2R - 43

REPORTS

DATE:

DEC 2003

SITE ASSESSMENT REPORT
GROUNDWATER REMEDIATION, GROUNDWATER QUALITY AND QUALITATIVE RISK ASSESSMENT
PCA JUNCTION
EDDY COUNTY, NEW MEXICO

Prepared for:

ConocoPhillips

Risk Management and Remediation
Threadneedle Office
600 North Dairy Ashford
Houston, TX 77079

Prepared by:

MAXIM TECHNOLOGIES INC®

10601 Lomas NE, Suite 106
Albuquerque, NM 87112

December 10, 2003

TABLE OF CONTENTS

MAXIM
TECHNOLOGIES INC®
A TETRA TECH COMPANY

10601 Lomas NE, Suite 106
Albuquerque, NM 87112
(505) 237-8440
Fax (505) 237-8656

December 23, 2003

Mr. Wayne Price
Environmental Bureau
Energy, Minerals and Natural Resource Department
Oil Conservation Division (OCD)
1220 South St. Francis Drive
Santa Fe, NM 87505

Subject: Delivery of Site Assessment Report, Groundwater Remediation, Groundwater Quality and Qualitative Risk Assessment PCA Junction, Eddy County, New Mexico

Dear Mr. Price:

On behalf of ConocoPhillips, Maxim Technologies, Inc. (Maxim) is pleased to deliver the above-referenced report on the PCA Junction Site for your review.

This site was impacted by natural gas condensate and has been investigated thoroughly over the past three years. Within the last year (2003), Maxim has conducted additional groundwater monitoring, a background groundwater quality study, and a risk assessment summary. In addition, Maxim conducted a three-month-long extraction effort that resulted in the capture of approximately 200 gallons of condensate.

We believe the evidence gained through the groundwater investigation and other studies documented in this report supports closure of this site. If the OCD would find it useful, ConocoPhillips would be pleased to meet with the OCD to further discuss this site and the path forward.

Should you have any questions, please contact me at (505) 237-8440.

Sincerely,

Maxim Technologies, Inc.

RM Sengebush

Robert M. Sengebush, R.G.
Senior Project Manager

Enclosure

cc: Neal Goates, ConocoPhillips

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SITE ASSESSMENT REPORT
GROUNDWATER REMEDIATION, GROUNDWATER QUALITY AND QUALITATIVE RISK ASSESSMENT
PCA JUNCTION
EDDY COUNTY, NEW MEXICO

EXECUTIVE SUMMARY

The ConocoPhillips PCA Junction site is located near Carlsbad, Eddy County, New Mexico. The site is the intersection of two natural gas pipelines and includes two 500-barrel tanks: one for water and one for natural gas condensate.

This report summarizes the site investigation history, presents recent groundwater sampling and aquifer analysis data, and presents the results of a remediation program (condensate skimming), a regional groundwater quality investigation, and a risk assessment.

A subsurface investigation conducted by Maxim Technologies, Inc. (Maxim) in 2000 revealed the presence of approximately two feet of condensate in monitoring well MW-1 at approximately 22 feet below ground surface (bgs). Groundwater beneath the site is interpreted to be a perched aquifer located above a discontinuous clay lens associated with playa-lake clay deposits.

The condensate is thought to have leaked from the condensate storage tank on the site. That tank was replaced with a new tank and, thus, the source of the impact to groundwater has been eliminated.

Groundwater sampling and analysis, conducted in April 2002 and September 2003, indicates that the condensate present in MW-1 is not detectable in any of the five other monitoring wells on the site.

A remediation program consisting of condensate skimming was conducted in the winter and spring of 2003. Approximately 200 gallons of condensate were extracted from MW-1. However, the recovery rate diminished significantly over a period of several months, making additional recovery impractical. This decline is the result of the fine-grained nature of the aquifer, which acts to retain the condensate in pore space rather than yield the condensate to mechanical extraction methods. Currently there is an estimated 300 gallons of recoverable condensate in the groundwater.

Maxim conducted a water quality study based on published data from stock and domestic wells in the site vicinity. This study revealed that groundwater in the area is high in naturally occurring chloride and sulfate. Water quality analyses from the PCA monitoring wells is similar to that of other wells in the area, with sulfate concentrations of more than twice the New Mexico standard and chloride concentrations nearly twice the standard.

