gas chromatograph
gpm	gallons per minute
LHA	Lifetime Health Advisory
MCL	maximum contaminant level
mg/L	milligrams per liter
mS/cm	microseimens per centimeter
mV	millivolts
NCP	National Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priority List
O&M	Operations and Maintenance
ORP	oxidation-reduction potential
PEX	Perryton Equity Exchange
ppb	parts per billion
PRG	preliminary remediation goal
PRP	potentially responsible party
RA	removal action
RBC	risk-based concentration
RIFS	remedial investigation and feasibility study
RUP	Restricted Use Pesticide
SARA	Superfund Amendments and Reauthorization Act
TAL	target analyte list
TBC	to-be-considered
TCL	target compound list
TDH	Texas Department of Health
TDS	total dissolved solids
TMV	toxicity, mass, volume
TNRCC	Texas Natural Resource Conservation Commission
TOC	total organic carbon
TSS	total suspended solids
TWC	Texas Water Commission
TWDB	Texas Water Development Board
ug/L	micrograms per liter

USGS	U.S. Geological Survey
VOC	volatile organic compound
WHP	Wellhead Protection Program

Executive Summary

This Engineering Evaluation/Cost Analysis (EE/CA) report presents an evaluation of non-time critical removal action (RA) alternatives for the Perryton Well No. 2 site located in Perryton, Texas. The evaluation was conducted in accordance with the Comprehensive Emergency Response and Comprehensive Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Well No. 2 is an inactive municipal well located in the northern part of Perryton. The well is adjacent to an elevated grain storage facility and a railroad. The well operated from approximately 1946 to early 1989 when use was suspended due to the detection of carbon tetrachloride (CTC) in water samples collected from the well. The source and distribution of CTC is unknown, however at least three potential sources were identified in an Expanded Site Investigation (ESI) Report completed in 1996 (EPA, 1996). These sources include the elevated grain storage facility, the Well No. 2 well house, and a potential dry well near the site. The Well No. 2 well house is considered a potential source of the CTC because the product was allegedly stored near the well and construction of the well is such that vertical migration of contaminants along the well annulus is possible. There is the potential that the well condition has deteriorated over the years as evidenced by a recent pump failure, corrosion of pump appurtenances, and a significant difference between the alleged constructed total depth and the one recently measured.

Limited groundwater sampling was performed at Well No. 2 as part of the EE/CA and the reported concentration of CTC in the groundwater samples ranged from 38.3 to 42.5 ug/L. The maximum contaminant level (MCL) for CTC is 5 ug/L. Previous investigations including the ESI have reported CTC at concentrations up to 50.3 ug/L. Two herbicides, atrazine and propazine, were also detected in recent and historical groundwater samples below MCLs or risk based concentrations. Nitrate, not analyzed in previous sampling events, was detected during the recent sampling at levels between 16.8 and 17.9 mg/L. The corresponding MCL for nitrate is 10 mg/L. Lead was detected above action levels during the ESI but was not detected above the action level during the recent sampling. The source of lead detected in 1996 may have been the pump or pump appurtenances, which were not present during the recent sampling. The City operates 10 other wells for the production of drinking water and none of these other wells presently contain CTC, pesticides, lead, or nitrates above applicable criteria.

The only domestic supply wells in the northern part of Perryton are Wells No. 1 and No. 2. The lack of pumping at Well No. 2 has created pressure problems within the City's distribution system while also resulting in additional pumping of Well No. 1 to compensate for inactivity at Well No. 2. This has led to concerns about the potential for drawing CTC toward Well No. 1 and other City wells located downgradient of Well No. 2. A water study completed for the City in 1998 (GAE, 1998) recommended construction of another municipal well to overcome the pressure problems. As a result of these concerns, the site was listed on the National Priorities List (NPL) in 1998.

The purpose of the EE/CA is to evaluate removal actions related to groundwater contamination identified at Well No. 2 in terms of providing an adequate supply of drinking water to the northern parts of Perryton. Using recent groundwater data, a streamlined evaluation of risks to human health

was performed to establish a basis for remediation goals. The risk evaluation shows that the current contaminants in groundwater provide a basis for remediation to protect public health.

Based on a review of historical data, collection of additional site data, and the results of the streamlined human health risk evaluation, the objective of the RA is to provide a permanent, cost-effective, potable water supply to the City of Perryton relative to the reported CTC contamination. A secondary objective of the removal action is to provide limited control of CTC plume migration until a full-scale remedy is implemented, potentially following completion of a remedial investigation and feasibility study (RIFS), anticipated to begin later this year.

To address these objectives, the cleanup criteria was set at MCLs established for public drinking water supplies.

Three alternatives were evaluated to address the removal scope, goals, objectives, and cleanup level established for CTC. These alternatives are as follows:

- **Alternative 1.** No action.- This alternative involves no response actions and maintaining the system at status quo. The no action alternative is included as required by the National Contingency Plan (NCP) to provide an absolute no action alternative for comparison purposes. Well No. 2 will not be put back in service and no new wells will be installed. The City of Perryton will continue to use water according to the current practices. As the population of Perryton grows, water conservation practices may be required during the high water demand months. The evaluation of this alternative assumes that no other efforts are implemented to augment the City water supply.

  The present net worth cost estimate for Alternative 1 is $0

- **Alternative 2.** Treatment of water from Well No. 2 to address CTC. This alternative involves installation and operation of a treatment system at the existing well location, which for this alternative is assumed to be fully operational (concerns about the condition of this well may need to be addressed before a treatment system is installed). The treatment system will remove CTC to levels below MCLs. The treatment system consists of a low-profile air stripper and a discharge pump. Air stripping was selected from several treatment technologies that were screened for use in Alternative 2. As part of this alternative, nitrate will be addressed via blending with water from Well No. 1. Wells No. 1 and No. 2 already share a common ground storage tank located at the Well No. 2 site. The U.S. Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC) have determined that Well No. 2 will be operated at approximately 140 gallons per minute (gpm) in order to treat groundwater containing nitrate to levels not exceeding 7 mg/L. Costs for blending were not evaluated during this EE/CA.

  The present net worth cost estimate for Alternative 2 is $517,868 assuming that the EPA would fund operations and maintenance (O&M) over 10 years. Total capital costs are $257,664 and O&M costs are $260,204 ($37,047 per year for 10 years at 7 percent effective interest).

- **Alternative 3.** Installation of a new public supply well. This alternative consists of installing a new 400-gpm well in a new location north and west of the current Well No. 2 location. This well would be placed outside the contaminant plume and it is assumed that water from this well would meet all applicable federal and state drinking water standards. Alternative 3 assumes that the existing Well No. 2 would be abandoned. It is assumed that the new well would be in operation for 8 hours per day in order to satisfy the water demands in the northern parts of the City.

  The present net worth cost estimate for Alternative 3 is $286,132, excluding O&M costs. The City would perform O&M as part of its routine operations.

A comparative analysis of the three alternatives in terms of effectiveness, implementability, and cost was conducted. In terms of effectiveness, only Alternative 2 is considered effective at both complying with applicable or relevant and appropriate requirements (ARARs) and to some extent, mitigating the movement of contaminated groundwater. Neither Alternative 1 nor Alternative 3 address the potential movement of the CTC plume to downgradient wells, including any downgradient wells constructed in the future.

All the alternatives are implementable. The City and TNRCC have indicated in previous correspondence that a pump and treat system using air stripping is the desired alternative. Air stripping is a well established treatment technology and one used successfully for the treatment of CTC.

The order of magnitude cost estimates for Alternatives 2 and 3 are considered accurate to +50 to -30 percent for the quantities and methods assumed. There is no cost for Alternative 1. For this evaluation, it was assumed that O&M charges would be included for only Alternative 2. Both Alternatives are similar in capital cost. Over a period of 10 years, O&M costs are approximately $260,204 for Alternative 2.

Section 1

Introduction

Section 300.415(b)(4)(I) of the NCP requires that an EE/CA be performed for all non-time critical removal actions under CERCLA. The goals of an EE/CA are to identify the objectives of a removal action and to analyze the effectiveness, implementability, and cost of various alternatives that may satisfy those objectives. This report presents the EE/CA for the City of Perryton Well No. 2 site, located in Perryton, Texas. The Well No. 2 site was proposed to the NPL on September 29, 1998, with a final listing on January 19, 1999.

Well No. 2 is an inactive municipal well that operated from approximately 1946 to early 1989 when use was suspended due to the detection of CTC in water samples collected from the well. The source and distribution of CTC is unknown; however, at least three potential sources have been identified. CTC has not been detected in any of the other 10 wells that the City operates for the production of drinking water. Wells No. 1 and No. 2 are the only wells in the northern part of Perryton. The lack of pumping of Well No. 2 has created pressure problems within the City's distribution system while also resulting in additional pumping of Well No. 1 to compensate for inactivity at Well No. 2. This has led to concerns about the potential for drawing CTC toward Well No. 1 and other wells located downgradient of Well No. 2.

The purpose of this EE/CA is to address CTC groundwater contamination relative to ensuring an adequate supply of drinking water to the northern parts of Perryton. Definition of the nature of the contamination has been based on previous investigations from 1989 through 1996 and limited field activities conducted as part of this EE/CA. Using this information, a streamlined evaluation of risks to human health has been conducted to establish a basis for remediation goals. A focused review of three alternatives (no action, wellhead treatment, and construction of a new well at an alternative location) has been performed. This EE/CA has been prepared using a site-specific streamlined approach to that described in EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993a).

Section 2

Site Characterization

A summary of the physical and operational characteristics of the City of Perryton Well No. 2 site is provided in this section. The information was obtained from past investigations as well as limited field activities that occurred during this project. Included in this section are a description of the nature of the contamination encountered as well as the results of a streamlined human health risk evaluation. This information is used as a basis for identification and selection of RA alternatives.

2.1 Site Description and Background

2.1.1 Site History

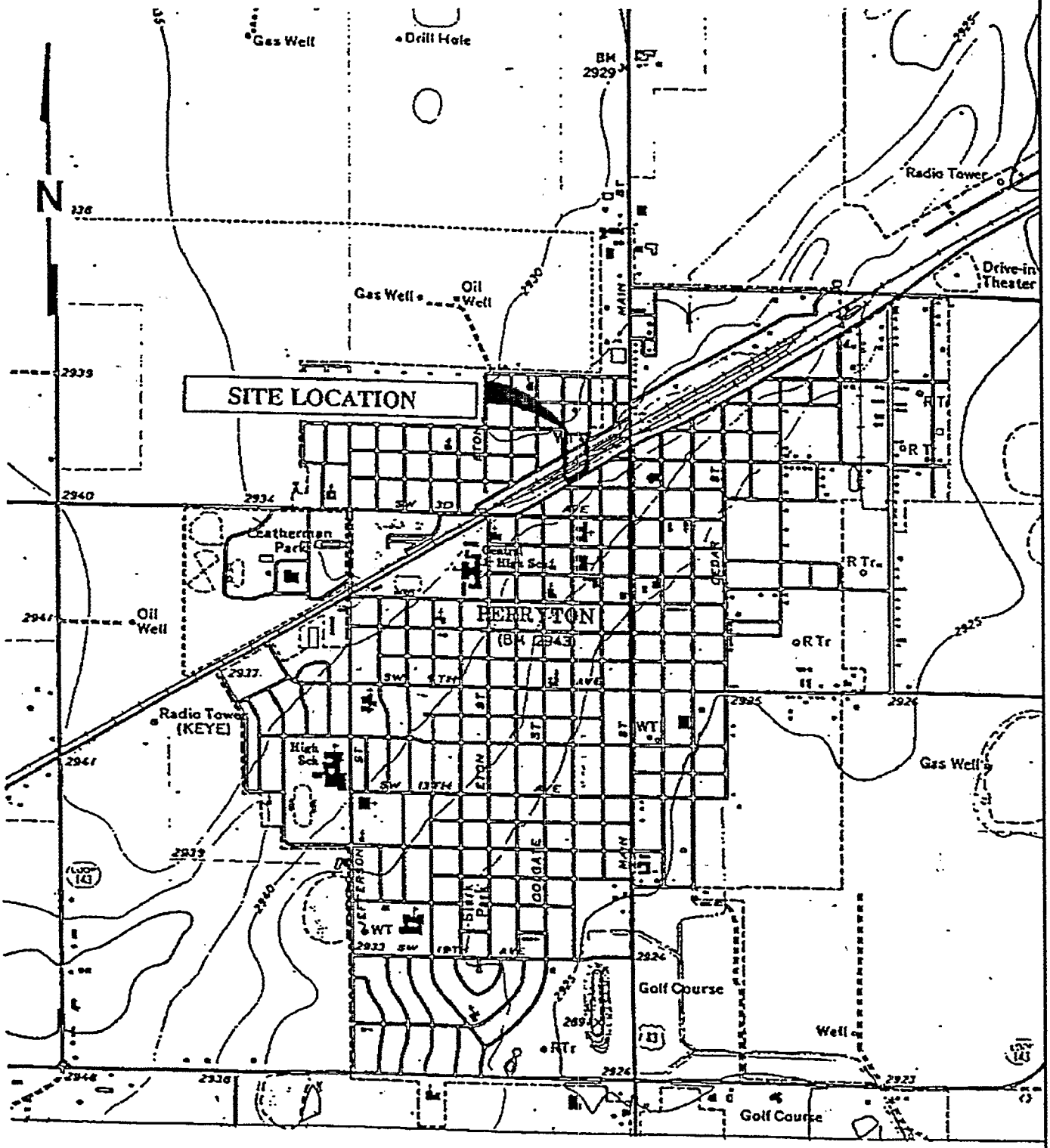
The City of Perryton Well No. 2 site is located within the City of Perryton in the northeastern corner of the Texas Panhandle (Figure 2-1). Well No. 2 is located in the northern half of the City, approximately 600 feet west of the intersection of North Amherst Street and Sante Fe Avenue and adjacent to the Southwestern Railroad. The well is situated within a fenced maintenance yard owned and operated by the City and located below a 75,000-gallon elevated storage tank. The approximate location of the well is shown on Figure 2-2. The geographic coordinates of the well are approximately 36°24'05" north latitude and 100°48'20" west longitude (USGS, 1973).

Well No. 2 is one of 11 municipal wells within the City used to provide drinking water. Groundwater is the sole source of drinking water for the City. Use of Well No. 2 was terminated in June 1989, upon discovery of CTC by the Texas Department of Health (TDH). The concentration of CTC has been detected at levels up to 50.3 micrograms per liter (ug/L) or parts per billion (ppb), which exceeds the MCL of 5 ug/L. Historically, CTC has been used as both a fumigant and for fire control. Neither the source of CTC or extent of CTC contamination in groundwater is known. Other contaminants encountered in Well No. 2 have included the herbicides atrazine and propazine. Elevated concentrations of lead were also detected during previous sampling.

2.1.2 Previous Investigations

Sampling of Well No. 2 first occurred in early 1989 shortly after the City began participation in the Texas Water Commission (TWC), Wellhead Protection Program (WHP). Preliminary sampling by the City revealed the presence of organic contaminants in the City's distribution system. Sampling by the TDH in May 1989 identified the contaminant as CTC at levels ranging from 9 to 25 ug/L. The TDH determined that the CTC originated from Well No. 2. The well was removed from service shortly thereafter and has not been in service since then.

In May 1989, the City attempted to flush the CTC from the well and discharged the water to an adjacent culvert. Post-flushing concentrations of CTC were similar to pre-flushing levels. In September 1990, the City submitted a report outlining a plan of action to address the CTC concentrations in Well No. 2 (City of Perryton, 1990). The report discussed the history of the site and identified the Perryton Equity Exchange (PEX), located directly south of the site as the most likely source of contamination (see Figure 2-2). The PEX is a former grain storage facility that used CTC as a grain fumigant prior to the compound's ban in 1986. The City's report documented that grain



BASE MAP FROM:

US DEPT OF THE INTERIOR
GEOLOGICAL SURVEY

PERRYTON 1973
PERRYTON SOUTHEAST 1973

TOPOGRAPHIC QUADRANGLE MAPS
7.5 MINUTE SERIES

SOURCE: EPA, 1996

0 1000 2000

SCALE IN FEET

FIGURE 2-1
SITE AREA MAP
CITY OF PERRYTON WELL NO. 2
PERRYTON, TEXAS

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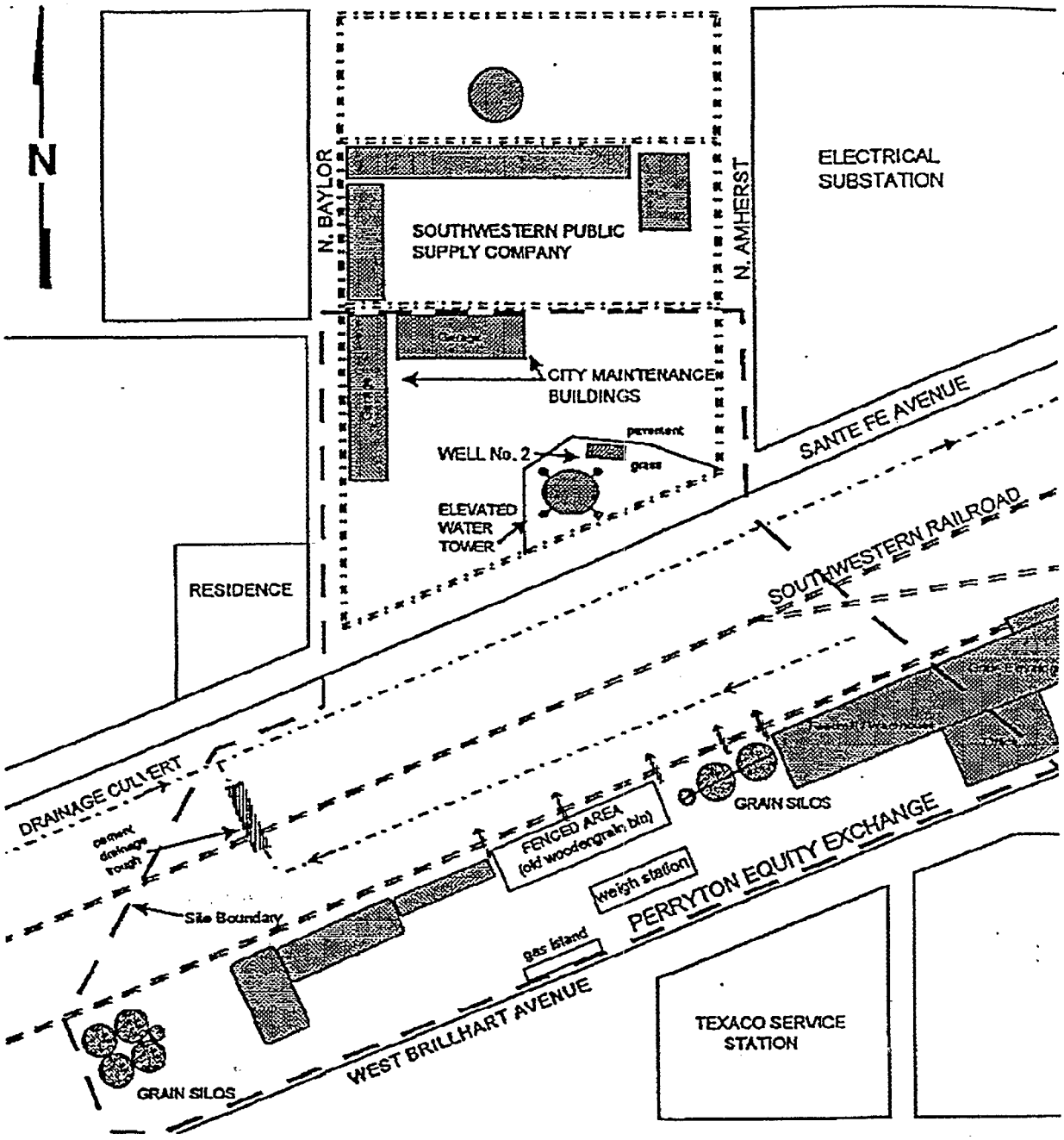

FIGURE 2-2
SITE PLAN
CITY OF PERRYTON WELL NO. 2
PERRYTON, TEXAS

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storage facilities have been implicated in similar groundwater contamination events (City of Perryton, 1990). The City also reported that a 30-gallon drum of CTC may have been stored in the Well No. 2 pump house. The City recommended that a treatment system, consisting of an air stripper, be installed so that the water from the well could be treated and continue to be used as a source of drinking water.