The risk assessment conducted for the PCA Junction site developed a conceptual site model (CSM), evaluated the groundwater analysis data for the initial sampling round, evaluated the contaminants of potential concern (COPCs), conducted an assessment of exposure pathways, considered land use scenarios and receptors, and performed an uncertainty analysis. The risk assessment concluded that the presence of the condensate in groundwater beneath the site is not necessarily indicative of a risk to human health or the environment because potential exposure pathways (i.e., direct ingestion of groundwater at the site and dermal contact or inhalation of volatile organics from subsurface soils) are unlikely to be completed under current land use scenarios (petroleum industry operations and livestock grazing). Land use at the site is not expected to change according to available information. The groundwater quality, site physical characteristics, and the extent of the contamination indicate there is a lack of a complete exposure pathway to impose any adverse health or ecological impacts.

In summary, the condensate plume appears to be stable or decreasing in size as a result of natural processes. Attempting to skim additional product from MW-1 will have little impact on the condensate plume volume due to the fine-grained nature of the aquifer. Water quality in the shallow, perched aquifer on the site and in other perched aquifers in the region is poor. These aquifers are recognized as "highly mineralized" and can only be used, if at all, for watering livestock. Finally, according to the risk assessment, the presence of the condensate plume on the perched aquifer poses no significant risk to human health or the environment due to the isolated location of the site, the absence of risk pathways, and the absence of risk receptors.

Based on the above findings, ConocoPhillips requests that the "no further action" be required for the PCA Junction site and that the OCD provide approval of the following "path forward."

Leave the six monitoring wells in place for the duration of operation of the facility. At the time of ownership transfer, or facility closure (tank removal, etc.), ConocoPhillips or the new owner/operator will conduct groundwater monitoring from existing wells. The monitoring data will be filed as a part of the site's permanent record.

ConocoPhillips requests concurrence by the OCD with this path forward.

SITE ASSESSMENT REPORT
GROUNDWATER REMEDIATION, GROUNDWATER QUALITY AND QUALITATIVE RISK ASSESSMENT
PCA JUNCTION
EDDY COUNTY, NEW MEXICO

1.0 INTRODUCTION

This report presents a collective site assessment for the ConocoPhillips PCA Junction facility. The site is located approximately 20 miles northeast of Carlsbad, in Section 11, Township 20 South, Range 30 East, N.M.P.M., Eddy County, New Mexico (Figure 1). The facility was acquired by ConocoPhillips in November 2000 from LG&E Energy, Inc., of Hobbs, New Mexico. The facility consists of two bermed condensate tanks, two methanol saddle tanks, and associated incoming and outgoing gas piping. The facility is within a small (approximately 60 square feet) fenced area (Figure 2).

A surface release of petroleum product is known to have occurred from a leaking condensate tank within the bermed area. Several field investigations have been performed at the site to determine if petroleum product migration away from the site has occurred and to what extent. This report briefly summarizes previous field investigations and site characterization results for the site. Secondly, this report describes the status of a pumping and recovery remedial action project implemented at monitoring well MW-1 from December 9, 2002, through May 19, 2003. Then results of a recent groundwater quality study conducted to evaluate background groundwater quality are assessed to determine if groundwater in the site vicinity meets New Mexico drinking water standards. Historic data is associated with groundwater quality data collected at the site in 2002. Also, potential health and environmental risks are evaluated for current and potential future site conditions.

2.0 SITE CHARACTERIZATION

During the due diligence work (September 27, 2000), a total of three soil borings (B-1 through B-3) were advanced to depths ranging from 25 to 40 feet bgs and temporary wells installed. In May 2001 three 2-inch-diameter PVC monitoring wells were installed around the condensate tanks (MW-1 through MW-3). Sampling analyses indicated the presence of contaminants associated with condensate storage activities at the site. Concentrations of total petroleum hydrocarbons (TPH) in the 20-foot depth soil sample from borehole B-1 exceeded the New Mexico Oil Conservation Division (OCD) action levels. Groundwater "grab" samples from borehole B-1 had levels of benzene, toluene, and total xylenes above ODC action levels. In borehole B-2 benzene levels in groundwater exceeded the ODC action level. Subsequent installation and sampling of three monitoring wells around the site in May 2001 detected the presence of hydrocarbons in groundwater at the MW-1 location. Soil vapor borings SVB-17 and SVB-18 also detected petroleum contamination. Other monitoring wells and soil vapor borings did not reveal any contamination. In conclusion, MW-1, SVB-16 and SVB-17 delineated the possible orientation of a groundwater contaminant plume (Figure 2).

In March 2002 Maxim returned to the site to complete a soil vapor survey and install additional monitoring wells. Twenty-two soil borings were advanced for the purpose of soil vapor monitoring. Three permanent monitoring wells (MW-4, MW-5, and MW-6) were installed per OCD guidelines. Groundwater was encountered at approximately 23 feet bgs in the new wells. Groundwater sampling indicated no detectable hydrocarbon in monitoring wells MW-2 through MW-6. Approximately 2 feet of free product was encountered in MW-1. The groundwater flow direction was identified to the northwest with a gradient as interpreted from water levels in the six wells of 0.00175 foot per foot (ft/ft). MW-2, MW-3, and MW-5 are upgradient from MW-1. MW-4 is cross gradient and MW-6 is downgradient from MW-1 (Figure 2). Remedial actions to remove free product from MW-1 were initiated in December 2002. Details of this remedial action are presented in Section 3.0.

The aquifer conditions encountered during drilling of wells MW-4, MW-5 and MW-6 suggest that the aquifer is only a few feet thick and is underlain by a semi-impermeable clayey silt layer. The thinness of the water-bearing zone and the nearly flat gradient suggest that the aquifer may be a discontinuous perched water zone within a localized, closed basin. This is further supported by surface topographic evidence, which depicts numerous closed basins and small playa lakes in the vicinity of the site. This hydrogeologic conceptual model is depicted in Figure 3. In such a hydrogeologic environment, groundwater zones do not actually flow as they do in more extensive water table aquifers and, thus, the hydrocarbon plume is expected to remain essentially stationary in the vicinity of the source, presumably the condensate tanks. This interpretation supports the findings that the free product has not migrated downgradient as far as MW-6 (Maxim, 2002). Furthermore, depending on the age of the free product seepage from the tanks, the free product plume could be in equilibrium (i.e., degradation of the free product is balanced with dissolution of free product into groundwater and biodegradation of the dissolved phase).

3.0 GROUNDWATER SAMPLING AND AQUIFER TESTING, SEPTEMBER 2003

This section describes the methods and results of the groundwater sampling and analysis, as well as the aquifer testing that took place in September 2003. The sampling event was the second round of sampling conducted on the PCA site.

3.1 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater sampling of monitoring wells MW-2, MW-3, MW-4, MW-5 and MW-6 was conducted on September 9, 2003. Monitoring well MW-1 was not sampled due to the presence of free product condensate in the well.

Groundwater elevations were measured in each well prior to sampling. The depth to water and resulting groundwater elevations are presented in Table 1. The groundwater elevation measurements indicate the groundwater gradient is westerly with a gradient of 0.0007 ft/ft. Groundwater elevation contours and the gradient are shown on Figure 2.

The water volume in each well was calculated and three bore volumes of water were purged with an electric submersible pump in order to obtain representative water samples. The pH, electrical conductivity and temperature of the purge water were measured during the purge. The purge volumes and groundwater parameters are presented on the water sampling field forms in Appendix D.

Groundwater samples were collected in laboratory-prepared containers and sent to Lancaster Laboratories for analysis of benzene, toluene, ethylbenzene and total xylenes (BTEX); metals; chloride; nitrate; sulfate; alkalinity (major ions); and total dissolved solids (TDS).

The results of this sampling round show no detectible BTEX in any of the five wells except for 2 micrograms per liter (µg/L) of benzene in MW-5. The benzene concentration in MW-5 is below the New Mexico Water Quality Control Commission (NMWQCC) standard for benzene of 10 µg/L. Metals, major ions and TDS are within expected ranges. These findings are consistent with the findings of the previous groundwater sampling event that took place in April 2002.

Analytical results for the April 2002 and September 2003 sampling events are presented in Table 2.

3.2 AQUIFER TESTING IN MONITORING WELL MW-3

Aquifer testing was conducted in MW-3 to measure the transmissivity of the aquifer and together with the gradient and estimated porosity, calculate the average groundwater flow velocity for the site.