TWC resampled Well No. 2 in November 1990 and results from the sampling revealed CTC at 40 ug/L. Based on the reports that CTC may have been stored at Well No. 2, the TWC collected soil samples around and under the pump house. CTC, a highly volatile compound, was not detected in these samples (Strahl, 1992).

Subsequent to the activities of 1989 and 1990, the site underwent review by the TNRCC, (formerly the TWC) and EPA Region 6. In 1991, the TNRCC requested information from nearby property owners in an effort to identify potential sources of CTC. Three potential sources of CTC were identified and investigated. These sources are listed below.

- Drum of CTC allegedly stored within well house
- Perryton Equity Exchange
- A hand-dug well

Employee accounts of a 30-gallon drum of CTC stored in the well house could not be substantiated by the City and soils samples collected by the TNRCC did not show CTC. The PEX is located approximately 1,500 feet south of the well which used CTC as a fumigant prior to 1986. The hand-dug well was reportedly located approximately 600 feet northwest of Well No. 2, behind a machine shop and an old electric generating plant. Both facilities could have used CTC as a solvent or fire extinguisher. No information is available on the specific location of the hand-dug well, the well's construction, or its current status.

In 1992, the EPA tasked Roy F. Weston to complete a "Site Inspection Prioritization Report and Prescore Package" for the Perryton site. The report was completed in February 1993 (EPA, 1993b). The report determined that the site may be eligible for inclusion on the NPL if it could be found that the contamination were the result of improper use of pesticides and fumigants. The report recommended sampling all or some of the municipal wells and developing a monitoring program consistent with the State's requirements of the WHP program. Concern was raised about potential contaminant migration due to the lack of pumping from Well No. 2.

In November 1996, Roy F. Weston completed an ESI report for the EPA (1996). The site inspection included soil and groundwater sampling. Thirteen soil borings were advanced to depths between 37 and 67 feet below ground surface (bgs) in the area around Well No. 2 and suspected sources. There were no detections of CTC in any of the soil samples collected from the borings. Groundwater samples were obtained from Well No. 2 and each of the 10 other municipal wells. There were no organic compounds detected in the other municipal wells. However, CTC was found in groundwater from Well No. 2 at levels between 35.8 ug/L and 50.3 ug/L and chloroform was detected at levels between 4.2 ug/L and 4.9 ug/L. Atrazine and propazine were also detected there as tentatively

identified compounds. Lead was detected in groundwater at concentrations ranging from 35 ug/l to 60 ug/L, well above the action limit (AL) of 15 ug/L. The report identified concerns about the change in hydraulic gradient caused by increased pumping at Well No. 1 and lack of pumping from Well No. 2. The change in gradient could result in CTC being drawn toward Well No. 1.

In October 1997, the TNRCC prepared a removal assessment report (TNRCC, 1997). The report summarized previous investigation results and reiterated concerns about the potential movement of the contaminants toward Well No. 1 and downgradient wells. The TNRCC recommended that an air stripper be installed at Well No. 2 to remediate the CTC. Remediation of the CTC in this manner would allow the City to begin operation of Well No. 2 while also slowing the spread of contamination to downgradient areas. They also recommended initiation of a groundwater monitoring program to ensure that each of the City's 10 remaining wells are monitored for potential CTC contamination.

2.1.3 Site Environmental Setting

The City of Perryton is located in the Texas High Plains. The High Plains form a southeast sloping plateau consisting of level to gently rolling prairie. Large areas within the region, including the area surrounding Perryton, are poorly drained. Drainage features include playa lakes and shallow creeks. The climate is considered semi-arid. The area around the City is used for agricultural purposes and oil and gas production.

Perryton lies within the outcrop of the Ogallala Formation, a Tertiary-age (≤40 million years before present) sequence of river and eolian (windblown) deposits. The Ogallala Formation is the principal aquifer in the High Plains region and is the sole source of drinking water in Perryton. The formation includes upper and lower units that have distinct characteristics. The upper unit consists of well-indurated caliche-cemented sediments considered caprock (TWDB, 1993). The caliche-cemented sediments generally have a low permeability and may form a barrier to vertical contaminant migration. The lower deposits consist of sands and gravels and form the primary water bearing zone of the formation. All of Perryton's wells are screened across this lower unit, approximately 400 to 600 feet bgs.

The depth to groundwater in Perryton ranges from 260 to 340 feet bgs; this groundwater probably occurs under unconfined conditions. Groundwater flow is believed to follow the topographic gradient toward the south and southeast. Based on drawdown measurements obtained during the ESI (EPA, 1996), and an estimated saturated thickness of 175 feet, Weston reported a hydraulic conductivity for the Ogallala Formation of 1.78×10^{-2} centimeters per second (cm/S).

According to records provided by the City, Well No. 2 was constructed in 1946 to a total depth of 420 feet. The well consists of 16 inch casing and is screened from 330 to 415 feet. The annular space between the casing and borehole is filled with gravel from the base of the well to approximately 15 feet bgs. A cement grout seal occurs between 0 and 15 feet bgs. A 6-foot by 6-foot concrete foundation surrounds the wellhead. Based on the well construction, it is possible that contaminants

handled near the well could leach through the shallow subsurface and migrate along the well annulus.

Well No. 2 is located within approximately 130 feet of a large drainage canal situated between the maintenance yard and the PEX. Flow in the canal is toward the west. It has been suggested that contaminants flowing in the canal have the potential of leaching through the subsurface, migrating horizontally along the caliche layer and flowing toward the annular space at Well No. 2 (TNRCC, 1997).

2.2 Site Characterization Activities

2.2.1 Groundwater Sampling and Analysis

It was determined that further site characterization was necessary for the purposes of this EE/CA to verify the presence of lead in groundwater encountered during the ESI, as well as to gather further physical characterization data that may affect the treatment options for the use of Well No. 2 as potable water. Site characterization activities at the City of Perryton Well No. 2 consisted of sampling of groundwater for inorganics, organics, and physical parameters, and measurement of groundwater levels in Well No. 2 during the pumping period.

Field Procedures

Groundwater sampling for this effort consisted of time series sampling over an approximate 9-hour operation of Well No. 2. The sampling was conducted in accordance with the Sampling and Analysis Plan prepared for the investigation (EPA, 1999). Several weeks prior to the scheduled sampling, it was discovered that the pump in the municipal well was not operational. The original pump was pulled and it was noted that the pump bowls were corroded and one of the rods had sheared off. The City of Perryton installed a temporary 30-horsepower, 4-inch submersible pump in Well No. 2. Logs for the well show it to be drilled to 420 feet bgs; however, the temporary pump appeared to be resting at the bottom of the well at approximately 335 feet bgs, possibly due to an obstruction in the well. PVC piping was attached to the temporary pump to direct purge water toward the sanitary sewer, and a spigot was attached to the side of the piping for sampling purposes.

The pump test and groundwater sampling at Well No. 2 was begun and completed April 6, 1999. During the pump test, the well was sampled at five different intervals: immediately after the pump was turned on; after the first well volume (approximately 1,400 gallons); the 4th well volume (approximately 5,600 gallons); 50,000 gallons; and 100,000 gallons. Flow from the pump was monitored via an in-line flow-meter. All five samples and associated QC samples were submitted to the EPA environmental laboratory in Houston, Texas, for analysis of target analyte list (TAL) inorganics (filtered and unfiltered), target compound list (TCL) organics, selected herbicides (atrazine and propazine), and general chemistry parameters. Additional samples were collected at each interval for confirmatory analysis of lead (filtered and unfiltered). The confirmation lead samples were sent to Columbia Analytical Services Laboratory (CAS) in Kelso, Washington.

At the first, third, and fifth sample intervals, samples were also collected for analysis of ammonia, hardness, alkalinity, total dissolved solids (TDS), total suspended solids (TSS), and total organic

carbon (TOC). Samples for anion analysis were collected during the first, third, and fourth sample intervals (anions were collected during the fourth sample interval instead of the fifth sample interval to ensure the samples were shipped the day of sampling and analyzed within the 48-hour holding time). Water levels and water quality parameters, including temperature, conductivity, dissolved oxygen, pH, and oxidation-reduction potential (ORP), were also measured prior to collection of each sample as well as at several other intervals during the test.

The flow rate was set at 100 gpm for the initial 27 minutes of the test during collection of the first two samples, after which it was run at 200 gpm for 3 hours, then at approximately 220 gpm for the remainder of the test. Table 2-1 shows the sample collection time, sample parameters, and flow rates associated with each sample collected.

Table 2-1
Sample Parameters, City of Perryton Well No. 2 Site EE/CA

Sample Interval	Sample ID	Time	Parameters collected	Flow rate (gpm)	Cumulative Gallons purged
1	034-GW2-01	08:39	VOCs, Pesticides, unfiltered metals, unfiltered lead, Anions, Ammonia, Hardness, Alkalinity, TSS, TDS, TOC	100	600
	034-GW2-01F	08:39	Filtered metals, filtered lead	100	600
2	034-GW2-02	08:49	VOCs, Pesticides, unfiltered metals, unfiltered lead	100	1,600
	034-GW2-02F	08:49	Filtered metals, filtered lead	100	1,600
3	034-GW2-03	09:15	VOCs, Pesticides, unfiltered metals, unfiltered lead, Anions, Ammonia, Hardness, Alkalinity, TSS, TDS, TOC	200	5,700
	034-GW2-03F	09:15	Filtered metals, filtered lead	200	5,700
4	034-GW2-04	13:10	VOCs, Pesticides, unfiltered metals, unfiltered lead, Anions	220	50,000
	034-GW2-04F	13:10	Filtered metals, filtered lead	220	50,000
	034-GW2-Dup1	13:10	VOCs, Pesticides, unfiltered metals, unfiltered lead	220	50,000
	034-GW2-Dup1F	13:10	Filtered metals, filtered lead	220	50,000

Sample Interval	Sample ID	Time	Parameters collected	Flow rate (gpm)	Cumulative Gallons purged
5	034-GW2-05	17:10	VOCs, Pesticides, unfiltered metals, unfiltered lead, Ammonia, Hardness, Alkalinity, TSS, TDS, TOC	220	100,000
	034-GW2-05F	17:10	Filtered metals, filtered lead	220	100,000

The test was concluded after purging slightly over 100,000 gallons from the well.

2.2.2 Aquifer Analysis

Water level measurements were collected at Well No. 2 during performance of the pump test in order to evaluate aquifer characteristics. A static water level measurement was collected prior to operation of the pump. The water level dropped approximately 31 feet from 276.32 to 307.38 feet during the test. Further discussion of aquifer characteristics is presented in Section 2.3.5.

2.3 Site Characterization Results

2.3.1 Field Results

Water Quality Parameters

Water quality parameters that were measured in the field are presented on Table 2-2. As shown, conductivity, DO, pH, and ORP readings were all fairly consistent for the duration of the test. The higher temperature readings are most likely a result of higher ambient temperatures during collection of those readings. Submersible pumps will also build up heat, which is in turn transferred to the water being pumped.

Table 2-2
Water Quality Parameters, City of Perryton Well No. 2 Site EE/CA

Time	Temp (C)	Conductivity(mS/cm)	DO (mg/L)	pH	ORP (mV)
8:35	14.78	0.933	5.62	7.34	223.1
8:48	15.96	0.921	6.00	7.12	242.7
9:24	15.38	0.904	6.13	7.11	263.1
10:35	17.45	0.906	5.59	7.10	247.4
11:04	17.56	0.913	5.59	7.10	250.9

Time	Temp (C)	Conductivity(mS/cm)	DO (mg/L)	pH	ORP (mV)
13:10	19.01*	0.907	5.32	7.10	238.0
14:51	18.32	0.910	5.77	7.09	254.1
17:08	17.69	0.898	5.43	7.10	287.4

Notes:
* Higher temperature most likely due to higher ambient temperature during reading
mS/cm - microseimens per centimeter
ug/L - milligrams per liter
mV - milli volts

Based on the water quality parameter data, groundwater accessed via Well No. 2 appears to be under aerobic conditions, the pH is neutral and it is not under reducing conditions. These conditions indicate that no special requirements would be necessary in a groundwater treatment train.

Well Condition

As stated above, the original pump in Well No. 2 was not operational and had to be pulled. The pump was highly corroded and in poor condition. In addition, although the well construction information shows the well was constructed to approximately 420 feet bgs, the temporary pump could not be lowered past 335 feet bgs. Measurements of the total well depth with a weighted tape yielded similar results. The well annulus may have collapsed near this interval prior to removal of the original pump, or possibly during removal. Rust fragments were noted in the purge water throughout the test. The City filmed the well several weeks after the sampling and a report containing the findings is in preparation. These findings should be taken into consideration during selection of the final Well No. 2 RA remedy.

2.3.2 Analytical Results

Raw laboratory analytical results for all samples are provided in Appendix A. A summary of compounds detected at least once by the EPA laboratory is provided in Table 2-3. A summary of lead detections reported by CAS for the confirmatory samples is provided in Table 2-4. A draft data evaluation technical memorandum summarizing the data's usability was provided to the EPA under separate cover.

Table 2-4
Confirmation Lead Results: Summary of Detections in Groundwater, April 1999
City of Perryton Well No. 2 Site

Station	MRL	Time	Total Lead Results	Dissolved Lead Results
034-GW2-01	0.02	8:39	9.24	1.37
034-GW2-02	0.02	8:49	8.58	2.37
034-GW2-03	0.02	9:15	8.19	1.52
034-GW2-04	0.02	13:10	9.81	0.73
034-GW2-05	0.02	17:10	1.63	1.20
EQ BLANK	0.02	NA	ND	NA

Notes: All results in micrograms per liter (ug/L)
ND Not detected
MRL Method Reporting Limit
"F" Denotes filtered sample
NA Not applicable

Volatile Organic Compounds (VOCs)

CTC and chloroform were detected in each of the five samples obtained from Well No. 2. The two compounds occurred in the range of 38.3 to 42.5 ug/L and 4.4 to 4.8 ug/L, respectively. No other VOCs were detected. The concentrations of these compounds are similar to those reported in 1996.

Herbicides

Atrazine and propazine were also detected in each of the samples from Well No. 2. The reported levels of these compounds ranged from 5.47 to 0.72 ug/L and 5.74 to 0.97 ug/L, respectively. The concentrations of these compounds are similar to those reported in 1996.

Metals

Metals were detected in all of the samples. No significant concentrations were identified. However, when compared with sample results from 1996, several metals were detected at significantly lower concentrations than previously observed. These include aluminum, barium, chromium, copper, iron, lead, manganese, and zinc.

The primary difference between the 1996 and 1999 sampling events is that samples in 1996 were obtained from the well using the original pump while a submersible pump was utilized during the recent sampling. As mentioned in Section 2.2.1, the original pump malfunctioned when tested prior to the recent sampling and was subsequently pulled. The equipment removed from the well appeared to be highly corroded. The results suggest that many of elevated metals concentrations reported in 1996 are the possible result of contamination from the pump shaft and impellers. Lead was the only metal detected above action levels in 1996. Unfiltered lead was detected between 11.2 and 6.4 ug/L during the recent sampling event (below the action level). Filtered lead results are about half the

Table 2-3
Summary of Detections in Groundwater, April 1999
City of Perryton Well No. 2 Site
Perryton, Texas

000272

Station			034-GW2-01		034-GW2-01F*		034-GW2-02		034-GW2-02F		034-GW2-03		034-GW2-03F		034-GW2-04		034-GW2-04F		034-GW2-DUP1		034-GW2-DUP1F		034-GW2-05		034-GW2-05F		TRIP BLANK	
Time			8:39				8:49				9:15				13:10								17:10				N/A	
Parameter	Detection Limit	units	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif	Result	Qualif
Volatiles																												
Chloroform	2	ug/L	4.5	=			4.8	=			4.4	=			4.4	=			4.6	=			4.7	=			ND	U
Carbon tetrachloride	2	ug/L	40.8	=			42.5	=			38.3	=			39.1	=			39.6	=			42.5	=			ND	U
Pesticides																												
Atrazine	0.2	ug/L	5.47	=			3.88	=			1.31	=			0.82	=			0.83	=			0.72	=				
Propazine	0.2	ug/L	5.74	=			4.16	=			1.75	=			0.97	=			1.03	=			1.01	=				
Cations																												
Aluminum	100	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Antimony	60	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Arsenic	3	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Barium	10	ug/L	182	=	180	=	177	=	178	=	175	=	177	=	181	=	180	=	186	=	179	=	177	=	178	=		
Beryllium	5	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Cadmium	5	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Calcium	150	ug/L	106000	=	104000	=	101000	=	103000	=	101000	=	102000	=	102000	=	103000	=	104000	=	102000	=	100000	=	101000	=		
Chromium	10	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Cobalt	20	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Copper	20	ug/L	26	=	ND	U	24	=	ND	U	35	=	ND	U	30	=	ND	U	74	=	ND	U	ND	U	ND	U		
Iron	25	ug/L	240	=	ND	U	418	=	29	=	544	=	ND	U	707	=	ND	U	2550	=	ND	U	172	=	30	=		
Lead	3	ug/L	9.9	=	ND	U	9.2	=	3	=	6.4	=	ND	U	5.7	=	ND	U	11.2	=	ND	U	ND	U	ND	U		
Magnesium	150	ug/L	39600	=	39200	=	38500	=	38900	=	38500	=	38800	=	39500	=	39800	=	40500	=	39600	=	39100	=	39100	=		
Manganese	5	ug/L	8	=	7	=	11	=	5	=	12	=	ND	U	12	=	ND	U	28	=	ND	U	ND	U	ND	U		
Mercury	0.1	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Nickel	20	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Potassium	1000	ug/L	8580	=	8370	=	8420	=	8540	=	8360	=	8510	=	8550	=	8580	=	8790	=	8610	=	8490	=	8490	=		
Selenium	3	ug/L	ND	U	ND	U	ND	U	3.3	=	3.9	=	3.1	=	3.1	=	3.2	=	3.1	=	3.3	=	3.4	=	3.3	=		
Silver	10	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Sodium	500	ug/L	25400	=	25100	=	25000	=	25500	=	24800	=	25500	=	26000	=	26100	=	26200	=	25700	=	25800	=	26100	=		
Thallium	5	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Vanadium	30	ug/L	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U	ND	U		
Zinc	20	ug/L	338	=	348	=	326	=	310	=	215	=	224	=	202	=	191	=	215	=	189	=	199	=	162	=		
Hardness	5	mg/L	428	=							411	=											411	=				
Anions																												
Alkalinity, bicarbonate	np	mg/L	292	=							292	=											299	=				
Alkalinity, carbonate	np	mg/L	0	=							0	=											0	=				
Alkalinity, phenylpthalein	np	mg/L	0	=							0	=											0	=				
Alkalinity, total	np	mg/L	292	=							292	=											299	=				
Ammonia Nitrogen	np	mg/L	< 0.05	U							<0.05	U											< 0.05	U				
Chloride, ic	np	mg/L	65	=							62	=			64	=												
Fluoride, ic	np	mg/L	0.99	=							1.05	=			1.01	=												
Nitrogen, Nitrate, ic	np	mg/L	17.9	=							16.6	=			16.8	=												
Nitrogen, Nitrite, ic	np	mg/L	< 0.05	U							< 0.05	U			< 0.05	U												
Sulfate, ic	np	mg/L	28	=							26	=			27	=												
General Chemistry																												
Total Dissolved Solids	np	mg/L	570	=							520	=											572	=				
Total Organic Carbon	np	mg/L	< 1	U							< 1	U											< 1	U				
Total Suspended Solids	np	mg/L	9	=							3	=											< 1	U				
Volatile Suspented Solids	np	mg/L	< 1	U							1	=											< 1	U				

Notes:
[Shading] Analysis not performed
* "F" denotes filtered cation sample
np - not provided by laboratory
ND - not detected at the corresponding detection limit
U - analyte was analyzed for but not detected above the detection limit
= - analyte detected at the reported concentration

unfiltered concentration and suggest that some of the lead is coming from particulate matter. As discussed earlier, rust fragments were observed throughout sampling. None of the other metals occurred above the corresponding MCLs or action level.