A drawdown and recovery test was conducted on September 17, 2003. The well was pumped at a constant rate of approximately 0.43 gallon per minute (gpm). Approximately 1.6 feet of drawdown occurred over a period of 169 minutes. Recovery of 1.27 feet took place over 90 minutes.

Water levels versus time measurements were collected using a hand-held water level measuring device. The data were tabulated in a spreadsheet then imported into an aquifer test analysis computer program.

The data were analyzed using the following methods:

Drawdown:

Theis – with confined and unconfined correction, with varying aquifer thickness
Cooper-Jacob – confined aquifer
Neuman – unconfined with delayed water table response

Recovery:

Theis and Jacob- confined aquifer

3.2.1 Interpretation

The results of the drawdown and recovery analysis show the transmissivity of the water table (unconfined) aquifer is an average of 5.46 x 10^{-1} cm^2/sec or 3.89 x 10^{-2} ft^2/min. Assuming an aquifer thickness of 10 feet (304.8 cm), the average hydraulic conductivity is 1.79 x 10^{-3} cm/sec. This is within the expected range for an aquifer in a silty sand formation (Freeze and Cherry, 1979).

An analysis summary table, aquifer analysis data, analysis curves and calculated parameters are presented in Appendix C.

Assuming an average porosity of 30% (Freeze and Cherry, 1979) and using the aquifer gradient of 0.0007 from September 2003, the average groundwater velocity for the site is approximately 4 feet per year toward the west. This velocity may vary within as much as an order of magnitude depending on aquifer characteristics.

4.0 REMEDIAL ACTIONS

This section describes the pumping and recovery remedial actions conducted at the site as recommended in the Report of Findings Groundwater Investigation Report, Maxim 2002. These activities were designed, in consultation and agreement with the OCD, to remove free product found above the groundwater during the 2002 site investigation.

A skimmer pump was installed in MW-1 in December 2002 to start removal of free product condensate in MW-1. The pump installed was a Xitech Instruments Model ADj 200 pump with a Model 2500 ES Controller and was installed per the Work Plan for Skimmer Pump Installation (Maxim, 2002). The pump has manual settings for setting the frequency of pump cycles and duration of pumping. These settings were varied to optimize recovery of free product at the well.

4.1 PUMPING DATA

During the operational period of December 9, 2002, to May 19, 2003, approximately 200 gallons of free product were pumped from monitoring well MW-1. Table 1 shows the recovery data from this period. Several trends could be seen during operation of the pump and in reviewing the data presented in the table. These observations are as follows:

- The initial setting of the pump was a 2-hour cycle with 30 minutes of pumping per cycle (2 hr/30 min). This cycle/duration could not be sustained because of the drawdown of the free product in the well (i.e., it was observed during operation of the pump that no free product was being pumped after about 15 to 20 minutes of the pumping period). The rate of pumping during this four-day period was 4.32 gallons per day (gpd).

- On December 12, 2002, the pumping cycle/duration was changed to a 4-hour/10 minutes. This rate was sustained until January 29, 2003. Even at this rate, the thickness of free product in the well decreased to 0.42 foot at the end of the period.

The rate of pumping during this period was variable but generally showed a decrease in the initial rate of 3.48 gpd (12/12 to 12/16) to 1.57 gpd (1/23 to 1/29). These variations in the pumping rate during this period can be explained by the cessation of pumping from 12/20 to 12/30. This allowed the free product above the groundwater table to recover, as can be seen from the increase of the free product thickness on 12/20 (0.53 foot) to 12/30 (1.60 feet). This increased the recoverable volume of free product when pumping resumed.

- On January 29, 2003, the pumping rate was again decreased and set at 8-hour/10 minutes for the pumping cycle and duration. This generally has been the pumping frequency and duration until the present time except for 2 one-week periods. At the middle of March (3/12 to 3/20) and at the end of May (4/23 to 4/30), the pumping duration was increased to 20 minutes per cycle. The volume per day subsequently increased during these times, but these rates (1.79 and 1.41 gpd, respectively) were not sustainable due to the decrease in free product thickness.

- Other observations should be noted for the period since January 29, 2003. The volume of free product pumped per day at both the 10-minute and 20-minute durations has decreased. The increase in rate to 0.95 gpd (2/28 to 3/12) after the initial rate of 0.83 gpd was due to recovery of the thickness of free product (0.42 foot at 1/29 to 1.51 feet at 2/28), which was similar to the December recovery during shutdown of pumping. The pumping rate for the 8-hour/10-minute cycle has subsequently decreased to 0.73 gpd (4/30 to 5/13).