The lead results in the confirmatory samples were similar to those reported above.

Nitrate

Elevated levels of nitrate were encountered in each of the samples. The concentrations ranged from 16.6 to 17.8 mg/L.

General Chemistry

The groundwater from Well No. 2 is considered very hard (428 mg/L). The dominant anions and cations are bicarbonate and calcium, respectively. The TDS concentration is low and reflects relatively fresh water (520 to 752 mg/L).

2.3.3 Trend Analysis

Figure 2-3 is a graph showing the concentration of selected analytes verses volume of water pumped from Well No. 2. The graph indicates that both lead and atrazine concentrations fell throughout the period of sampling whereas CTC and nitrate concentrations generally remained constant. The change in concentration of lead and atrazine is likely a result of dilution and suggests that the source of both analytes may be relatively close to the well if not the well itself. Neither contaminant is considered to be very mobile in a typical groundwater flow system. The relatively consistent concentration of CTC and nitrate throughout pumping may reflect their more mobile characteristics as well as a more distant source of contamination. Consequently, it is likely that atrazine and lead concentrations will continue to decrease with long term pumping if the well is put back into service. CTC and nitrate, on the other hand, may not unless the source area is completely captured.

The TSS drops with time and reflects the clearing of water with volume of water pumped from the well (9 to <1 mg/L). The elevated TSS levels early in the pumping may reflect the lack of pumping.

2.3.4 Nature of Contamination

Based on past and recent sampling, six contaminants of potential concern (COPC) were identified. Provided below is a summary of each contaminant including its characteristics and potential hazards.

Carbon Tetrachloride (CTC)

CTC is a volatile, dense liquid with a sweet odor. It has been widely used as a refrigerant, solvent, degreasing agent, and a grain fumigant. CTC is very stable in the environment with a half-life of between 30 and 100 years. Acute exposure to CTC has been shown to induce dizziness, nausea, and liver damage. CTC has been shown to be mildly hepatotoxic and nephrotoxic at chronic low-level doses, and there is evidence to suggest that it may be a teratogen. CTC is classified as a B2 carcinogen based upon animal studies. An MCL of 5 ug/L has been established for CTC (ATSDR, 1992).

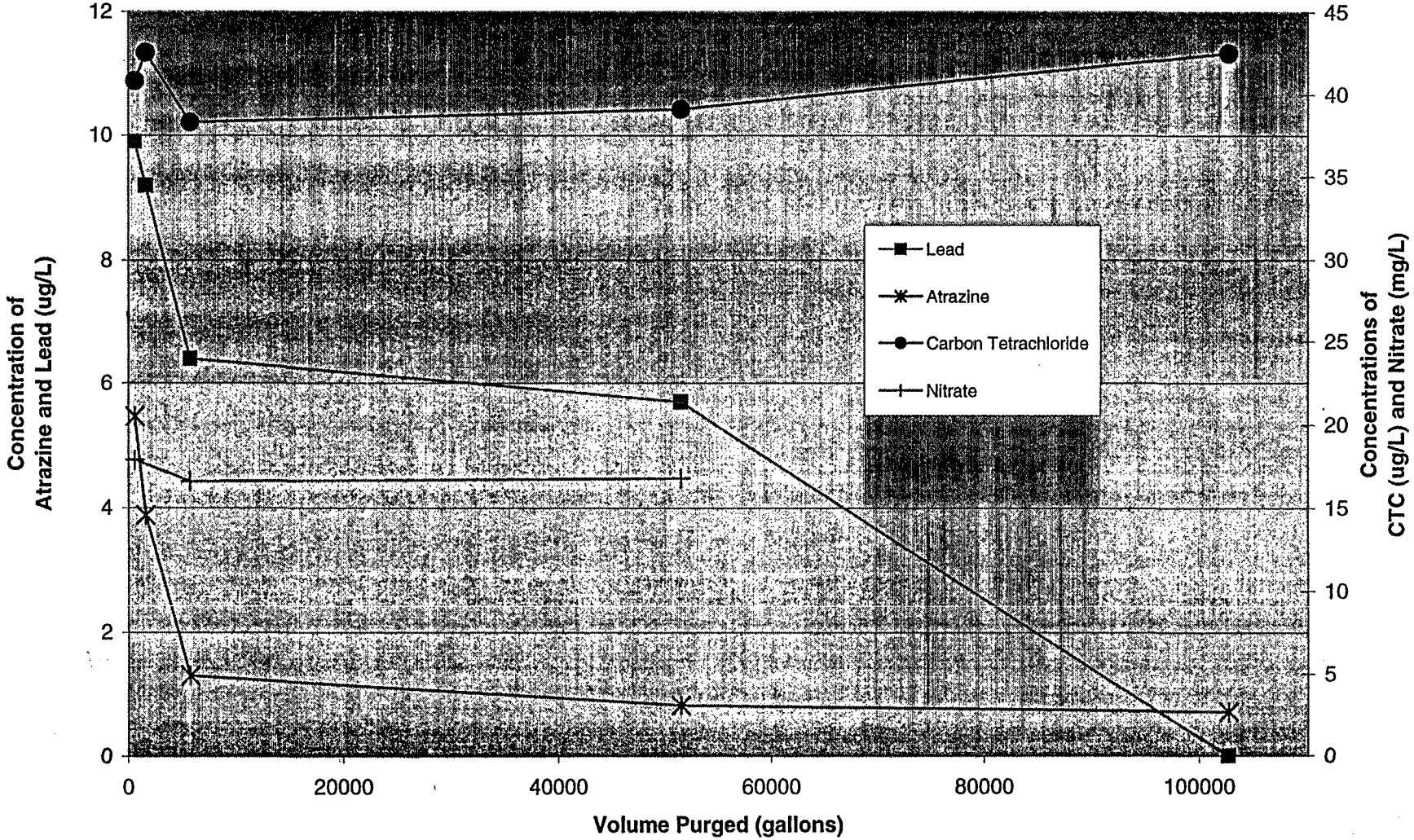

Figure 2-3
Carbon Tetrachloride, Nitrate, Lead and Atrazine Concentration vs. Volume Purged, Well No. 2
Perryton EE/CA

Chloroform

Chloroform was one of the earliest anesthetics used in humans. It is a by-product of municipal water supply chlorination, and is often present at extremely low concentrations in drinking water. Chloroform is also considered to be a biodegradation product of CTC (Norris, et al, 1994). Exposure to high levels of chloroform can cause liver and kidney damage as well as cardiac arrhythmia. Chronic, low-level exposure can also result in liver and kidney damage, as well as depression and gastrointestinal distress. It is classified as a B2 carcinogen, although rodent-to-human extrapolation has been difficult due to route-of-administration tumor formation in rats. An MCL of 100 ug/L has been established for chloroform.

Atrazine

Atrazine has been classified as a "Restricted Use Pesticide (RUP)" because of its potential for groundwater contamination. It has been used as both a selective and non-selective herbicide for controlling broadleaf and grassy weeds in a variety of crops. Atrazine is moderately toxic to humans, and exposure can occur through all routes, i.e. dermal, ingestion, and inhalation. Acute doses administered to rodents have resulted in respiratory distress and certain neurotoxicities. An MCL of 3 ug/L has been established for atrazine.

Propazine

Propazine has been classified as an RUP by the EPA. It is mildly toxic to humans. Like atrazine, it has been used as both a selective and non-selective herbicide for controlling broadleaf and grassy weeds in a variety of crops. Epidemiological studies have indicated that atrazine is a mild skin and eye irritant. No MCL has been set for propazine; however, a Lifetime Health Advisory (LHA) of 10 ug/L has been established.

Lead

Lead is a naturally-occurring metal with considerable toxic effects. Chronic exposure to lead affects several organ systems in adults: the hematologic system, nervous system (central and peripheral), and the kidneys. Exposure of unborn children to lead via maternal blood has been shown to retard neurological development. Acute exposure to lead can result in encephalopathy, convulsions, and death. Although lead has not been shown to be carcinogenic in humans, high doses administered to rodents have resulted in kidney tumors. It is classified as a B2 carcinogen because of the rodent data. An action level of 15 ug/L has been established for lead.

Nitrates

Nitrates are produced by natural biological and physical oxidations and therefore are ubiquitous in the environment. Most of the excess nitrates in the environment originate from inorganic chemicals manufactured for agriculture. Organic molecules containing nitrate groups are manufactured primarily for explosives or for their pharmacological effects. Exposure to inorganic nitrates is primarily through food and drinking water, whereas exposure to organic nitrates can occur orally, dermally, or by respiration. The primary toxic effect of inorganic nitrates is the oxidation of the iron in hemoglobin by excess nitrites forming methemoglobin. Infants less than 6 months old comprise

the most sensitive population. Epidemiological studies have shown that baby formula made with drinking water containing nitrate nitrogen levels over 10 mg/L can result in methemoglobinemia, especially in infants less than 2 months of age. Nitrate has not been classified as to its carcinogenicity by the EPA, although it is under review. An MCL of 10 mg/L has been established for nitrate.

2.3.5 Aquifer Characteristics

Drawdown measurements collected during pumping were plotted against time for the purposes of evaluating the aquifer transmissivity. The data were fitted to a solution for an unconfined aquifer using the Neuman Method (1974). Appendix B contains the assumptions and data plots used in the calculation of the transmissivity. It should be noted that the results from single well aquifer tests are not necessarily reliable, particularly where drawdown data is used for analysis. Ideally, recovery data should be used in the case of single well aquifer tests. However, recovery data was not obtained as part of this evaluation.

Based on the analysis described in detail in Appendix B, the calculated transmissivity for Well No. 2 is approximately 9,125 gallons per day per foot (gal/day-ft) or 1,220 feet squared per day (ft^2/day) (113 m^2/day). A transmissivity value of 66,183 gal/day-ft (8,853 ft^2/day) was calculated by Weston (EPA, 1996). The only other reported transmissivity value for the Ogallala Formation in Ochiltree County is 21,301 gal/day-ft (Bradley, 1999).

2.4 Streamlined Human Health Risk Evaluation

This section presents the streamlined risk evaluation for the City of Perryton Well No. 2 site. The streamlined risk evaluation process identifies current or future potential risks that may result from exposure to site-related contaminants in groundwater. The results of this evaluation provide a basis for defining the goals and objectives for the RA alternatives.

Sampling results from the April 1999 groundwater field investigation were compared to federal MCLs, action levels, or preliminary screening-level risk-based concentrations (RBC) for the identified COPCs: CTC, chloroform, atrazine, propazine, lead, and nitrate. Nitrates were included in this evaluation because of the elevated concentrations detected during the April 1999 sampling. RBC were calculated for those COPCs without established MCLs and included the ingestion and inhalation pathways for exposure to groundwater.

2.4.1 Potentially Exposed Populations

Well No. 2, before it was shut down in 1989, provided potable water to approximately 500 residents north of the Southwestern Railroad (Rung, 1996). Potential receptors include residential adults and children who rely upon municipal water as a source of drinking water.

2.4.2 Comparison to MCLs, Action Levels, and RBC

Location-average (arithmetic mean) concentrations were calculated from the time-series groundwater data collected during the April 1999 pump test at Well No. 2. The location-average concentrations for the COPCs were compared to their corresponding applicable groundwater criteria, either MCLs or calculated RBC for chemicals without MCLs. RBC were calculated using the equations and exposure assumptions consistent with EPA Region 6 guidance for calculating human-health medium-specific screening levels (EPA, 1998). The equations and exposure factors for the carcinogenic and noncarcinogenic RBC are presented in Appendix C. Table 2.5 presents a comparison of range and mean detected concentrations of COPCs to applicable MCLs, action limits, and RBC.

Table 2-5
Comparison of Mean Detected Concentrations to MCLs and RBC, City of Perryton Well No. 2 Site EE/CA

Contaminant of Potential Concern	Detected Concentration Range (µg/L)	Mean Concentration (µg/L)	Criterion (µg/L)	Source	Max Exceeds Criterion?	Mean Exceeds Criterion?
Nitrate	16,800 -17,900	17,100	10,000	MCL	Yes	Yes
Lead	5.7 - 9.9	7.8	15	AL	No	No
Atrazine	0.72 - 5.47	2.44	3	MCL	Yes	No
Propazine	0.97 - 5.74	2.73	730	RBC	No	No
[1]Chloroform	4.4 - 4.8	4.6	100	MCL	No	No
Carbon tetrachloride	38.3 - 42.5	40.6	5	MCL	Yes	Yes

Notes:
µg/L - micrograms per liter
MCL - Maximum Contaminant Level (Safe Drinking Water Act)
RBC - Risk-Based Concentration (EPA Region 6)
AL - Action Limit
[1] Chloroform is a component of the total trihalomethane MCL (100 ug/L)

Of the five COPCs, CTC and nitrate were the only constituents with a mean detected concentration exceeding the groundwater criterion. Propazine was detected below both the RBC and the LHA of 10 ug/L. Although the maximum detected concentration of atrazine exceeded the criterion, the average (2.44 ug/L) was less than the MCL. The actual exposure point concentration of atrazine is likely to be considerably less than the maximum detected concentration because of the significant decrease in detected concentrations over the duration of the pump test. It is likely that the extent of the atrazine contamination is limited to the immediate vicinity of the well.

Section 3

Identification of Removal Action Scope, Goals, and Objectives

3.1 Statutory Limits on Removal Action

The EPA has set a $2 million and 12-month statutory limit for Fund-financed removal actions pursuant to section 104(c)(1) of CERCLA. The RAs described herein fall within the $2 million limitation. An exemption from the 12-month limitation may be required for the long-term treatment alternative (See Alternative 2 in Section 4). It is assumed for the purposes of this evaluation that the EPA will assume responsibility for long-term operation and thus the 12-month time limit will be exceeded. If the potentially responsible party (PRP) is identified and accepts responsibility for the treatment system prior to the 12-month limit, then the exemption may not be required. Further discussions will be required to resolve the necessity of an exemption.

3.2 Applicable or Relevant and Appropriate Requirements

RAs must be protective of public health and the environment. Section 121(d)(2) of the CERCLA requires that federal and state ARARs be identified, and that response actions achieve compliance with the identified ARARs. The purpose of this requirement is to make CERCLA response actions consistent with pertinent federal and state environmental requirements as well as to adequately protect public health and the environment.

A requirement under environmental laws may be either "applicable" or "relevant and appropriate," 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.

- **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.

3.2.1 ARARs Classifications

A list and description of ARARs identified for the Perryton Well No. 2 Site are provided in Appendix D. The list was compiled based on the framework described above and divided into the three categories:

- contaminant-specific
- action-specific
- location-specific

The primary factors that influenced selection of the ARARs were the elevated contaminant levels found in Well No. 2. Tables C-1 and C-2 present preliminary federal and State of Texas ARARs, respectively. The ARARs are grouped into two types: chemical specific and action specific. There are no location-specific ARARs pertinent to Perryton Well No. 2. A summary of the ARARs is provided below.

3.2.2 Contaminant-Specific ARARs

Contaminant-specific requirements are promulgated values that include health- or risk-based standards, numerical values, or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a contaminant that may be detected in or discharged to the ambient environment. These values are typically based on protection of public health and the environment. However, some values, such as MCLs or Action Limits, may be influenced by technological or cost limitations.

The chemical specific ARARs most pertinent to Perryton Well No. 2 are the federal Safe Drinking Water Act MCLs, Action Limits, and the State of Texas Risk Reduction Standards and drinking water standards. These standards are important in establishing remediation goals for soil and groundwater.

3.2.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances, pollutants, and contaminants. The action-specific ARARs in this document 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.

Action-specific ARARs most pertinent to the removal actions discussed later in this report are the federal and state laws pertaining to the management of solid and hazardous waste.

3.2.4 Guidelines To Be Considered

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.

TBCs for Perryton Well No. 2 include risk assessment guidance.

3.3 Determination of the Removal Action Scope and Objectives

The scope of the RA is to evaluate removal actions related to groundwater contamination consisting of CTC and identified at Well No. 2 in order to provide potable water to the northern sections of the City of Perryton. The existing water supply system, with Well No. 2 out of service, is inadequate to meet the City's water demands in the northern half of town (GAE, 1998).

The objective of the RA is to prevent exposure to drinking water from Well No. 2 containing CTC and potentially nitrate. The RA will meet all ARARs. A secondary objective is to provide limited control of plume migration until a full-scale remedy is implemented.

3.4 Determination of Removal Schedule

The schedule of the RA is assumed to require approximately six months to design, procure services and materials, obtain permits, construct the required removal action alternative, and perform testing. The RA will operate continuously until such time that the federal, state, and local agencies determine it is no longer required.

Section 4

Identification and Evaluation of Removal Action Alternatives

This section describes the RA alternatives and evaluates them based on the EPA effectiveness, implementability, and cost criteria.

4.1 Identification of Removal Action Alternatives

The following RA alternatives were considered:

Alternative 1 - No Action
Alternative 2 - Treatment at Existing Well
Alternative 3 - New Well at Remote Location

4.1.1 Alternative 1 - No Action

Alternative 1 involves no response actions and maintaining the system at status quo. The no action alternative is included as required by the NCP to provide an absolute no action alternative for comparison purposes under this alternative. The existing water supply system will function without modifications; Well No. 2 will not be put back in service and no new wells will be installed. The City of Perryton will continue to utilize water according to the current practices. As the population of Perryton grows, water conservation practices may be required during the high water demand months. The evaluation of this alternative assumes that no other efforts are implemented to augment the City water supply.

4.1.2 Alternative 2 - Treatment at the Existing Well

The treatment alternative involves installation and operation of a treatment system at the existing well location. The treatment system will remove CTC to levels below MCLs. It is assumed that nitrate will be addressed through blending of water from Well No.1 in the north ground storage tank. As per EPA Region 6, the treated water from the Well No. 2 treatment system will be discharged directly into the existing pipeline at 140 gpm, a rate that produces a combined nitrate concentration less than or equal to 7 mg/L. The MCL for nitrate is 10 mg/L. The appropriate nitrate blending will be achieved by pump sizing and a pump motor control system. Costs for the blending system controls were not included in this analysis.

Alternative 2 assumes that there is a functioning well at the existing location and that water is pumped from the well and into the treatment system. The treatment system would discharge directly into the existing water distribution piping. The treatment system consists of a low-profile air stripper and a discharge pump. Air stripping was selected from several treatment technologies that were screened for use in Alternative 2. Details of the technology screening are described in the next section.

Treatment Technology Selection

The following technologies were evaluated for treatment of CTC from Well No. 2 for Alternative 2:
(a) air stripping
(b) adsorption
(c) oxidation

Air Stripping

Air stripping is a mass transfer process whereby contaminants are removed from the groundwater using mechanical aeration. Mechanical aeration of the groundwater causes volatile contaminants to transfer from the aqueous-phase into the gaseous-phase. Air stripping is typically effective for contaminants that have a Henry's Law Constant greater than 10 atmospheres (ATMs). Air stripping has been achieved using packed tower and low profile systems. The advantages of low profile systems are (1) reduced aesthetic impacts due to process equipment that can be housed in a conventional sized building and (2) lower O&M costs due to the elimination of packing material and the use of stainless steel aeration trays, which are less prone to fouling. Low profile systems have been proven effective at treating contaminated water at high flow rates.