- The thickness of free product on the groundwater has been decreasing due to operation of the skimmer pump. The initial thickness measured on December 9, 2002, prior to installation of the pump was 1.94 feet. During shutdown of the pump from December 20 to 30, 2002, the measured level was 1.60 feet; during the 8-day shutdown at the end of February 2003 the measured thickness was 1.56 feet. The greatest thickness of free product measured before pumping since February was 1.43 feet on May 13, 2003. While this is probably not a full recovered thickness of free product, it is indicative of the overall drawdown of free product in the vicinity of the well due to pumping.

4.2 DISCUSSION OF LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL)

When free product/Light Non-Aqueous Phase Liquid (LNAPL) is found above the groundwater table in a well, it should be understood that due to capillary forces there are both LNAPL and water in the pore spaces above the LNAPL/water interface. The soil pore space above the LNAPL/water interface to the LNAPL/air interface that is not filled with LNAPL is filled with water. Figure 2 from Huntley and Beckett, 2002 (shown below) shows that the LNAPL saturation (percentage of pore space occupied by LNAPL) at the LNAPL/water interface is zero, and increases upward peaking at the LNAPL/air interface. As measured in a monitoring well, these two phases are distinct and separate, but they are mixed in the pore spaces of the soils. Therefore, measuring the thickness of LNAPL in a well will result in a volume exaggeration of LNAPL in the soil surrounding the well. The amount of free product actually present in the soil

pores above the groundwater table depends primarily on the type of soil (i.e., coarse or fine grained) and the thickness of free product (as measured in the well).

The figure below also shows there is a significant difference in percent saturation of LNAPL with respect to water as a result of soil types. The coarse-grained sand has a much higher percent saturation and total volume of LNAPL than does the silty sand for the same measured thickness of LNAPL in a monitoring well. In this example, the coarse-grained sand peaks at about 80 percent relative saturation of LNAPL to water and the silty sand peaks below 30 percent in a measured thickness of 3 meters (~10 feet).

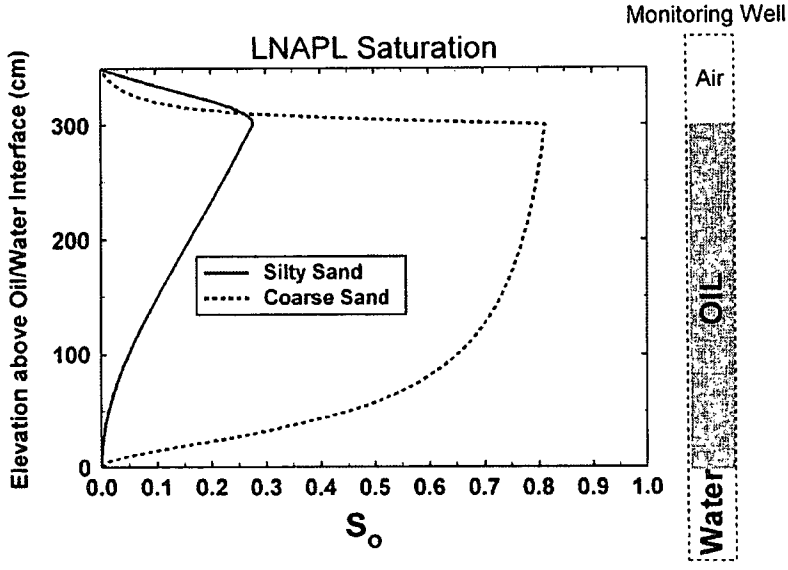


Fig. 2. LNAPL saturation profile for coarse- and fine-grained soils with 3 m of LNAPL in a monitoring well.

(Huntley and Beckett, December 2002)

The soil encountered during boring activities in 2001 and 2002 consisted of silty sand with caliche layers between 1 and 10 feet and 15 and 20 feet bgs. Below 20 feet the soil encountered was clayey sand with clay and siltstone occurring between 24 and 31 feet bgs (Report of Findings Groundwater Investigation, ConocoPhillips PCA Junction, Eddy County, New Mexico, June 2002) (Maxim 2002).