CTC has a Henry's Constant of approximately 900 atm at 15°C and is therefore extremely amenable to air stripping. The air stripper offgas concentration is estimated to be less than the TNRCC atmospheric discharge limit and two orders of magnitude lower than the National Institute for Occupational Safety and Health (NIOSH) exposure standards; therefore, the offgas from the air stripper does not require treatment. The influent chemistry shows that pretreatment will not be required. The iron and manganese concentrations are below 0.5 mg/L, which is considered by the low-profile air stripper vendor to be the threshold for iron and manganese precipitation problems. The alkalinity, pH, temperature, and calcium concentrations do not indicate a high potential for calcium carbonate scaling problems. Therefore, air stripping will be a relatively simple process. The approximate direct capital cost for a package low-profile air stripper system that can accommodate 400-gpm and treat the water to MCLs is $190,000. The O&M costs will be minimal and involve labor for periodic tray cleaning and general blower maintenance only.

Low profile air stripping was selected for use in the treatment system for Alternative 2 due to low capital and O&M costs and process simplicity.

Adsorption

Adsorption is a mass transfer process whereby contaminants are removed from the groundwater using media filtration. The granular activated carbon (GAC) filtration media adsorbs organic contaminants with a moderate to high adsorption coefficient. The contaminant is transferred from the aqueous-phase to the solid-phase. Once the GAC has become saturated with the contaminant (i.e., the GAC has adsorbed to its capacity), it becomes spent and is typically either disposed or regenerated for reuse. The effectiveness of GAC adsorption of CTC is limited by the physical properties of the contaminant.

CTC has a relatively low adsorption coefficient (0.05% adsorption rate). The low adsorption rate translates into high capital and O&M costs for a GAC treatment system. Large carbon vessels would be required to minimize the number of carbon changeouts and large amounts of GAC material would be required to remove the CTC from the 400 gpm flow. The approximate capital cost for a package GAC treatment system is estimated to be similar to the cost for the air stripping system; however, the annual GAC costs would be in excess of $70,000. GAC treatment was eliminated based on high O&M costs and the generation of a hazardous waste (i.e., spent GAC would be classified as a hazardous waste).

Advanced Oxidation

Oxidation is a contaminant conversion process whereby contaminants are oxidized into benign by-products using photovoltaic and/or chemical reactions. In chemical oxidation, the groundwater is processed through a variety of unit processes. Unit processes typically involved include chemical reaction, exposure to ultraviolet light, high pressure, high temperature, catalysts, or a combination of these and associated chemicals. All these additional reactants and reaction parameters add cost to the removal of the organic from the groundwater. Typically, the groundwater will be passed through an ultraviolet light reactor. The ultraviolet light will be absorbed by, and excite, specific carbon to carbon bonds. An oxidant, like hydrogen peroxide or ozone, will then be added to oxidize the organic contaminant. The by-products of the oxidation depend on the precursor molecules. Often they are only carbon dioxide and water. Many organic contaminants have been successfully removed from groundwater using photovoltaic and chemical oxidation. There is a large body of documentation that gives a good indication of which organic molecules can be removed effectively with chemical oxidation.

Treatment of CTC by UV oxidation is limited by its inert structure. Large amounts of UV energy would be required to chemically oxidize the CTC into harmless by-products. A capital cost in excess of $1 million was estimated by a vendor to treat the water to MCLs. In addition, O&M costs were estimated to be in excess of $150,000 per year to maintain the lamps and provide enough chemical to oxidize the CTC. UV oxidation was eliminated from consideration based on these high costs.

4.1.3 Alternative 3 - New Well at Remote Location

Alternative 3 consists of installing a new 400-gpm public supply water well in a new location northwest of the current Well No. 2 location. This well will be placed outside the contaminant plume and it is assumed that water from this well will meet all applicable federal and state drinking water standards. Alternative 3 assumes that the existing Well No. 2 will be abandoned. It is assumed that the new well will be in operation for 8 hours per day in order to meet current water demand.

4.2 Conceptual Models of Removal Action Alternatives

This section presents the conceptual models for each of the removal action alternatives. The conceptual models were based on the information available and represent the basis for the detailed evaluation and cost estimates.

4.2.1 Conceptual Model of Alternative 1 - No Action

The conceptual model for Alternative 1 is presented in Figure 4-1. The conceptual model for the No Action alternative incorporates the existing water distribution system as it currently exists. No modifications will be made. Well No. 2 will remain non-functional. The CTC plume will remain in-situ.

4.2.2 Conceptual Model of Alternative 2 - Treatment at the Existing Well

Figure 4-2 presents the conceptual model for the treatment system alternative. Calculations used in the conceptual design and costs of this alternative may be found in Appendix E. It involves installation of an air stripping treatment system at the existing wellhead location. It incorporates use of the existing facilities (i.e., water distribution piping) to the extent practicable. Water will be pumped directly from the well into the air stripper. The water will be aerated in the tray air stripper. The sump of the air stripper will be equipped with a level switch that will trigger operation of a discharge pump to send water directly to the North Ground Storage for distribution. Bag filters will be installed prior to the air stripper to prevent sand from fouling the air stripper unit. No additional pretreatment processes will be installed based on preliminary calculations that show scaling and precipitation will not be a problem. Operations of the pump and treat system will create a capture zone for the limited control of the CTC plume.

4.2.3 Conceptual Model of Alternative 3 - New Well at Remote Location

The conceptual model for Alternative 3 is presented in Figure 4-3. Design and cost calculations are listed in Appendix E. It presents a new well located upgradient of the presumed contaminant plume. The new water supply well will pump potable water directly to the North Ground Storage. The siting of the well was based on information presented in the Water Study (GAE, 1998) and should not be construed as a recommended location for the new well. Detailed study is required to site the new well.

4.3 Evaluation of Removal Action Alternatives

This section evaluates each of the RA alternatives based on EPA's criteria (USEPA, 1993a):

Effectiveness

Overall Protection of Human Health
- long-term risk to human health

Overall Protection of the Environment
- long-term risk to the environment

Compliance with ARARs and Other Criteria, Advisories, and Guidance
- meet MCLs or groundwater cleanup standards

Long-Term Effectiveness and Permanence
- long-term risks
- adequacy of reliable controls

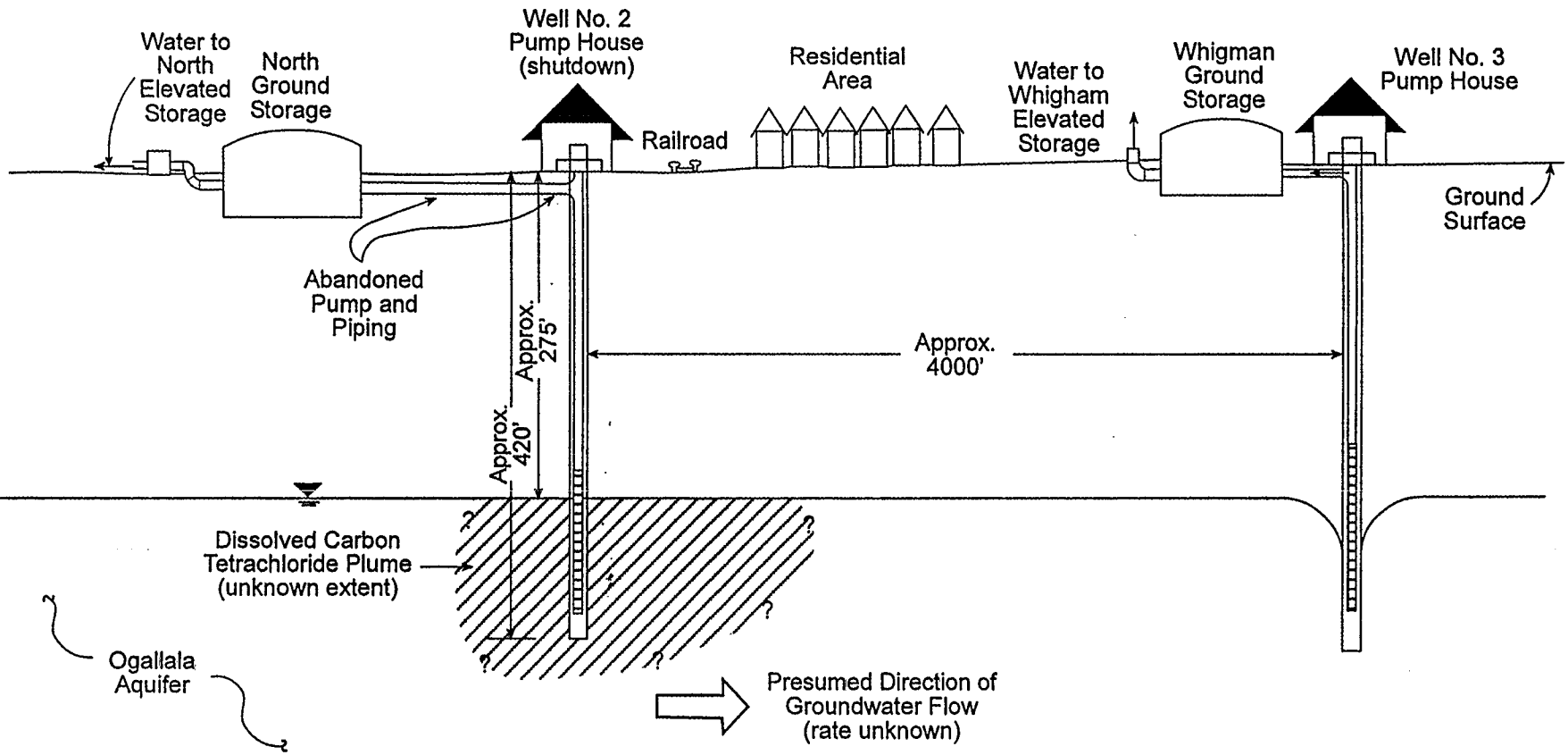

Figure 4-1
No Action, Alternative 1
Conceptual Model
City of Perryton, Well No. 2 Site
Perryton, Texas

CH2MHILL

DEN/R/151498.EE.EE/Figure 4-1/5-99

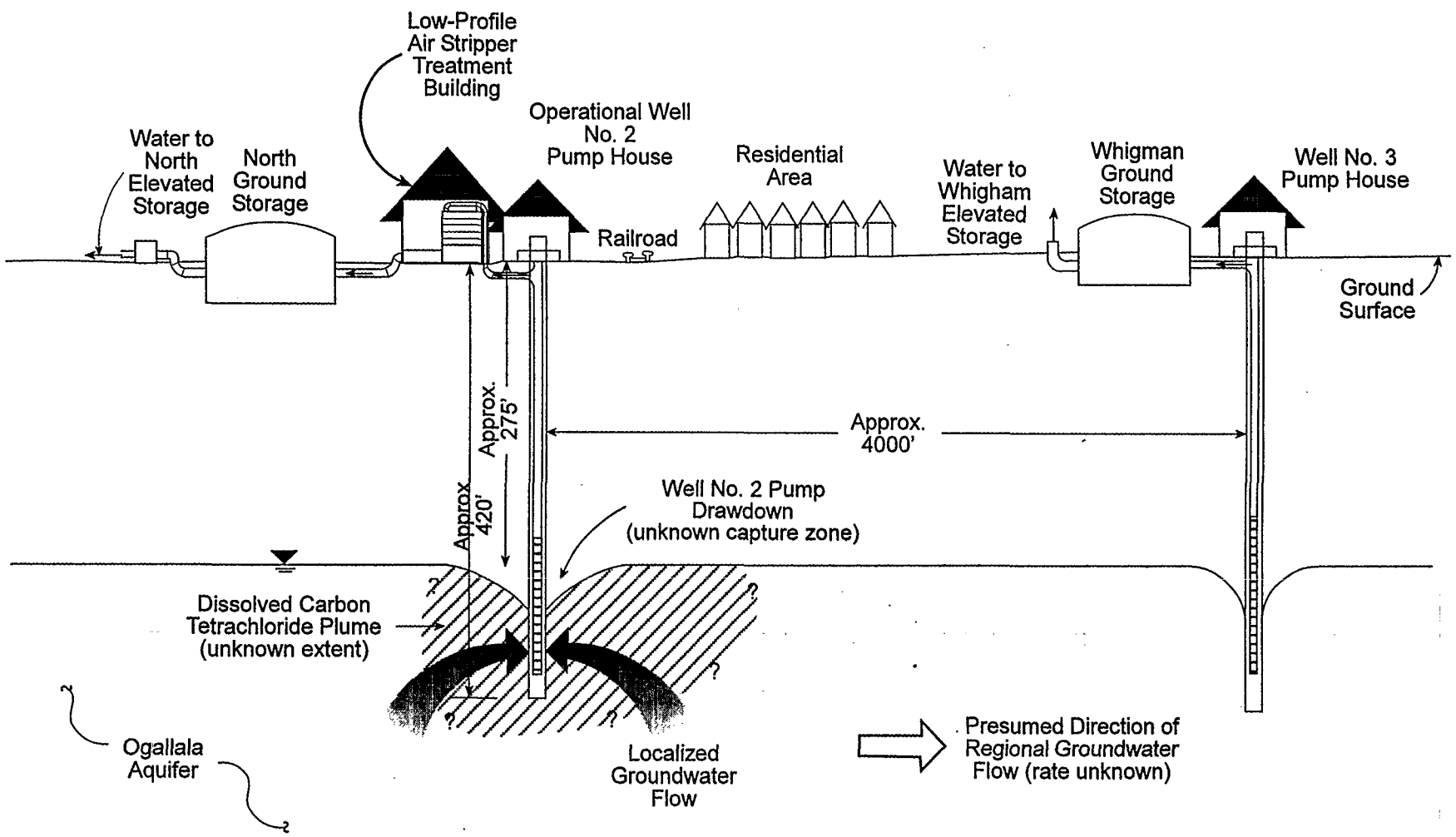

Figure 4-2
Treatment, Alternative 2
Conceptual Model
City of Perryton, Well No. 2 Site
Perryton, Texas

CH2MHILL

DEN/R/151498.EE.EE/Figure 4-2/5-99

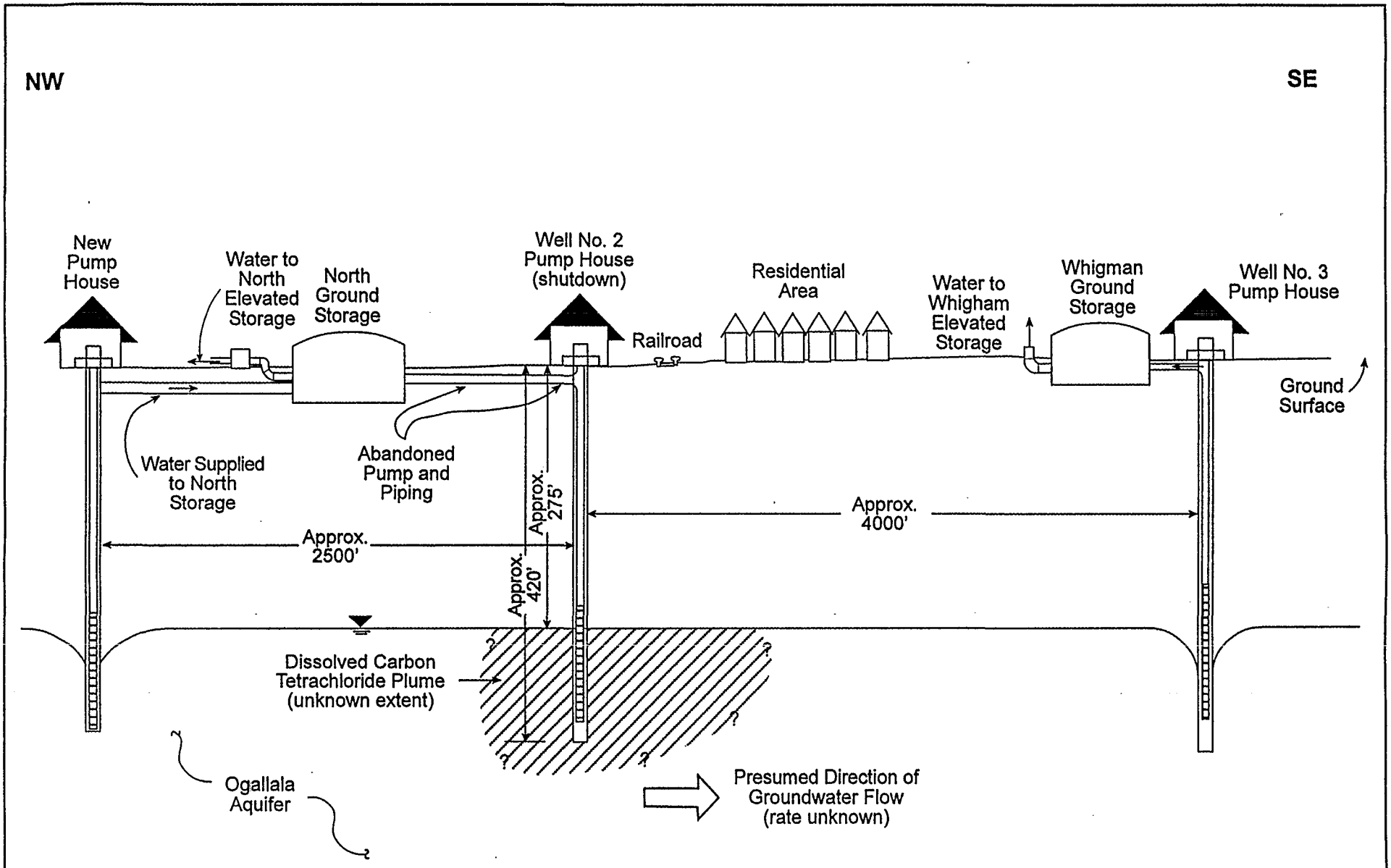

Figure 4-3
New Well, Alternative 3
Conceptual Model
City of Perryton, Well No. 2 Site
Perryton, Texas

CH2MHILL

DEN/R/151498.EE.EE/Figure 4-3/5-99

Reduction of Toxicity, Mobility, or Volume Through Treatment
- contribution to site remediation

Short-Term Effectiveness
- risks during construction
- timeliness to meet RA objectives

Implementability

Technical Feasibility
- construction and O&M considerations
- site access issues
- availability of services and materials

Administrative Feasibility
- permits required
- waivers required
- meet statutory limits

Federal, State, and Local Agency Acceptance

Community Acceptance

Cost

Direct Capital Cost
- equipment and material cost
- construction cost
- building and service cost
- contingency cost

Indirect Capital Cost
- general requirements (health and safety, mob/demob)
- engineering and design
- permitting and legal
- services during construction
- startup cost (testing, debugging, training)

Annual Post-Remedial Site Control Cost
- operator labor
- technician labor
- engineer labor
- analytical cost
- equipment and supply cost
- operations cost (electric power)
- contingency cost

A description of each of these criteria is described in detail in the Guidance on Conducting Non-Time Critical Removal Actions under CERCLA (USEPA, 1993a).

Table 4-1 presents a summary of the alternative evaluation. A comparison of the alternatives follows in the next section.

Table 4-1
Detailed Evaluation of Removal Action Alternatives, City of Perryton Well No. 2 Site

Evaluation Criteria	Alternative 1 - No Action	Alternative 2 - Treatment at Existing Well	Alternative 3 - New Well at Remote Location
Effectiveness			
Protection of Human Health (including long-term risks to human health)	Poor to Moderate. Existing water supply system provides safe drinking water to the City, but no action at the site would allow the existing contaminant plume to migrate uncontrolled and may impact downgradient water supply wells. However, since the fate and transport characteristics of the groundwater plume are unknown, the extent of dow-gradient impacts are unknown. Migration of the plume may be retarded by natural processes and it may not impact other water supply areas.	Moderate to Good. Pump and treat would provide safe drinking water to the City and would partially contain and control a portion of the contaminant plume and minimize the potential for plume migration to other downgradient water supply wells. However, the extent of the plume control by pumping the site well is unknown. The discharge of the treatment system would be equipped with an on-line gas chromatograph (GC) and alarm system to eliminate or minimize the potential for discharge of water exceeding MCLs to the water distribution system.	Poor to Moderate. A new well would provide safe drinking water to the City, but no action at the site would allow the existing contaminant plume to migrate uncontrolled and may impact downgradient water supply wells. However, since the fate and transport characteristics of the groundwater plume are unknown, the extent of downgradient impacts are unknown. Migration of the plume may be retarded by natural processes and it may not impact other water supply areas.
Protection of the Environment (including long-term risks to the environment)	Poor. No action at the site would allow the existing contaminants to remain in the environment. While it is unlikely that the CTC or nitrate pose any danger to the environment, an evaluation of this risk potential was not performed.	Moderate. Pump and treat system would achieve some contaminant removal from the subsurface. No invasive activities are involved, therefore, no hazardous waste would be generated. The air stripper offgas would impact the atmosphere since it will be discharged untreated in accordance with TNRCC regulations.	Poor. No action at the site would allow the existing contaminants to remain in the environment.
Compliance with ARARs and Other Criteria, Advisories, and Guidance	Moderate. It is assumed that the existing water supply system provides water that meets MCLs and Action Limits. The groundwater at the site would continue to exceed the TNRCC groundwater standards for CTC.	Moderate to Good. The treatment system would provide safe drinking water that meets MCLs. In addition, the pump and treat system would attempt to meet groundwater cleanup standards for the CTC, but it is likely that additional RA would be required.	Moderate. The new well will provide water that meets MCLs and Action Limits assuming that the well is sited in an area where groundwater is free of contamination. The extent of CTC and nitrate contamination has not been defined. The groundwater at the Well No. 2 site would continue to exceed the TNRCC groundwater standards for CTC.
Long-Term Effectiveness and Permanence (long-term risks and adequacy of reliable controls)	Poor. No action would result in a risk of inadequate water supply to the City. It is not a permanent solution.	Moderate to Good. Little risk is involved with this alternative. The air stripping treatment system is a proven and reliable technology to meet MCLs. It would be equipped with an on-line effluent GC to shutdown the system in the case of discharge of CTC above MCLs. The duration of system operation would depend on the mass of contaminants which exists in the subsurface. The mass and extent of contamination are not known at this time.	Moderate. No long-term risk would be involved in this alternative. The new well will provide an adequate supply of safe drinking water to the City for the lifetime of the well. It will not be effective at controlling the groundwater plume. If attainment of the secondary objectives is required, then a separate remedy for plume control will be required.
Reduction of toxicity, mobility, and volume (TMV) Through Treatment (including contribution to site remediation)	Poor. No action would not achieve reductions in the TMV of the site contamination.	Poor to Moderate. A pump and treat system would achieve very limited removal of contamination from the groundwater. Assuming water containing CTC at 50 ppb is continuously pumped at a rate of 140 gpm, 0.08 pounds of CTC would be removed per day or 31 pounds of CTC per year. The reduction of TMV achieved by this alternative is limited.	Poor. This alternative would allow the contaminants to remain as is and would not achieve reductions in the TMV of the site contamination.
Short-Term Effectiveness (including risks during construction and timeliness to meet RA objectives)	Poor. No action would not achieve the main objective of providing the City with potable water to meet its demands. In addition, it would not achieve the secondary objective to provide limited control of plume migration.	Good. Installation of a treatment system at the existing well location would achieve the main objective of providing the City with potable water to meet its demands. The City has indicated that the 140 gpm planned flow rate would be a great help to satisfying water demands. In addition, it would achieve the secondary objective to provide limited control of plume migration. The time to achieve the objectives is estimated to be approximately 6 months.	Moderate. Installation of a new remote well would achieve the main objective of providing the City with potable water to meet its demands. However, it would not achieve the secondary objective to provide limited control of plume migration. The time to achieve the main objective is estimated to be approximately 6 months.
Implementability			
Technical Feasibility (including construction and O&M considerations, site access, availability of services and materials)	Good. No action requires no work.	Moderate to Good. Low profile air stripping is a readily available, proven treatment system that can be installed at the site with minimal impacts. O&M is simple and involves labor to clean the trays and perform routine maintenance of the mechanical components (blower, pump, and pipeline). Implementation of this alternative requires an operational well. Based on preliminary information about the condition of Well No. 2, there may be concerns about its reliability.	Good. Water supply well installation is common and can be implemented with locally available labor and materials. O&M is simple and involves labor to maintain the pump and pipeline.

Table 4-1
Detailed Evaluation of Removal Action Alternatives, City of Perryton Well No. 2 Site

Evaluation Criteria	Alternative 1 - No Action	Alternative 2 - Treatment at Existing Well	Alternative 3 - New Well at Remote Location
Administrative Feasibility (permits, waivers, statutory limits)	Good. No administrative procedures are required.	Moderate. Multiple permits will be required for the treatment system. A permit for the air stripper offgas would be required. The TNRCC provides an exemption for equipment used to remove chemicals from contaminated groundwater. Preliminary estimates show that the air stripper would meet the requirements for the exemption. A NPDES permit may also be required. This alternative will meet the $2 million statutory limit, but may not meet the 12-month limit. A waiver may be required to extend the time frame for O&M of the removal action if a full-scale remedy is not implemented within the 12-month limit or the PRP does not accept responsibility for the treatment system O&M.	Moderate-Good. A permit for installation of a new water supply well will be required. This alternative will meet the $2 million statutory limit and the 12-month limit. It is assumed that the City will assume responsibility for O&M of the new well once it is installed by the EPA.
Federal, State, and Local Agency Acceptance	Poor. The City will not accept the no action alternative due to leaving the contamination as is and no augmentation of the existing deficient water supply.	Good. The City has previously requested installation of an air stripper at the existing location and will most likely accept this alternative since it also provides some control of the plume migration. The TNRCC will accept the air stripper providing the system meets the air emissions regulations.	Moderate. The City will accept the alternative safe drinking water alternative, but will most likely not accept leaving the contamination in subsurface.
Community Acceptance	Poor. The City water supply will be deficient and the threat of impacts to the existing water supply will remain.	Moderate-Good. Depending on the proximity of the air stripper to the community, the community may not accept air stripping without offgas treatment even though the emissions would be two orders of magnitude below NIOSH exposure limits and below TNRCC limits. The City water shortage problem will be solved. The threats of migrating contamination will partially be addressed.	Moderate. The City water shortage problem will be solved, however, the threat of impacts to existing water supply wells will remain.
Cost (Appendix E)			
Capital Cost	$0	$257,664	$286,132
Annual O&M Cost	$0	$37,047	$0
Present Worth Cost	$0	$517,868	$286,132

Section 5.0

Comparative Analysis of Removal Action Alternatives

This section discusses the advantages and disadvantages of the RA alternatives in relation to each of the three main evaluation criteria effectiveness, implementability, and cost. The purpose of the comparison is to provide a summary of the information necessary to select the most appropriate RA.

Table 5-1 presents a summary of the comparison. The following sections present the comparison in comparative text that directly relates each alternative to one another.

Table 5-1
Comparison of Remedial Action Alternatives, City of Perryton Well No. 2 Site

	Alternative		
Evaluation Criteria	**1 - No Action**	**2 - Treatment**	**3 - New Well**
Effectiveness	Poor	Moderate to Good	Moderate
Implementability	Poor	Moderate to Good	Moderate
Present Worth Cost	$0	$517,868	$286,132

Details of the ratings and the comparison are presented in the following sections.

5.1 Effectiveness

Effectiveness is measured by the ability of an alternative to minimize risk to the public and the environment while complying with ARARs and providing a mechanism to meet the RA objectives in a timely, reliable manner. Each of the alternatives involves minimal risks during construction and will provide water that meets ARARs and meets the City's water demand. Although the flow rate provided by Alternative 2 (140 gpm) is much lower than that provided by Alternative 3 (400 gpm), the City has indicated that 140 gpm is sufficient to meet demands in the area. The main difference between the alternatives in this criteria is the degree of long-term protection from contamination that is provided.

The main advantage of Alternative 2 in this criteria is the extra level of protection of human health and the environment that is provided by the pump and treat system at the site. Although this is only a secondary objective of the RA, the City considers it important. The City has indicated in previous correspondence that control of plume migration is important to them to reduce the potential for impact of downgradient water supply wells. Alternatives 1 and 3 allow the groundwater contaminant plume to migrate uncontrolled. Alternative 2 provides limited plume control. It should be noted that due to the fact that the extent of contamination or specific aquifer characteristics are unknown at the site, the magnitude of plume control that would be provided by Alternative 2 is unknown. Therefore, rather than assign a good rating to Alternative 2, it was assigned a moderate to good rating to reflect the possibility that the degree of plume control may be very limited. The public will be protected by

installation of an on-line effluent monitoring system on the treatment system. This will provide a fail-safe system that will shutdown the treatment system and well pump in the case of poor treatment performance.

The slight reduction of TMV of contaminants by Alternative 2 is not viewed as a significant advantage due to the limitations of the pump and treatment method. The time required to implement Alternatives 2 and 3 is considered similar and does not show an advantage or disadvantage.

5.2 Implementability

Implementability is measured by the ease of alternative implementation and is achieved through use of proven and available technology, simple permitting procedures, and regulatory and community acceptance. Air stripping technology is well established and used worldwide for treatment of organic compounds such as CTC. The driver for overall evaluation of the alternatives in this category is community acceptance.

The City and the TNRCC have indicated in previous correspondence that a pump and treat system using air stripping is the desired alternative. Any alternative that does not address control of the groundwater plume will be difficult to implement without proof that there is no risk from the existing plume. On the other hand, the treatment alternative requires more extensive permitting than the other alternatives. Community acceptance of air stripper atmospheric discharge may be an issue due to the fact that it will not be treated. Conservative emission calculations show that the CTC concentrations in the offgas will be below the TNRCC limits for untreated emissions. In addition, access to the public will be restricted to 100 feet from the air stripper equipment. Community acceptance of the new water well location and pipeline may be an issue as well, depending on the impact to adjacent land use.

5.3 Cost

The present worth cost of each of the alternatives was presented in Section 4. These costs were estimated assuming a 10-year period of performance and an effective rate of 7 percent. An equal level of detail was included in the cost estimate for each alternative to provide figures for an equivalent comparison. These estimates are not intended for budgetary purposes, they should be used for alternative comparison only.

The capital cost for implementation of Alternative 3 ($286,132) is slightly higher than installation of a treatment system in Alternative 2 ($251,664). It should be noted that additional cost for rehabilitation of the existing well in Alternative 2 will be assumed by the City of Perryton. It is also assumed that the City of Perryton will take responsibility of O&M of the well pump and piping in both alternatives. Therefore, the O&M cost for Alternative 3 is $0. The present worth of the added O&M cost for the treatment system in Alternative 2 is estimated to be $260,204 ($37,047 per year for 10 years at 7 percent effective interest rate).

In conclusion, the present worth cost of Alternative 2 ($517,868) is greater than Alternative 3 (286,132) due to the additional O&M for the treatment system. The present worth costs for both alternatives may be reduced if the PRP is identified and accepts responsibility for the system.

Section 6

References

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Appendix A
Laboratory Analytical Results

EPA Data

United States Environmental Protection Agency
Region 6 Environmental Services Branch Laboratory
10625 Fallstone, Houston, Texas 77099

000298

Final Analytical Report

Site Name ..... City of Perryton Well No. 2

CERCLIS Number TXD001399435

Sample Collection Date(s) ..... April 6, 1999

Laboratory Sample Identification 9T5BCW06

Contact ..... Vince Malott (6SF-AP)

Report Date ..... May 10, 1999

Report Narrative:

Note 1: The pesticide fraction was analyzed for atrazine and propazine only.

Standard procedures for quality assurance and quality control were followed in the analysis and reporting of the sample results. The results apply only to the samples tested. This final report should only be reproduced in full.

The laboratory routinely disposes of samples 90 days after all analysis has been completed. If you have a need to hold these samples in custody longer than 90 days, please send an e-mail to Sylvia Gorostiza (gorostiza-sylvia) within the next 30 days briefly stating your need to hold these samples in custody.

Report Approvals:

Mike Daggett
Deputy Branch Chief

Douglas A. Lipka
Region 6 Laboratory Branch Chief

United States Environmental Protection Agency
Region 6 Environmental Services Branch Laboratory
10625 Fallstone, Houston, Texas 77099

000299

Final Analytical Report

Report Contents

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0601

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-01

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:39 AM

Sample Type: LIQUID

Comments:

Parameter	Description
ALK	ALKALINITY
BCO	BICARBONATE
CL-	CHLORIDES
CO3	CARBONATE
F-	FLUORIDE
HAR	HARDNESS
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
NH3	AMMONIA NITROGEN
PES	PESTICIDES
SO4	SULFATE
TDS	TOTAL DISSOLVED SOLIDS
TOC	TOTAL ORGANIC CARBON
TSS	TOTAL SUSPENDED SOLIDS
N-N	NITRATE - NITRITE

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-01 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

000301

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	5.47	0.2
Propazine	5.74	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

US EPA REGION 6 LABORATORY

000302

SAMPLE #: 9T5CIW06-01
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	182	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	106000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	26	20	UG/L	200.7
IRON	240	25	UG/L	200.7
LEAD	9.9	3.0	UG/L	200.9
MAGNESIUM	39600	150	UG/L	200.7
MANGANESE	8	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8580	1000	UG/L	200.7
SELENIUM	ND	3.0	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25400	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	338	20	UG/L	200.7
HARDNESS	428	5		MG/L

ND: LESS THAN DETECTION LIMIT

TNRCC Laboratory

Report of Analysis

May 05, 1999 15:30

000303

TNRCC Sample #: 9901888 Group#: 19990592 Chain of Custody #: 9T5BCW06-01 Region: 0

Program Code: EPA Sample Matrix: LIQUID Sample Depth: Station ID:

Sample Collected: 4/6/99 08:39 am Sample Recieved: 4/7/99 Sample Collector: EPA

Collection Site: City of Perryton Well No. 2

Storet	Parameter Name	Result	Unit	Prepared	Analyzed	Method
04255	Alkalinity, Bicarbonate	292	mg/L	N/A	4/7/99 16:00	310.1
29808	Alkalinity, Carbonate	0	mg/L	N/A	4/7/99 16:00	310.1
00415	Alkalinity, Phenylphthalein	0	mg/L	N/A	4/7/99 16:00	310.1
00410	Alkalinity, Total	292	mg/L	N/A	4/7/99 16:00	310.1
00610	Ammonia Nitrogen	<0.05	mg/L	N/A	4/30/99 07:10	350.1
00940	Chloride, ic	65	mg/L	N/A	4/7/99 15:00	300.0
00951	Fluoride, ic	0.99	mg/L	N/A	4/7/99 14:00	300.0
00620	Nitrogen, Nitrate, ic	17.9	mg/L	N/A	4/7/99 12:15	300.0
00615	Nitrogen, Nitrite, ic	<0.05	mg/L	N/A	4/7/99 12:21	300.0
00945	Sulfate, ic	28	mg/L	N/A	4/7/99 14:00	300.0
70300	Total Dissolved Solids	570	mg/L	N/A	4/9/99 08:00	160.1
00680	Total Organic Carbon	<1	mg/L	N/A	4/13/99 09:30	415.2
00530	Total Suspended Solids	9	mg/L	N/A	4/9/99 08:00	160.2
00535	Volatile Suspended Solids	<1	mg/L	N/A	4/9/99 08:00	160.4
82394	Hardness, Total, Calculated	*	mg/L	4/8/99	4/9/99 16:05	200.7

Comments: End of Data for TNRCC Sample# :9901888

Laboratory Approval: _____ **Approval Date: 5-May-1999**

RP15FYNL 28 Oct1998

U. S. Environmental Protection Agency
Region 6 Houston Laboratory

000304

Report For Sample Number 9T5BCW0608

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-01

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:39 AM

Sample Type: LIQUID

Comments:

Parameter	Description
VOA	VOLATILE ORGANIC ANALYSIS

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-08 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000305

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.5	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	40.8	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds

Method 624*

Sample Number: 9T5BCW06-08 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0602

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-01F

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:39 AM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000308

SAMPLE #: 9T5CIW06-02
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	180	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	104000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	ND	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	39200	150	UG/L	200.7
MANGANESE	7	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8370	1000	UG/L	200.7
SELENIUM	ND	3.0	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25100	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	348	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0603

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-02

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:49 AM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
PES	PESTICIDES

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-03 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

000310

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	3.88	0.2
Propazine	4.16	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

US EPA REGION 6 LABORATORY

000311

SAMPLE #: 9T5CIW06-03
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID
ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	177	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	101000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	24	20	UG/L	200.7
IRON	418	25	UG/L	200.7
LEAD	9.2	3.0	UG/L	200.9
MAGNESIUM	38500	150	UG/L	200.7
MANGANESE	11	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8420	1000	UG/L	200.7
SELENIUM	ND	3.0	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25000	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	326	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

000312

Report For Sample Number 9T5BCW0609

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-02

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:49 AM

Sample Type: LIQUID

Comments:

Parameter	Description
VOA	VOLATILE ORGANIC ANALYSIS

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-09 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000313

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.8	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	42.5	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds

Method 624*

Sample Number: 9T5BCW06-09 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0604

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-02F

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:49 AM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000316

SAMPLE #: 9T5CIW06-04
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	178	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	103000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	29	25	UG/L	200.7
LEAD	3.0	3.0	UG/L	200.9
MAGNESIUM	38900	150	UG/L	200.7
MANGANESE	5	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8540	1000	UG/L	200.7
SELENIUM	3.3	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25500	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	310	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0605

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-03

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 09:15 AM

Sample Type: LIQUID

Comments:

Parameter	Description
ALK	ALKALINITY
BCO	BICARBONATE
CL-	CHLORIDES
CO3	CARBONATE
F-	FLUORIDE
HAR	HARDNESS
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
NH3	AMMONIA NITROGEN
PES	PESTICIDES
SO4	SULFATE
TDS	TOTAL DISSOLVED SOLIDS
TOC	TOTAL ORGANIC CARBON
TSS	TOTAL SUSPENDED SOLIDS
N-N	NITRATE - NITRITE

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-05 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

000318

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	1.31	0.2
Propazine	1.75	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

US EPA REGION 6 LABORATORY

000319

SAMPLE #: 9T5CIW06-05
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID
ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	175	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	101000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	35	20	UG/L	200.7
IRON	544	25	UG/L	200.7
LEAD	6.4	3.0	UG/L	200.9
MAGNESIUM	38500	150	UG/L	200.7
MANGANESE	12	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8360	1000	UG/L	200.7
SELENIUM	3.9	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	24800	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	215	20	UG/L	200.7
HARDNESS	411	5		MG/L

ND: LESS THAN DETECTION LIMIT

TNRCC Laboratory

Report of Analysis

May 05, 1999 15:30

000320

TNRCC Sample #: 9901889 Group#: 19990592 Chain of Custody #: 9T5BCW06-05 Region: 0

Program Code: EPA Sample Matrix: LIQUID Sample Depth: Station ID:

Sample Collected: 4/6/99 09:15 am Sample Recieved: 4/7/99 Sample Collector: EPA

Collection Site: City of Perryton Well No. 2

Storet	Parameter Name	Result	Unit	Prepared	Analyzed	Method
04255	Alkalinity, Bicarbonate	292	mg/L	N/A	4/7/99 16:00	310.1
29808	Alkalinity, Carbonate	0	mg/L	N/A	4/7/99 16:00	310.1
00415	Alkalinity, Phenylphthalein	0	mg/L	N/A	4/7/99 16:00	310.1
00410	Alkalinity, Total	292	mg/L	N/A	4/7/99 16:00	310.1
00610	Ammonia Nitrogen	<0.05	mg/L	N/A	4/30/99 07:10	350.1
00940	Chloride, ic	62	mg/L	N/A	4/7/99 15:00	300.0
00951	Fluoride, ic	1.05	mg/L	N/A	4/7/99 14:00	300.0
00620	Nitrogen, Nitrate, ic	16.6	mg/L	N/A	4/7/99 12:15	300.0
00615	Nitrogen, Nitrite, ic	<0.05	mg/L	N/A	4/7/99 12:21	300.0
00945	Sulfate, ic	26	mg/L	N/A	4/7/99 14:00	300.0
70300	Total Dissolved Solids	520	mg/L	N/A	4/9/99 08:00	160.1
00680	Total Organic Carbon	<1	mg/L	N/A	4/13/99 09:30	415.2
00530	Total Suspended Solids	3	mg/L	N/A	4/9/99 08:00	160.2
00535	Volatile Suspended Solids	1	mg/L	N/A	4/9/99 08:00	160.4
82394	Hardness, Total, Calculated	*	mg/L	4/8/99	4/9/99 16:05	200.7