The rate of recovery of free product (volume per day) has decreased over 80 percent since the start of pumping in December 2002 to May 2003. Concurrently with this decrease, the thickness of free product on the groundwater table as measured in monitoring MW-1 has also decreased approximately 25 percent (one-half foot).

Based on the pumping data (i.e., pumping rate) and the characteristics of the site, the effective conductivity of free product in the soils can be calculated. The effective conductivity of a soil with respect to movement of free product (K_e) is a function of the intrinsic hydraulic

conductivity of the soil (K_W) and the relative conductivity of the free product with respect to water as it would move through the soil. The relative conductivity varies with the percent saturation (S_o) of free product and water. A lower percent S_o results in a lower K_e, which is always less than the intrinsic hydraulic conductivity of the soils. Appendix B shows a calculation of the effective conductivity of the soil with respect to the free product (LNAPL) during different periods of pumping. The results of the calculations (Appendix C) are as follows:

- $K_e = 2 \times 10^{-4}$ centimeters per second (cm/s); beginning of pumping (December 2002)
- $K_e = 6 \times 10^{-5}$ cm/s; end of period (May 2003)

The decrease in K_e observed was due to the decrease in saturation of the free product above the groundwater table as the result of recovery of free product. Soils encountered during the investigation of the site were silty sand with some interbedded caliche layers and clayey sands; siltstone occurred at 24 to 31 feet bgs. The calculated effective conductivities appear to be reasonable and representative of silty soils that were described in the boring logs and the amount of saturation of free product in the soils.

The figure below (which is Figure 3-11 from API Publication 4715 [September 2002]) shows in more detail the influence of thickness of LNAPL (oil) as measured in a well on the relative saturation of LNAPL to water. The relationship of the LNAPL to water saturation is nonlinear. In this case (silty sand), at a thickness of 1.5 meters (~ 4.8 feet) the percent LNAPL saturation relative to the amount of water in the soil pore spaces is about 28 percent; at 0.8 meters (2.6 feet) it is 13 percent and keeps decreasing to 5 percent at 0.4 meter (1.3 feet) to zero at the LNAPL/water interface.

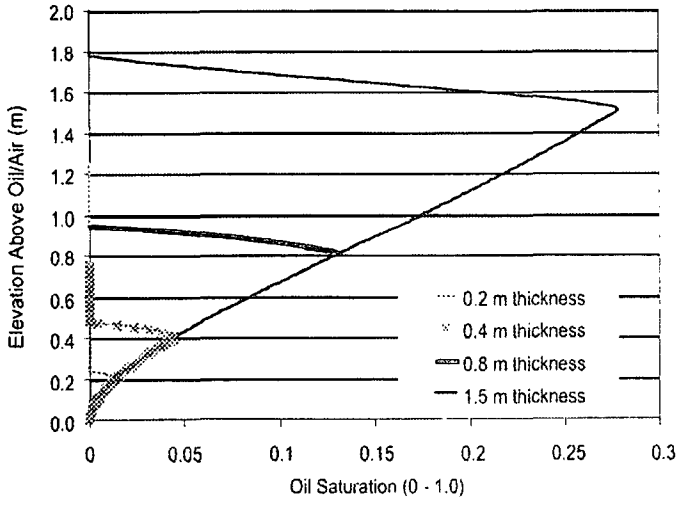


Figure 3-11. LNAPL saturation profiles for different equilibrated thicknesses in a silty sand showing nonlinear dependency on capillary pressure as related to thickness.

(API Publication 4715, September 2002)

This figure also shows that the percent LNAPL saturation is highest near the LNAPL/air interface and decreases as the profile gets nearer to the LNAPL/water interface as the percent water in the pore spaces increases.

The effective conductivity of free product (LNAPL) in the soils in response to pumping at MW-1 decreased (as shown in the calculations) with a decrease in thickness of free product and the relative saturation of the free product to water above the groundwater table. With this decrease in effective hydraulic conductivity, the mobility of the free product is reduced. Thus, as the thickness of the LNAPL decreases, the remaining LNAPL is less recoverable.