Comments: End of Data for TNRCC Sample# :9901889

Laboratory Approval: _____ **Approval Date:** 5-May-1999

RP15FYNL 28 Oct1998

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0610

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-03

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 09:15 AM

Sample Type: LIQUID

Comments:

Parameter	Description
VOA	VOLATILE ORGANIC ANALYSIS

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-10 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000322

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.4	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	38.3	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds

Method 624*

Sample Number: 9T5BCW06-10 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0606

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-03F

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 09:15 AM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000325

SAMPLE #: 9T5CIW06-06
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	177	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	102000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	ND	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	38800	150	UG/L	200.7
MANGANESE	ND	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8510	1000	UG/L	200.7
SELENIUM	3.1	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25500	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	224	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0607

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-04

Date/Time Received: 4/7/1999 09:40 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 01:10 PM

Sample Type: LIQUID

Comments:

Parameter	Description
CL-	CHLORIDES
F-	FLUORIDE
SO4	SULFATE
N-N	NITRATE - NITRITE

TNRCC Laboratory

Report of Analysis

May 05, 1999 15:30

000327

TNRCC Sample #: 9901890 Group#: 19990592 Chain of Custody #: 9T5BCW06-07 Region: 0

Program Code: EPA Sample Matrix: LIQUID Sample Depth: Station ID:

Sample Collected: 4/6/99 01:10 pm Sample Recieved: 4/7/99 Sample Collector: EPA

Collection Site: City of Perryton Well No. 2

Storet	Parameter Name	Result	Unit	Prepared	Analyzed	Method
00940	Chloride, ic	64	mg/L	N/A	4/7/99 15:00	300.0
00951	Fluoride, ic	1.01	mg/L	N/A	4/7/99 14:00	300.0
00620	Nitrogen, Nitrate, ic	16.8	mg/L	N/A	4/7/99 12:15	300.0
00615	Nitrogen, Nitrite, ic	<0.05	mg/L	N/A	4/7/99 12:21	300.0
00945	Sulfate, ic	27	mg/L	N/A	4/7/99 14:00	300.0

Comments: End of Data for TNRCC Sample# :9901890

Laboratory Approval: _____ **Approval Date: 5-May-1999**

RP15FYNL 28 Oct1998

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0611

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-04

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 01:10 PM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
PES	PESTICIDES
VOA	VOLATILE ORGANIC ANALYSIS

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-11 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	0.82	0.2
Propazine	0.97	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-11 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000330

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.4	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	39.1	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-11 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

US EPA REGION 6 LABORATORY

000332

SAMPLE #: 9T5CIW06-11
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID
ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	181	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	102000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	30	20	UG/L	200.7
IRON	707	25	UG/L	200.7
LEAD	5.7	3.0	UG/L	200.9
MAGNESIUM	39500	150	UG/L	200.7
MANGANESE	12	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8550	1000	UG/L	200.7
SELENIUM	3.1	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	26000	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	202	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0612

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW-04F

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 01:10 PM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000334

SAMPLE #: 9T5CIW06-12
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	180	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	103000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	ND	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	39800	150	UG/L	200.7
MANGANESE	ND	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8580	1000	UG/L	200.7
SELENIUM	3.2	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	26100	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	191	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0613

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-DUP1

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
PES	PESTICIDES
VOA	VOLATILE ORGANIC ANALYSIS

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-13 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	0.83	0.2
Propazine	1.03	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-13 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000337

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.6	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	39.6	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds

Method 624*

Sample Number: 9T5BCW06-13 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO:	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

US EPA REGION 6 LABORATORY

000339

SAMPLE #: 9T5CIW06-13
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	186	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	104000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	74	20	UG/L	200.7
IRON	2550	25	UG/L	200.7
LEAD	11.2	3.0	UG/L	200.9
MAGNESIUM	40500	150	UG/L	200.7
MANGANESE	28	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8790	1000	UG/L	200.7
SELENIUM	3.1	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	26200	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	215	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0614

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-DUP1F

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000341

SAMPLE #: 9T5CIW06-14
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID
ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	179	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	102000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	ND	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	39600	150	UG/L	200.7
MANGANESE	ND	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8610	1000	UG/L	200.7
SELENIUM	3.3	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25700	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	189	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0615

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-05

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 05:10 PM

Sample Type: LIQUID

Comments:

Parameter	Description
ALK	ALKALINITY
BCO	BICARBONATE
CO3	CARBONATE
HAR	HARDNESS
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS
NH3	AMMONIA NITROGEN
PES	PESTICIDES
TDS	TOTAL DISSOLVED SOLIDS
TOC	TOTAL ORGANIC CARBON
TSS	TOTAL SUSPENDED SOLIDS
VOA	VOLATILE ORGANIC ANALYSIS

ORGANIC ANALYSIS DATA

6MD-HO Sample Number: 9T5BCW06-15 Date Analyzed: 12-Apr-99

Analyst: D. Gregg Sample Type: liquid

PESTICIDE COMPOUNDS BY MODIFIED METHOD 525.2*

UNITS: UG/L

Compound Name	Results**	Detection Limits
Atrazine	0.72	0.2
Propazine	1.01	0.2

* Sample was extracted by Accelerated One Step.

** ND --- Means not detected above the listed detection limits.

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-15 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000344

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	4.7	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	42.5	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds

Method 624*

Sample Number: 9T5BCW06-15 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

US EPA REGION 6 LABORATORY

000346

SAMPLE #: 9T5CIW06-15
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID
ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	177	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	100000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	172	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	39100	150	UG/L	200.7
MANGANESE	ND	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8490	1000	UG/L	200.7
SELENIUM	3.4	3	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	25800	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	199	20	UG/L	200.7
HARDNESS	411	5		MG/L

ND: LESS THAN DETECTION LIMIT

TNRCC Laboratory

Report of Analysis

May 05, 1999 15:30

000347

TNRCC Sample #: 9901907 Group#: 19990599 Chain of Custody #: 9T5BCW06-15 Region: 0

Program Code: EPA Sample Matrix: LIQUID Sample Depth: Station ID:

Sample Collected: 4/6/99 05:10 pm Sample Recieved: 4/8/99 Sample Collector: EPA

Collection Site: City of Perryton Well No. 2

Storet	Parameter Name	Result	Unit	Prepared	Analyzed	Method
04255	Alkalinity, Bicarbonate	299	mg/L	N/A	4/13/99 15:00	310.1
29808	Alkalinity, Carbonate	0	mg/L	N/A	4/13/99 15:00	310.1
00415	Alkalinity, Phenylphthalein	0	mg/L	N/A	4/13/99 15:00	310.1
00410	Alkalinity, Total	299	mg/L	N/A	4/13/99 16:00	310.1
00610	Ammonia Nitrogen	<0.05	mg/L	N/A	4/30/99 07:10	350.1
70300	Total Dissolved Solids	572	mg/L	N/A	4/9/99 08:00	160.1
00680	Total Organic Carbon	<1	mg/L	N/A	4/13/99 09:30	415.2
00530	Total Suspended Solids	<1	mg/L	N/A	4/9/99 08:00	160.2
00535	Volatile Suspended Solids	<1	mg/L	N/A	4/9/99 08:00	160.4
82394	Hardness, Total, Calculated	*	mg/L	4/8/99	4/9/99 16:05	200.7

Comments: End of Data for TNRCC Sample# :9901907

Laboratory Approval: SBest **Approval Date:** 5-May-1999

RP15FYNL 26 Oct1998

U. S. Environmental Protection Agency

Region 6 Houston Laboratory

Report For Sample Number 9T5BCW0616

Source: CITY OF PERRYTON WELL NO. 2

Site Description: 034-GW2-05F

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 05:10 PM

Sample Type: LIQUID

Comments:

Parameter	Description
MAA	GFAAS METALS
MHG	MERCURY
MICP	ICP METALS

US EPA REGION 6 LABORATORY

000349

SAMPLE #: 9T5CIW06-16
CITY OF PERRYTON WELL NO. 2

SOURCE:
MATRIX LIQUID

ANALYSTS: KD, LC, LL

DATE RECEIVED: 07-APR-99
DATES ANALYZED: 19-APR-99 TO 29-APR-99
REPORTED: 30-APR-99

PARAMETER	CONCENTRATION	DETECTION LIMIT <=	UNITS	METHOD
ALUMINUM	ND	100	UG/L	200.7
ANTIMONY	ND	60	UG/L	200.7
ARSENIC	ND	3.0	UG/L	200.9
BARIUM	178	10	UG/L	200.7
BERYLLIUM	ND	5	UG/L	200.7
CADMIUM	ND	5	UG/L	200.7
CALCIUM	101000	150	UG/L	200.7
CHROMIUM	ND	10	UG/L	200.7
COBALT	ND	20	UG/L	200.7
COPPER	ND	20	UG/L	200.7
IRON	30	25	UG/L	200.7
LEAD	ND	3.0	UG/L	200.9
MAGNESIUM	39100	150	UG/L	200.7
MANGANESE	ND	5	UG/L	200.7
MERCURY	ND	0.1	UG/L	245.1
NICKEL	ND	20	UG/L	200.7
POTASSIUM	8490	1000	UG/L	200.7
SELENIUM	3.3	3.0	UG/L	200.9
SILVER	ND	10	UG/L	200.7
SODIUM	26100	500	UG/L	200.7
THALLIUM	ND	5.0	UG/L	200.9
VANADIUM	ND	30	UG/L	200.7
ZINC	162	20	UG/L	200.7

ND: LESS THAN DETECTION LIMIT

U. S. Environmental Protection Agency
Region 6 Houston Laboratory

000350

Report For Sample Number 9T5BCW0617

Source: CITY OF PERRYTON WELL NO. 2

Site Description: TRIP BLANK

Date/Time Received: 4/8/1999 09:20 AM **Date Completed** 5/10/1999

Date/Time Collected: 4/6/1999 08:49 AM

Sample Type: LIQUID

Comments:

Parameter	Description
VOA	VOLATILE ORGANIC ANALYSIS

Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-17 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000351

Compound	results** (µg/L)	detection limits
Chloromethane	ND	5
Bromomethane	ND	5
Vinyl Chloride	ND	5
Chloroethane	ND	5
Methylene Chloride	ND	5
Acetone	ND	5
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	2
1,1-Dichloroethane	ND	2
trans-1,2-Dichloroethene	ND	2
Chloroform	ND	2
1,2-Dichloroethane	ND	2
2-Butanone	ND	5
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	ND	2
Bromodichloromethane	ND	2
1,2-Dichloropropane	ND	2
cis-1,3-Dichloropropene	ND	2
Trichloroethene	ND	2
Benzene	ND	2
Dibromochloromethane	ND	2
trans-1,3-Dichloropropene	ND	2
1,1,2-Trichloroethane	ND	2
Bromoform	ND	2
4-Methyl-2-Pentanone	ND	5
2-Hexanone	ND	5
Tetrachloroethene	ND	2
1,1,2,2-Tetrachloroethane	ND	2
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
o-xylene	ND	5
m/p-xylene	ND	5
cis-1,2-Dichloroethene	ND	2

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

** "ND" means not detected at the corresponding detection limit.

Tentatively Identified Volatile Organic Compounds
Method 624*

Sample Number: 9T5BCW06-17 Date Extracted: 12-Apr-99

Sample Type: LIQUID Date Analyzed: 12-Apr-99

000352

Number TICs found: 0

TIC NO.	CAS NO.	COMPOUND NAME	RT min.	EST. CONC. µg/l

* A modified 624-CLP method was used that satisfies the major QC criteria of both methods.

CHAIN OF CUSTODY RECORD

↑ 2 coolers

PROJ. NO.	PROJECT NAME
151498.AN.AN	City of Perryton Well No.2

SAMPLERS: (Signature) Katherine Ogwan / CH2M HILL

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOA's	Pesticides (Atrazine & Propazine)	Metals	Ammonia	Hardness	Alkalinity, TDS, TSS	TOC	REMARKS
Well No 2	4/6/99	0839		X	034-GW2-01	2	2							
Well No. 2	4/6/99	0849		X	034-GW2-02	2	2							
Well No. 2	4/6/99	0915		X	034-GW2-03	2	2							
Well No. 2	4/6/99	1310		X	034-GW2-04	5	2	2	1					
Well No. 2	4/6/99	1310		X	034-GW2-04F	1			1					
Well No. 2	4/6/99	[redacted]		X	034-GW2-Dup1	5	2	2	1					
Well No. 2	4/6/99	[redacted]		X	034-GW2-Dup1F	1			1					
Well No. 2	4/6/99	1710		X	034-GW2-05	18	4	4	2	2	2	2	2	Use extra samples for MS/MSD
Well No. 2	4/6/99	1710		X	034-GW2-05F	2			2					" "
Well No. 2	4/6/99	(FES)			Trip Blank	2	2							
Well No 2	4/6/99				EQ Blank	1			1					Please rinse container with DI water and analyze water for metals

Nothing Follows

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Peterson Moor	04/06/99 1900				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) Sylvia Arostegui	4/8/99	9:20am	Remarks: Temp Blank 10°C 4/8/99
Shipped by: Fed EX		Airbill Number: 810380873245			

Distribution: White Accompanies Shipment; Pink to Coordinator Field Files;
Green to Report; Yellow Returns with Warrant

EPA 7500-53
(11/96)

6- 07374

000353

OFFICIAL

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
151498.SC.SC	City of Penticton Well No. 2

SAMPLERS: (Signature) Katherine Egwan / Peter Van Noort

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Pesticides (Atrazine & Propazine)	Metals	Anions	Ammonia	Hardness	Alkalinity, TDS, TSS	TOC	REMARKS
Well No. 2	4/6/99	0839		X	034-GW2-01	108	X	X	X	X	X	X	X	
Well No. 2	4/6/99	0839		X	034-GW2-01F	1		X						"F" = filtered in field
Well No. 2	4/6/99	0849		X	034-GW2-02	3	X	X						
Well No. 2	4/6/99	0849		X	034-GW2-02F	1		X						
Well No. 2	4/6/99	0915		X	034-GW2-03	8	X	X	X	X	X	X	X	
Well No. 2	4/6/99	0915		X	034-GW2-03F	1		X						
Well No. 2	4/6/99	1310		X	034-GW2-04	2			X					Use extra volume for MS/MSD

4/6/99

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Peter van Noort	4/6/99 1305				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) Debra Donaldson	4/7/99 9:40	Remarks	
Shipped by: Fed Ex Pri 1		Airbill Number: 810380 873212		Temp Blank — 4°C #34/7/99	

Distribution: White Accompanies Shipment; Pink to Coordinator Field Files
Green to Report; Yellow Returns with Warrant

EPA 7500-53
(11/96)

6- 07372

000354

CAS Data

000356

Columbia Analytical Services INC.
An Employee-Owned Company

April 22, 1999 Service Request No: K9902162

Peter VanNoort
CH2M Hill Corporation
5339 Alpha Rd. Suite 300
Dallas, TX 75240

Re: City of Perryton Well No. 2/151498.AN.AN

Dear Peter:

Enclosed are the results of the sample(s) submitted to our laboratory on April 8, 1999. For your reference, these analyses have been assigned our service request number K9902162.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions. My extension is 258.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein

Lynda A. Huckestein
Client Services Manager

LAH/clb

cc: Herb Kelly [CH2M Hill/Gainesville]

1317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 360/ 577-7222 • Fax 360/636-1068

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
J	Estimated concentration. The value is less than the method reporting limit, but greater than the method detection limit.
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NAN	Not Analyzed
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected at or above the MRL
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: CH2M Hill Corporation
Project: City of Perryton Well No. 2/151498.AN.AN
Sample Matrix: Water

Service Request: K9902162
Date Collected: 4/6/99
Date Received: 4/8/99
Date Extracted: 4/19/99
Date Analyzed: 4/20/99

Total Lead
EPA Method 200.8
Units: µg/L (ppb)

Sample Name	Lab Code	MRL	Result
034-GW2-01	K9902162-001	0.02	9.24
034-GW2-02	K9902162-003	0.02	8.58
034-GW2-03	K9902162-005	0.02	8.19
034-GW2-04	K9902162-007	0.02	9.81
034-GW2-05	K9902162-009	0.02	1.63
EQ BLANK	K9902162-011	0.02	ND
Method Blank	K9902162-MB	0.02	ND

Approved By: _____ Date: 4/22/99

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	CH2M Hill Corporation	**Service Request:**	K9902162
Project:	City of Perryton Well No. 2/151498.AN.AN	**Date Collected:**	4/6/99
Sample Matrix:	Water	**Date Received:**	4/8/99
		Date Extracted:	4/19/99
		Date Analyzed:	4/20/99

Dissolved Lead
EPA Method 200.8
Units: µg/L (ppb)

Sample Name	Lab Code	MRL	Result
034-GW2-01F	K9902162-002	0.02	1.37
034-GW2-02F	K9902162-004	0.02	2.37
034-GW2-03F	K9902162-006	0.02	1.52
034-GW2-04F	K9902162-008	0.02	0.73
034-GW2-05F	K9902162-0010	0.02	1.20

Approved By: _____ Date: 4/21/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

000360

Client:	CH2M Hill Corporation	**Service Request:**	K9902162
Project:	City of Perryton Well No. 2/151498.AN.AN	**Date Collected:**	4/6/99
Sample Matrix:	Water	**Date Received:**	4/8/99
		Date Extracted:	4/19/99
		Date Analyzed:	4/20/99

Matrix Spike Summary
Total Metals
Units: µg/L (ppb)

Sample Name: 034-GW2-01
Lab Code: K9902162-001MS

Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Lead	0.2	20	9.24	28.1	94	75-125

Approved By: _____ Date: 4/21/99

00005

MS1S/102194
02162ICP.BR1 - Spike 4/21/99

Page No.:

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

000361

Client: CH2M Hill Corporation
Project: City of Perryton Well No. 2/151498.AN.AN
Sample Matrix: Water

Service Request: K9902162
Date Collected: 4/6/99
Date Received: 4/8/99
Date Extracted: 4/19/99
Date Analyzed: 4/20/99

Duplicate Summary
Total Metals
Units: µg/L (ppb)

Sample Name: 034-GW2-01
Lab Code: K9902162-001DUP

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lead	200.8	0.2	9.24	9.31	9.28	<1

Approved By: _____ Date: 4/21/99

00006

DUP1SEPA/102194

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	CH2M Hill Corporation	**Service Request:**	K9902162
Project:	City of Perryton Well No. 2/151498.AN.AN	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	4/20/99

Laboratory Control Sample Summary
Total Metals
Units: µg/L (ppb)

Source: CAS Spike Solution

Analyte	EPA Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Lead	7421	20.0	20.7	104	85-115

Approved By: _____ Date: 4/21/99

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: CH2M Hill Corporation
Project: City of Perryton Well No. 2/151498.AN.AN

Service Request: K9902162
Date Analyzed: 4/20/99

Total Lead
EPA Method 6020
Units: µg/L (ppb)

INITIAL CALIBRATION VERIFICATION (ICV)

	True Value	Measured Value	Percent Recovery
ICV 1 Result	50.0	49.0	98

CONTINUING CALIBRATION VERIFICATION (CCV)

	True Value	Measured Value	Percent Recovery
CCV 1 Result	25.0	25.6	102
CCV 2 Result	25.0	25.8	103
CCV 3 Result	25.0	25.4	102

CONTINUING CALIBRATION BLANK (CCB)