The type of soil that free product (LNAPL) is found in is very much a controlling factor in the behavior and impact that the LNAPL has on the groundwater. LNAPL percent saturation in a silty sand, such as is found at PCA Junction, will be much lower relative to water, approximately 10 to 15 percent versus 80 percent for a coarse sand, because of the smaller size of the soil pore spaces. This is favorable in the sense that there is less volume of free product and it will have a more limited mobility, thereby reducing its potential impacts on groundwater. The saturation profile of LNAPL found above groundwater in a silty sand is also more dependent upon the thickness the LNAPL (as measured in a monitoring well) than a coarse sand such that a decrease in thickness will generally result in a greater relative decrease in saturation.

Previous calculations based on full saturation of the free product above the water table conservatively estimated that there were approximately 31,000 gallons of free product in the vicinity of MW-1. Since no free product was found in any other monitoring wells at the site, it was assumed (for calculation purposes) that free product extended half way to the nearest wells and decreased in thickness away from MW-1. The following estimated quantities of free product at the site and recoverable free product (modeling by Huntley and Beckett of 13% in silty sands) are based on the thickness of free product (maximum of 2 feet) and estimated range of percent saturation of free product with respect to water and type of soils:

Ave. Percent LNAPL Saturation	Volume of LNAPL	Est. Possible Recoverable Volume
7.5 %	2325 gallons	300 gallons
(Figure 3.11)	(Appendix C)	(Appendix C)

Refer to Figure 3-11 for the range in saturation of 0.8-meter thickness of LNAPL in silty sands. Volume calculations are presented in Appendix C. The volume listed above is based on an estimated 13 percent of recoverable LNAPL on a thickness of 2.6 feet (0.8 meter). Recoverable LNAPL from Huntley and Beckett (September 2002) is a function of the thickness of LNAPL above the LNAPL/water interface and decreases with a decreasing thickness of LNAPL. Since at PCA Junction the maximum LNAPL thickness has been approximately 2 feet, the actual recoverable volume of LNAPL should be less than 13 percent. At an estimated 10 percent recovery, the possible recoverable volume of LNAPL would be approximately 230 gallons. These estimated volumes of recoverable LNAPL may be possible but become less and less practicable as the LNAPL is removed. The recovery of free product decreases asymptotically as the saturation approaches the residual saturation level of free product in the soils. This has been shown in the decrease in the rate of recovery (Table 3), which is a result of the decrease

in the effective hydraulic conductivity of the free product (LNAPL) during pumping (see previous sections). The effective conductivity and recovery of the free product would continue to decrease if pumping were to be resumed, thereby making recovery less and less practicable.

The type of release of free product at the site is not known specifically, but probably occurred over time from the former condensate tank located in the bermed and fenced area. There are no known recent instances of release. Once a release has occurred at a location and there is sufficient quantity of free product/LNAPL to reach the groundwater, there will be a non-aqueous phase of the free product on top of the groundwater because it is less dense than water. There will then be a slow release and growth of a dissolved-phase plume in the groundwater. At some point in time, for biodegradable constituents (in this case hydrocarbons), the plume will reach an approximate steady-state condition where mass removal of dissolved-phase components by biodegradation keeps pace with the rate of dissolution from the LNAPL source. Essentially, the plume is in equilibrium and will not expand in size. Eventually, the dissolved plume contracts as the LNAPL source is depleted (Huntley and Beckett, 2002). Based on the investigation and measurements conducted to date, i.e., one well (MW-1) with measured free product and two soil vapor borings (adjacent to the condensate berm) with a trace of measured soil vapors) and no known recent releases, it appears the plume at PCA Junction is in equilibrium.

4.3 RESULTS/STATUS OF REMEDIAL ACTIONS

Monitoring well MW-1 is the only well in which free product has been found at PCA Junction. Pumping of free product from MW-1 since December 2002 to the present has removed the greatest portion of recoverable volume of free product in the vicinity of MW-1 since the highest percent saturation and greatest volume of free product (LNAPL) is in the upper portion of the saturated zone.

The effective hydraulic conductivity (Ke) of the free product at the site and thereby its mobility has been reduced by pumping. A Ke in the range of 10-5 centimeters per second is resistive to flow, especially under low hydraulic gradients. The percent saturation of free product above the groundwater table has been reduced and is significantly closer to the residual saturation of the site soils where the free product cannot be removed by pumping.