	MRL	Blank Value
CCB 1 Result	0.02	ND
CCB 2 Result	0.02	ND
CCB 3 Result	0.02	ND

Approved By: _____ Date: 4/21/99 00008

COMBOQCD/042695

Columbia Analytical Services, Inc.
An Employee-Owned Company

000364

CHAIN OF CUSTODY

Page 1 of 2

COC # No 991490

5090 Caterpillar Road • Redding, CA 96003 • Phone: (530) 244-5227 • FAX: (530) 244-4109

Project # 151498.AN.AN	Purchase Order #
Project Name: City of Perryton Well No. 2	
Company Name: CH2M HILL	
Project Manager or Contact & Phone #: Peter van Noort	Report Copy to: Peter van Noort & Herb Kelly
Requested Completion Date: Verbal - 4/22/99; Hard Copy - within 28 days of receipt	Site ID
Sample Disposal: Dispose [X] Return [ ]	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # (E200.8 - Lead only)	Preservative (to be filled out by customer) (HNO_3)
4/6/99	0839		X	X			034-GW-2-01		1	1	
4/6/99	0839		X	X			034-GW-2-01F		1	1	
4/6/99	0849		X	X			034-GW-2-02		1	1	
4/6/99	0849		X	X			034-GW-2-02F		1	1	
4/6/99	0915		X	X			034-GW-2-03		1	1	
4/6/99	0915		X	X			034-GW-2-03F		1	1	
4/6/99	1310		X	X			034-GW-2-04		1	1	
4/6/99	1310		X	X			034-GW-2-04F		1	1	
4/6/99	1710		X	X			034-GW-2-05		1	1	
4/6/99	1710		X	X			034-GW-2-05F		1	1	

THIS AREA FOR LAB USE ONLY

Lab #	Page / of 19
Lab PM	Custody Review 00
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N

QC Level 1 2 3 Other

Cooler Temperature

Alternate Description	Lab ID
QC this one As per Kate Swanson FA	

Sampled By and Title: Kate Swanson - Tech - (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) / Date/Time
Received By: Jean Alan Fax Alan CAS (Please sign and print name)	Date/Time 4/8/99 1000	Relinquished By (Please sign and print name) / Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS (Fed-Ex) Other / Shipping # 810380941996

Special Instructions:

INVOICE INFORMATION

P.O. #

Bill To: Peter van Noort / CH2M HILL
5339 Alpha Road,
Dallas, TX 75240

TB5.1

Columbia Analytical Services INC.
An Employee-Owned Company

000365

CHAIN OF CUSTODY

5090 Caterpillar Road • Redding, CA 96003 • Phone: (530) 244-5227 • FAX: (530) 244-4109

COC # No 991485

Project # 151498.AN.AN	Purchase Order #
Project Name: City of Perryton Well No. 2	
Company Name: CH2M HILL	
Project Manager or Contact & Phone #: Peter van Noort	Report Copy to: Peter van Noort & Herb Kelly
Requested Completion Date: Verbal – 4/22/99; Hard Copy – within 28 days of receipt	Site ID
Sample Disposal: Dispose ☒ Return ☐	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method #	Preservative (to be filled out by customer)
4/6/99							EQ BLANK		1	E200.8 - Lead only	none

THIS AREA FOR LAB USE ONLY

Lab #	Page 1 of 1
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N

QC Level 1 2 3 Other_____

Cooler Temperature

Alternate Description	Lab ID

Sampled By and Title: Katie Swanson Tech (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By: Jane Adair Jane Adair OAS (Please sign and print name)	Date/Time: 4/8/99 0800	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS (Fed-Ex) Other_____ Shipping # 810380941996	

Special Instructions:

Please rinse container with DI water, then analyze water for Lead

INVOICE INFORMATION

P.O. #

Bill To: Peter van Noort/CH2M HILL
5339 Alpha Road
Dallas, TX 75240

Appendix B
Aquifer Characterization Data

Appendix B

Aquifer Characterization Data

The time-drawdown data were analyzed using AQTESOLV's Aquifer Test Design and Analysis software program. Transmissivity was calculated using the Neuman method for unconfined aquifers (Neuman, 1974). Assumptions of the Neuman Method are listed below:

- Aquifer is unconfined
- Aquifer has infinite area extent
- Aquifer is isotropic, homogeneous and has a uniform thickness
- Aquifer potentiometric surface is initially horizontal
- Flow is unsteady
- Diameter of pumping well is very small so that storage in the well can be neglected.

Transmissivity is determined from the following relationship:

$$T = Q/4\pi s\ W(\mu_a, B)$$

Where:

Q	=	pumping rate (gallons per minute)
s	=	drawdown (feet)
$W(\mu_a, B)$	=	well function

The calculations are performed by selecting type curves to match late time and early time drawdown measurements. The late-time curve is matched first to late time drawdown measurements followed by a match to the early time data with the early portions of the type curve. Although the testing occurred for eight hours, the pumping rate was changed after 3 hours (Figure B-1) and as a result, only the first three hours of drawdown data were used in the analysis. In general, a reasonable match was achieved with late time data although later time data would be beneficial to improve the match. There was a poor match with the early time data, potentially as a result of the fact that the pumping well was used for analysis. Drawdown from a pumping well is typically greater than what would be expected in an observation well because of well losses. Figure B-2 presents the results of automatic curve matching using the least squares method. Confirmatory, manual calculations using the Bolten equation (Prickett, 1965) resulted in a similar, albeit slightly lower transmissivity. If additional aquifer information is required, future aquifer tests should be run longer (minimum 16 - 24 hours) and drawdown data obtained from a non-pumping observation well.

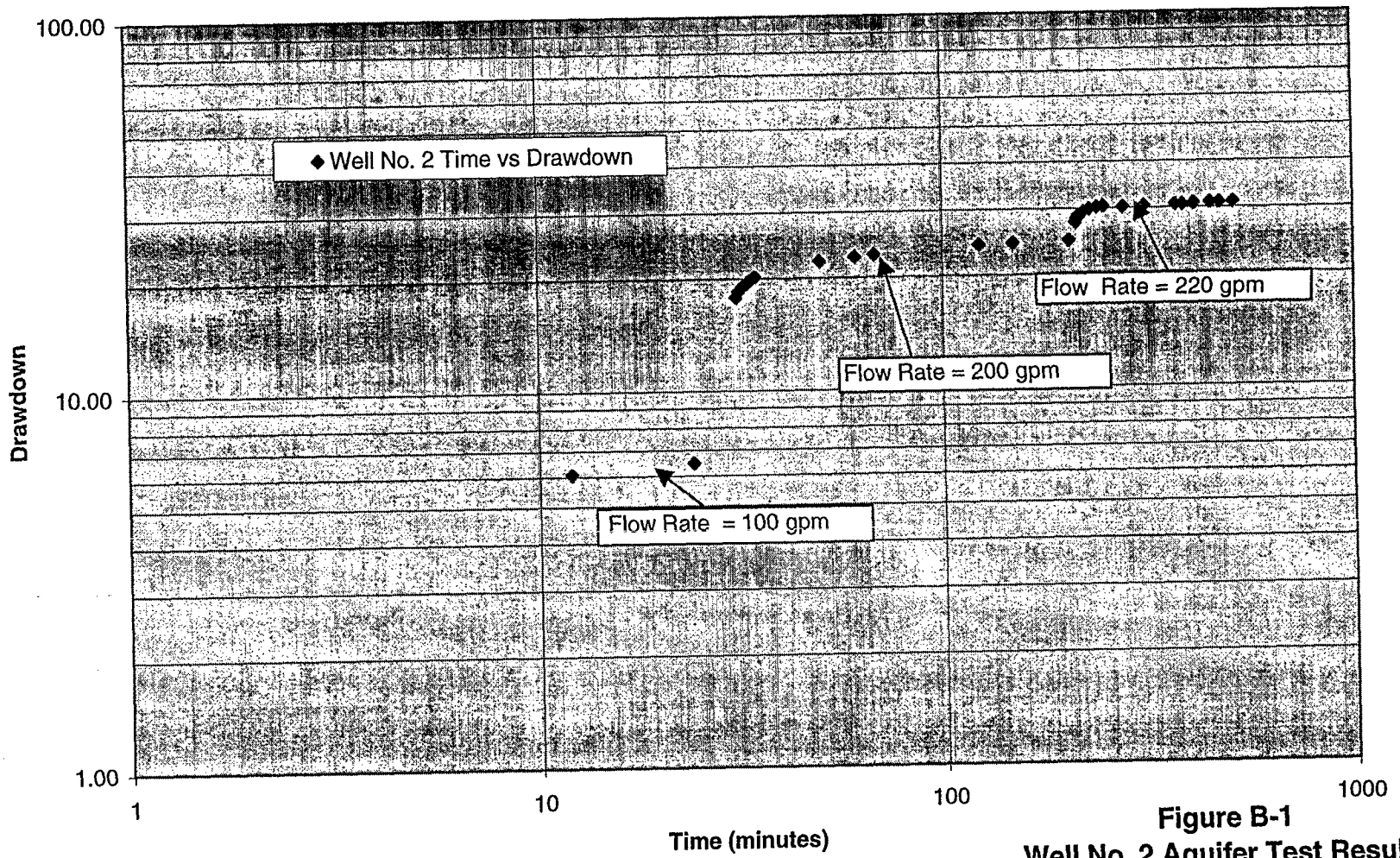
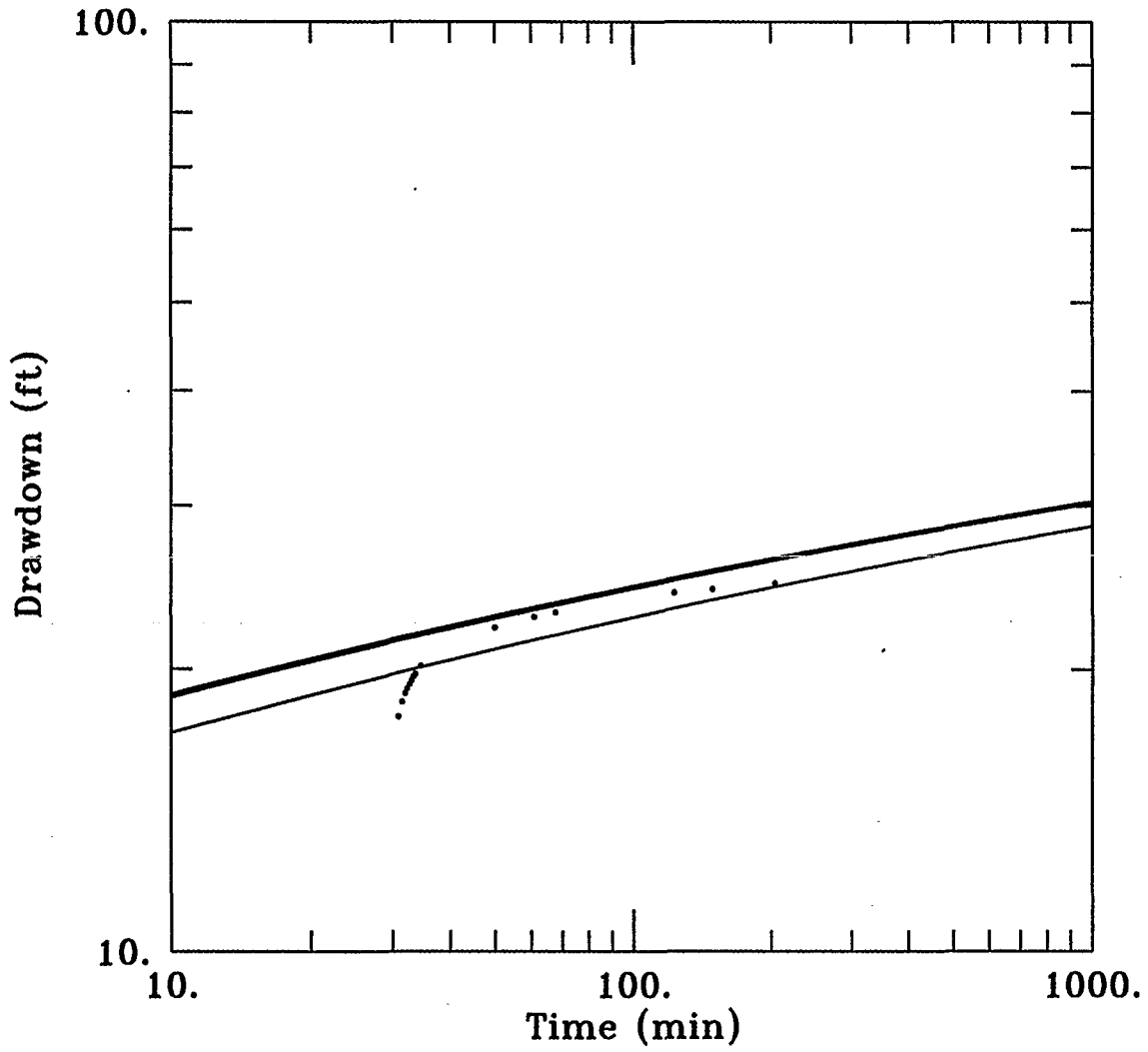


Figure B-1
Well No. 2 Aquifer Test Results
Time vs Drawdown, April 6, 1999

Client: **EPA**	Company: **CH2M HILL**
Location: **Perryton, Texas**	Project: **151498**

City of Perryton, Well No.2 Aquifer Test



DATA SET:
WELLNO2-
05/26/99

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman (approx.)

PROJECT DATA:
test date: April 6, 1999
test well: Well No. 2
obs. well: Well No. 2

TEST DATA:
Q = 200. gal/min
r = 0. ft
r_c = 0.66 ft
r_w = 1. ft
b = 175. ft

PARAMETER ESTIMATES:
T = 9125.8 gal/day/ft
S = 0.01141
Sy = 0.0107
β = 0.001

Figure B-2
Well No. 2 Aquifer Test Results
Type Curve Match

AQTESOLV

000370

Appendix C
Risk-based Concentration Calculations

Appendix C

Equations and Exposure Assumptions for the Calculation of Risk-Based Concetrations (RBCs)

Carcinogenic Risk-Based Concentration for Water:

$$RBC(mg/L) = \frac{TR \times AT_C}{EF_R\left[(IFW_{ADJ} \times SF_O) + (VF_W \times InhF_{ADJ} \times SF_I)\right]}$$

Noncarcinogenic Risk-Based Concentration for Water:

$$RBC(mg/L) = \frac{THQ \times BW_A \times AT_{NC}}{EF_R \times ED_R\left[\left(\frac{IRW_A}{RfD_O}\right) + \left(\frac{VF_W \times IRA_A}{RfD_I}\right)\right]}$$

Table C-1
Input Factors and Exposure Assumptions

Parameter	Definition (units)	Residential Assumption
ATc	Averaging Time –cancer (days)	25,550
ATnc	Averaging Time – noncancer (days)	10,950
BW_A	Body Weight – Adult (kg)	70
ED	Exposure Duration (years)	30
EF	Exposure Frequency (days/year)	350
IFW_{ADJ}	Water Ingestion Factor (age-adjusted) (L-yr/kg-	1.1
$InhF_{ADJ}$	Inhalation Factor (age-adjusted) (m^3-yr/kg-day)	11
IRA_A	Inhalation Rate – Adult (m^3/day)	20
RfD_I	Chronic Inhalation Reference Dose (mg/kg-day)	Chemical-Specific
RfD_O	Chronic Oral Reference Dose (mg/kg-day)	Chemical-Specific
SF_I	Inhalation Cancer Slope Factor (kg-day/mg)	Chemical-Specific
SF_o	Oral Cancer Slope Factor (kg-day/mg)	Chemical-Specific
THQ	Target Hazard Quotient	1
TR	Target Risk	1×10^{-6}
VF_W	Volatilization Factor - Water (L/m^3)	0.5

Table C-2

Toxicity Factors for Contaminants of Concern

Contaminant of Concern	RfDo	Ref.	RfDi	Ref.	SFo	Ref.	SFi	Ref.
Lead	--		--		--		--	
Nitrate	--		--		--		--	
Atrazine	0.035	H	0.035	R	0.22	H	0.22	R
Propazine	0.02	I	0.02	R	--		--	
Chloroform	0.01	I	0.01	R	0.0061	I	0.081	I
CTC	0.0007	I	0.00057	--	0.13	I	0.053	I

Notes:

CTC - Carbon tetrachloride

H - Health Effects Assessment Summary Tables (HEAST)

I - Integrated Risk Information System (IRIS)

R - Route-extrapolated (oral to inhalation)

RfDo - Oral Reference Dose (mg/kg-day)

RfDi - Inhalation Reference Dose (mg/kg-day)

SFo - Oral Slope Factor (kg-day/mg)

SFi - Inhalation Slope Factor (kg-day/mg)

000373

Appendix D
ARARs

Table D-1
Federal Applicable or Relevant and Appropriate Requirements for Remedial Action at Well No. 2
Perryton, Texas

ARAR Citation	Requirement	Rationale for Use	Type of Requirement
Chemical-Specific			
Solid Waste Disposal Act (SWDA), as amended by the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.)	Establishes the basic framework for federal regulation of solid and hazardous waste including specific chemical criteria. Authority for implementation has been delegated, in part, to the state.	Solid/hazardous waste may be generated as part of the remedial action due to the presence of carbon tetrachloride.	Applicable
Identification and Listing of Hazardous Waste (40 CFR 261)	Contains numerical criteria for designating a waste as a hazardous waste.	Authority to implement these requirements has been delegated to the state. See 30 TAC 355 in Table A-2.	NA
Land Disposal Restrictions (40 CFR 268)	Provides numerical treatment standards for land disposal of some hazardous wastes.	Solid/hazardous waste may be generated as part of the remedial action due to the presence of carbon tetrachloride. Depending on concentration levels, it may need to be treated prior to disposal.	Potentially applicable
Safe Drinking Water Act (SDWA) as amended (42 U.S.C. 201.)	Establishes the basic framework for protection of drinking water through risk-based standards.	Perryton Well No. 2 is used for drinking water purposes.	Applicable
Maximum Contaminant Levels for Organic Contaminants (40 CFR 141)	Provides primary drinking water standards including MCLs and maximum contaminant level goals (MCLGs).	Carbon tetrachloride and atrazine are present at the Perryton Well No. 2 site. Carbon tetrachloride has an MCL of 0.005 mg/l and an MCLG of 0 mg/l. Atrazine has an MCL and MCLG of 0.003 mg/l.	Applicable
Reference Doses (RfDs), EPA Office of Research and Development	Presents nonenforceable toxicity data for specific chemicals for use in public health assessments.	Standard used to assess risk associated with soil and groundwater.	TBC
Risk Specific Doses (RSDs), EPA Carcinogen Assessment Group and EPA Environmental Criteria and Assessment Office	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).	Standard used to assess risk associated with soil and groundwater.	TBC

Table D-1
Federal Applicable or Relevant and Appropriate Requirements for Remedial Action at Well No. 2
Perryton, Texas

ARAR Citation	Requirement	Rationale for Use	Type of Requirement
Action-Specific			
Occupational Safety and Health Administration (OSHA) Requirements (29 CFR 1910, 1926, and 1904)	Establishes requirements for occupational health and safety applicable to workers engaged in hazardous waste site or CERCLA response actions.	Required for workers who will be exposed to hazardous substances during remediation activities.	Applicable
DOT Rules for Hazardous Materials Transport (49 CFR 107, 171.1-500)	Establishes requirements for the transport of hazardous materials including packaging, shipping, and placarding.	Remedial actions may require transportation of hazardous materials for treatment and/or disposal.	Potentially applicable
SWDA, as amended by the RCRA (42 U.S.C. 6901 et seq.)	Establishes the basic framework for federal regulation of solid and hazardous waste, including specific requirements related to waste activities. Subpart C of RCRA controls the generation, transportation, treatment, storage, and disposal of hazardous waste through a comprehensive "cradle to grave" system of hazardous waste management requirements.	Solid/hazardous waste may be managed as part of the remedial action.	Applicable
Identification and Listing of Hazardous Waste (40 CFR 261)	Provides methodology for determining whether a material is a hazardous waste.	Authority to implement these requirements has been delegated to the state. See 30 TAC 355 in Table A-2.	NA
Standards for Generators and Transporters of Hazardous Waste and Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 262-265, and 266)	Establishes detailed requirements related to generation and management of hazardous waste.	Authority to implement these requirements has been delegated to the state. See 30 TAC 355 in Table A-2.	NA
Land Disposal Restrictions (40 CFR 268)	Restricts certain hazardous wastes from placement or disposal on land without treatment.	Soil or secondary wastes from remedial actions that designate as hazardous waste must be treated prior to disposal.	Potentially applicable

Table D-2
State of Texas Applicable or Relevant and Appropriate Requirements for Well No. 2
Perryton, Texas

ARAR Citation	Requirement	Rationale for Use	Type of Requirement
Chemical-Specific			
Texas Industrial Solid Waste and Municipal Hazardous Waste (30 TAC Chapter 335)	Establishes the basic framework for state regulation of solid and hazardous waste.	Solid/hazardous waste might be generated as part of remedial actions.	Potentially applicable
Subchapter R, Waste Classification	Contains numerical criteria for designating a waste as a hazardous waste or as one of three classes of solid waste.	Soil, sediments, or secondary waste generated as part of remedial actions may designate as hazardous waste depending on concentrations. For example, a maximum leachable concentration of 0.5 mg/L carbon tetrachloride designates as a hazardous waste.	Potentially applicable
Subchapter S, Risk Reduction Rules	Establishes a three-tiered cleanup program for cleanup of contaminated media. Standard 1 is cleanup to background concentrations. Standards 2 and 3 identify methods for calculating MSCs for soil.	There is soil and groundwater contamination at Perryton Well No. 2 due to the presence of carbon tetrachloride, atrazine, and propazine.	Relevant and appropriate.
Water Hygiene (30 TAC Chapter 290)	Sets drinking water standards for water systems in Texas.	Carbon tetrachloride and atrazine are present at the Perryton Well No. 2 site. Carbon tetrachloride has an MCL of 0.005 mg/l and atrazine has an MCL of 0.003 mg/l.	Applicable
Action-Specific			
Exemptions from Permitting (30 TAC Chapter 106)	Establishes criteria for Standard Exemptions under which certain facilities or types of facilities do not require air permits.	Remedial actions may generate air emissions.	Potentially applicable
Subchapter X, Waste Processes and Remediation	Per 30 TAC 106.533, water and soil remediation projects are exempt from air permitting if: Emissions are less than specified in 30 TAC 106.262 (see Table 4.4) There are no visible emissions If abatement equipment is used to meet emissions limits, it satisfies conditions for direct-flame combustion, flares, catalytic oxidizers, or carbon adsorption as specified in the regulation.	Remedial actions may qualify for the permitting exemption if they meet the requirements of the exemption.	Potentially applicable

Table D-2
State of Texas Applicable or Relevant and Appropriate Requirements for Well No. 2
Perryton, Texas

ARAR Citation	Requirement	Rationale for Use	Type of Requirement
Consolidated Permits (30 TAC Chapter 305)	Establishes standards and requirements for management of waste disposal activities. Includes wastewater discharge permits, solid waste permits, and injection well permits.	Remedial actions may involve management/processing of solid or hazardous waste.	Potentially applicable
Control of Air Pollution From Visible Emissions and Particulate Matter (30 TAC Chapter 111)	Establishes requirements and standards for activities that could produce visible and particulate emissions.	Remedial actions may release particulate into the air.	Potentially applicable
Industrial Solid Waste and Municipal Hazardous Waste (30 TAC Chapter 335)	Establishes the basic framework for state regulation of solid and hazardous waste.	Solid and/or hazardous waste might be generated, stored, processed, and/or disposed as part of remedial actions.	Potentially applicable
Subchapter B, Hazardous Waste Management General Provisions	Defines when a permit is required for activities involving industrial solid waste and municipal hazardous waste.	Excavated soil, sediments, and/or secondary wastes might designate as hazardous waste, and storage/treatment/disposal may require permitting.	Potentially applicable
Subchapters C, D, and F, Standards Applicable to Generators and Transporters of Hazardous Waste, Facilities Storing, Processing, or Disposing Hazardous Waste	Establishes detailed requirements (e.g., labeling, containment, permitting) for the management, storage, processing, and disposal of hazardous waste.	Excavated soil, sediments, and/or secondary wastes from remedial actions might designate as hazardous waste. During remedial action, these materials may be stored, processed, or disposed.	Potentially applicable
Subchapter S, Risk Reduction Rules	Establishes administrative process for remediating releases to environmental media.	There is soil and groundwater contamination at Perryton Well No. 2 due to the presence of carbon tetrachloride, atrazine, and propazine.	Relevant and appropriate.
Subchapter O, Land Disposal Restrictions (LDRs)	Restricts placement/land disposal of certain listed or characteristic hazardous waste without treatment.	Secondary waste may be designated as hazardous waste and would thus require treatment before placement or disposal.	Potentially applicable

Appendix E
Conceptual Design and Cost Calculations

Alternative 2

TREATMENT SYSTEM CONCEPTUAL DESIGN AND COMPARISON

City of Perryton, TX Well No. 2 EE/CA

000380

Contamination Characterization			Limit	
Carbon tetrachloride (CTC) concentration range	35.8 ppb to	50.3 ppb	5 ppb	MCL
Chloroform concentration range	4.4 ppb to	4.8 ppb	100 ppb	MCL
Benzene concentration range	1 ppb to	1 ppb	5 ppb	MCL
Atrazine concentration range	<1 ppb to	5.47 ppb	3 ppb	MCL
Propazine concentration range	<1 ppb to	5.74 ppb	730 ppb	(risk-based level)
Lead concentration range	5.7 ppb to	60.9 ppb	15 ppb	(action limit)

Air Stripper Conceptual Design Parameters

Stripper design flowrate [140] gpm

Governing contaminant CTC at [101] ppb (with 2X safety factor)

Governing contaminant is based on consideration of a combination of low Henry's Constant and high concentration versus MCL.

Influent temperature 33 °F

The Henry's Law Constant for CTC (20°C) = 1290 atm

Converting the Henry's Constant for an actual temperature of 15 °C and using the Van't Hoff conv (JMM, 1985, page 238)

Actual Henry's Constant is 961 atm which is greater than the 10 atm threshold for effective air stripping.

Assume 100% of CTC stripped and discharged untreated to the atmosphere.

Assume a ShallowTray 312 using a blower airflow rate of [1,800] cfm

CTC emissions 0.007 lbs/hr or 0.17 lbs/day or 61.6 lbs/yr

Average CTC emissions concentration is 1.0 mg/m^3 or 0.4 ppm

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

30 TAC 106.533 and 106.262 limit CTC emissions to 0.037 lbs/hr with a 100 feet setback from the nearest receptor.

The NIOSH Exposure Limit (more conservative than OSHA limits) of CTC is [2] ppm or [5] mg/m^3

Since the actual emission rate is less than the TNRCC limit and less than the NIOSH limit, NO OFFGAS TREATMENT IS REQUIRED.

Form PI-7 needs to be completed and the TNRCC will need to notified of the source prior to installation.

Granular Activated Carbon (GAC) Conceptual Design Parameters

All organic contaminants found in the Well 2 water are adsorbable with GAC.

GAC treatment system design flowrate is 140 gpm

Governing contaminant CTC at 101 ppb (with 2X safety factor)

Governing contaminant is based on a combination of consideration of low adsorption and high concentration versus MCL.

Carbon adsorption Freundlich Isotherm data obtained from EPA RREL Database.

Adsorption constant, $q = K*c^{(1/n)}$ where

q = mg CTC / g GAC

K and (1/n) are Freundlich Isotherm constants

c = concentration of CTC in µg/L

Use average constants for several brands of GAC.

Assume K = [0.185]

(1/n) = [0.715]

c = 101 µg/L

Calculate q = 5.0 mg CTC/gm GAC or 0.0050 gm CTC/gm GAC or 0.5% pickup

GAC usage rate 1.41 lbs GAC/hr or 33.77 lbs GAC/day or 12,327 lbs GAC/yr

Assuming a carbon cost of [$2.00] per lb GAC for supply and changeout --> $24,653 per year GAC

Assume a changeout period of [3] times per year

The desired changeout period drives the size of the vessels = 4,108.84 lb size

Assume a carbon vessel size of [5,000] lb and we need [2] vessels in series for safety factor.

Assuming a 5,000 lb vessel costs [$25,000] with GAC, total cost = $50,000 for vessels and GAC only.

In addition, there would be an annual recurring cost of $24,653 for GAC changeout

Advanced Oxidation System Conceptual Design Parameters

Oxidation system design flowrate is 140 gpm

Governing contaminant CTC at 101 ppb (with 2X safety factor)

Governing contaminant is based on consideration of a combination of low biodegradability and high concentration versus MCL.

Per Billy McGrane/CH2M HILL Expert, due to the inert structure of CTC, a UV/ox system would cost greater than $0.5M.

Thus, UV oxidation was not considered further.

COST ESTIMATE FOR ALTERNATIVE 2 - AIR STRIPPER TREATMENT SYSTEM

City of Perryton, TX Well No. 2 EE/CA

Assumptions:

1. CTC is the controlling contaminant for design of the air stripper.
2. A low profile air stripper will be used to minimize aesthetic impact on environment and for ease of O&M.
3. The general chemistry of the water will not cause scaling or fouling of the tray system.
4. The North East Environmental Products Shallow Tray Modeler software is accurate to provide the equipment sizing.
5. This cost estimate was prepared for the purposes of evaluating various EE/CA alternatives is considered an order-of-magnitude cost estimate only.
6. Offgas treatment is not required by the TNRCC.

Direct Capital Cost

Item	Qty	Unit	Unit Cost	Cost	Comments
Package Low Profile Air Stripper	1	ea	$42,500.00	$42,500.00	Quote from TD Miller Assoc, Denver, CO (303)989-7737. Package includes Model 31221 tray stripper unit, blower, discharge pump, control panel, flowmeter/totalizer, blower inlet silencer
Bag Filter System	1	ls	$5,000.00	$5,000.00	Engr estimate from previous experience
On-Line Effluent Analyzer	1	ea	$50,000.00	$50,000.00	Quote from Varian. Includes on-line GC, autosampler, and datarecorder.
Discharge concentration monitoring system	1	ls	$10,000.00	$10,000.00	PLC for automatic shutdown and autodial for MCL exceedance in effluent
System Enclosure	300	sf	$50.00	$15,000.00	Engr estimate for 15'x20' insulated, prefab building with heating for freeze protection
Overhead Crane	1	ls	$30,000.00	$30,000.00	Engr estimate based on prior experience
Subtotal Direct Capital Cost				$152,500.00	
Mechanical/ Electrical	10%	of Subtotal Direct Capital Costs		$15,250.00	
Total Direct Capital Cost				$167,750.00	

Indirect Capital Cost

Engineering and Design	10%	of Total Direct Capital Cost	$16,775.00	
General Requirements	8%	of Total Direct Capital Cost	$13,420.00	
Permitting and Legal	5%	of Total Direct Capital Cost	$8,387.50	
Services During Construction	5%	of Total Direct Capital Cost	$8,387.50	
Subtotal Capital Cost			$214,720.00	
Contingency	20%	of Subtotal Capital Cost	$42,944.00	
TOTAL CAPITAL COST			$257,664.00	

Annual Operations and Maintenance Cost

Operator	192	hrs	$45.00	$8,640.00	Assume 1 operator, 16 hrs/month to clean trays, inspect system, and perform routine mech O&M
Technician	96	hrs	$60.00	$5,760.00	Assume 8 hrs/month to inspect and calibrate GC
Engineer	48	hrs	$75.00	$3,600.00	Assume 4 hours/month for data analysis and reporting
Effluent Sampling and Analysis	12	sample	$175.00	$2,100.00	Assume 1 sample per month for VOCs by GC/MS
Offgas Sampling and Analysis	4	sample	$300.00	$1,200.00	Assume 1 offgas sample per quarter for TO14
Miscellaneous Equipment/Supplies	1	ls	$5,000.00	$5,000.00	
Electrical	76,211	kw-hr	$0.06	$4,572.63	25 hp blower, 10 hp discharge pump, operates 8 hrs/day
Subtotal Operations and Maintenance Cost				$30,872.63	
Contingency	20%	of Subtotal O&M Cost		$6,174.53	
TOTAL ANNUAL OPERATIONS AND MAINTENANCE COST				$37,047.16	

PRESENT WORTH ANALYSIS

Period of Operation	10 years
Effective Rate	7%
Annual O&M Amortization Factor	7.0236
Total Capital Cost	$257,664.00
Present Value of Annual O&M Cost	$260,204.43
Total Present Value	$517,868.43

Langlier Index Calculation

Perryton, TX Well No. 2 EE/CA
5/20/99 0:00

000382

Sample 034-GW02-01 (after 600 gallons flush)

Contaminant	Value	
pH	7.34	Actual pH
$[H^+]$ (M)	4.57E-08	Calculated from pH
Alkalinity (mg/l as HCO3-)	292	
$[Ca^{2+}]$ (mg/l)	106	
Langlier Index (LI)	0.26	

Langlier Index less than 1 indicates low potential for CaCO3 scaling.

The Nalco Water Handbook (Kemmer, 1988) Figure 4.9 incorporates temperature.
Effluent temperature = 15°C (59°F)

Alkalinity as $CaCO_3$ =	239 mg/l
Calcium as $CaCO_3$ =	265 mg/l
pHs from Figure 4.9 =	7.3
LI = 7.34 - 7.3 =	0.04

The LI estimates are in close agreement and indicate a low tendency for calcium carbonate precipitation.

Sample 034-GW02-3 (after 4,500 gallons flush)

Parameter	Value	
pH	7.11	Actual pH
$[H^+]$ (M)	7.76E-08	Calculated from pH
Alkalinity (mg/l as HCO3-)	292	
$[Ca^{2+}]$ (mg/l)	101	
Langlier Index (LI)	0.01	

Langlier Index less than 1 indicates low potential for CaCO3 scaling.

The Nalco Water Handbook (Kemmer, 1988) Figure 4.9 incorporates temperature.
Effluent temperature = 15°C (59°F)

Alkalinity as $CaCO_3$ =	239 mg/l
Calcium as $CaCO_3$ =	252.5 mg/l
pHs from Figure 4.9 =	7.35
$LI = pH_a - pH_s = 7.11 - 7.35 =$	-0.24

The LI estimates are in close agreement and indicate a little to no tendency for calcium carbonate precipitation.

Sample 034-GW02-5 (after 105,580 gallons flush)

Parameter	Value	
pH	7.10	Actual pH
$[H^+]$ (M)	7.94E-08	Calculated from pH
Alkalinity (mg/l as HCO3-)	299	
$[Ca^{2+}]$ (mg/l)	100	
Langlier Index (LI)	0.01	

Langlier Index less than 1 indicates low potential for CaCO3 scaling.

The Nalco Water Handbook (Kemmer, 1988) Figure 4.9 incorporates temperature.
Effluent temperature = 18°C (64°F)

Alkalinity as $CaCO_3$ =	245 mg/l
Calcium as $CaCO_3$ =	250 mg/l
pHs from Figure 4.9 =	7.3
$LI = pH_a - pH_s = 7.1 - 7.3 =$	-0.20

The LI estimates are in close agreement and indicate a little to no tendency for calcium carbonate precipitation.

Alternative 3

COST ESTIMATE FOR ALTERNATIVE 3 - NEW REMOTE WELL INSTALLATION

City of Perryton, TX Well No. 2 EE/CA

Assumptions:

Application	Ogallala Public Water Supply Well			
Design Rate	400 gpm			
Well Details		Setting Depth (ft bls)	Effective BoreHole Dia.(in)	Nominal Casing Dia.(in)
	Final Casing	200	26	16
	Screen	420	26	16
No. of Wells	1 well			
Pumping Rate	400 gpm			
Pumping setting	340 ft bls (10 ft lower than design drawdown level)			
Motor	46 hp			
Daily Operation	8 hours			

Direct Capital Cost

Item	Qty	Unit	Unit Cost	Cost
New Well Construction				
Drill 26-inch hole - 16 inch casing	200	LF	$40.00	$8,000.00
Drill 26-inch hole - 16 inch slotted casing	220	LF	$40.00	$8,800.00
Final Casing	200	LF	$50.00	$10,000.00
Cement (neat)	427	SK	$20.00	$8,540.00
Screen	220	LF	$60.00	$13,200.00
Gravel	554	CF	$10.00	$5,540.00
Development pump	1	Ea	$5,000.00	$5,000.00
Pump Base	1	Ea	$1,500.00	$1,500.00
75 Hp Production Pump incl. Production testing	1	LS	$35,000.00	$35,000.00
Automated Controls	1	LS	$10,000.00	$10,000.00
Cathodic Protection	1	LS	$5,000.00	$5,000.00
6 inch Water Supply Line (w/misc. valves)	4,300	LF	$22.00	$94,600.00
Existing Well Abandonment				
Gravel (inside screen)	11	CY	$100.00	$1,100.00
Cement (neat in cased section)	260	SK	$20.00	$5,200.00
Total Direct Capital Cost				$211,480.00

Indirect Capital Cost

Engineering and Design	5% of Total Direct Capital Cost	$10,574.00
General Requirements	8% of Total Direct Capital Cost	$16,918.40
Permitting and Legal	5% of Total Direct Capital Cost	$10,574.00
Services During Construction	5% of Total Direct Capital Cost	$10,574.00
Subtotal Capital Cost		$260,120.40
Contingency	10% of Subtotal Capital Cost	$26,012.04
TOTAL CAPITAL COST		$286,132.44

COST ESTIMATE FOR ALTERNATIVE 3 - NEW REMOTE WELL INSTALLATION

City of Perryton, TX Well No. 2 EE/CA

Annual Operations and Maintenance Cost

Activity	Per Well Number Comp's	Frequency (Years)	Unit Cost	Average Annual Cost Per Well
All O&M costs will be assumed by the City of Perryton				
				$0.00
TOTAL ANNUAL OPERATIONS AND MAINTENANCE COST				$0.00

PRESENT WORTH ANALYSIS

Period of Operation	10 years
Effective Rate	7%
Annual O&M Amortization Factor	7.0236
Total Capital Cost	$286,132
Present Value of Annual O&M Cost	$0
Total Present Value	$286,132

CEMENT VOLUME WORKSHEET

City of Perryton, TX Well No. 2 EE/CA

New Well Construction

Effective Borehole Dia. (in)	26			
Casing Dia. (in)	16			
Length (ft)	200			
Loss Factor	1.1			
Cement Volume	504	ft3		
Assumed Cement Yield	1.18	ft3/sk	**Total Cement Volume**	**427 sks**

Existing Well Abandonment

Casing Dia. (in)	16			
Length (ft)	200			
Loss Factor	1.1			
Cement Volume	307	ft3		
Assumed Cement Yield	1.18	ft3/sk	**Total Cement Volume**	**260 sks**

GRAVEL VOLUME WORKSHEET

City of Perryton; TX Well No. 2 EE/CA

New Well Construction - Screen Section

Open Hole Section	
Effective Borehole Dia. (in)	26
Screen Dia (in)	16
Length (ft)	220
Loss Factor	1.1
Gravel Volume (ft3)	554

Existing Well Abandonment - Screen Section

Open Hole Section	
Screen Dia (in)	16
Length (ft)	220
Loss Factor	1
Gravel Volume (CY)	11

HORSEPOWER AND PUMP COLUMN WORKSHEET

City of Perryton, TX Well No. 2 EE/CA

000388

Assume:	12.99	psi manifold head
	330	ft pumping lift
	80%	pump eff.
	80%	motor eff.
	400	gpm design recovery rate
Motor hp =	46	hp
Electrical hp =	57	hp
Pump Column =	340	ft