As presented previously, approximately 200 gallons of free product has been pumped from above the water table at MW-1 at PCA Junction and the total recoverable volume is probably about 300 gallons. Huntley and Beckett, 2002, present analytical results that show for LNAPLs in a silty sand with a thickness of one meter (3 feet) or less, recovery of the LNAPL/free product does not affect longevity or lateral extent of the plume. The difference between the initial hydrocarbon saturation and the residual hydrocarbon saturation is what really determines the effectiveness of remediation in terms of reducing the longevity of any component. Since this difference is much smaller in fine-grained soils such as silty sands found at the site, resulting in a smaller percentage decrease in mass in fine-grained soils, remediation in fine-grained soils is much less effective than in coarse-grained soils.

Removal of free product through operation of the skimmer pump in MW-1 has reduced potential impacts to groundwater in the vicinity of the site. The site conditions at PCA Junction (i.e., silty sand soils), limited thickness of free product above the groundwater table, and limited areal extent of free product are such that further pumping will have only a reduced effectiveness in removing free product as shown by the decrease in K_e with pumping. Furthermore, technical literature suggests that free product such as that at PCA Junction is already in, or will attain, equilibrium through natural degradation on the downstream side of the plume, resulting in no net movement of the plume over time.

5.0 GROUNDWATER QUALITY

This section summarizes data and information found in Hendrickson, G. E., and Jones, R. S., 1952, Geology and Ground-Water Resources of Eddy County, New Mexico, Ground-Water Report 3, New Mexico Bureau of Mines and Mineral Resources (Report 3). Historic groundwater quality data tables and well location maps were used in the assessment of background water quality and quantity in the PCA site vicinity. This historic data is associated with data from groundwater sampling activities conducted by Maxim at the PCA site in April 2002 and September 2003 to determine if background water quality at the site meets New Mexico drinking water standards. Water quality data for contaminants in groundwater at the site is also summarized for further use in the site risk assessment.

5.1 REGIONAL BACKGROUND GROUNDWATER QUALITY

Ground water in the site vicinity occurs in shallow perched zones associated with shallow surface depressions or playa lakes. The alluvial materials in these playa lake basins consist of alternating layers of clay and silt. Water is present in the thin silty and sandy zones between the clay layers. The water is derived primarily from rainfall. It pools on the clay-rich lakebed surface and infiltrates eventually into the shallow, "aquifer" zones. These saturated zones do not flow in the traditional sense that groundwater flows in a more continuous aquifer. In fact, the water in the saturated silty zones in these closed basins is essentially standing water, although it is standing just below the ground surface. The saturated zones may or may not connect with the zones in other playa lake basins.

Surface waters leach soluble minerals from the rock and soil in the area resulting in elevated concentrations of sulfate and chloride in the shallow, perched groundwater. The presence of these soluble minerals is shown by the crusts of white, crystalline material on the margins of the playa lakes. Water in the lakes and in the shallow saturated zones thus typically contains an abundance of sulfate, chloride, and other ions derived from soluble minerals.

Report 3 (Hendrickson and Jones, 1952) characterizes the groundwater resources associated with the playa lakes as follows:

> *"Lake and playa deposits: The many small closed shallow depressions east of the Pecos contain silt and clay washed in from the surrounding areas. Some of the depressions contain shallow lakes, such as Salt Lake (Laguna Grande del la Sal), which have deposited and are depositing gypsite and some halite. The lake and*

> *playa deposits are similar in age to the younger alluvium. Water wells in and near these depressions generally yield highly mineralized water which can be used, if at all, only for stock."*

Report 3 documents the presence of five stock wells and two domestic wells in Township 20 South, Range 30 East. The locations, water quality data, and other well specifications are shown in Figure 4. A map showing the locations of these wells with respect to the PCA Junction site and the depth to water in each well is presented as Figure 4. The wells closest to PCA Junction are located in Section 3 of Township 20 South, Range 30 East, within approximately a mile northwest of the site. Both of these wells are identified as stock wells, meaning that they are (or were) used to supply water to livestock. The wells are designated with numbers that correlate with their location within the Section.

Appendix C summarizes well information and water quality data for both regional and site-specific wells. The depths to water in wells 223 and 424 are 6 and 8.5 feet bgs, respectively. This suggests that these wells are completed in a shallow, perched water table. This is supported by the presence of two playa lakebeds in the northeast portion of Section 3, as depicted on the U.S. Geological Survey Tower Hill North 7.5 minute topographic map, 1985. No data are available as to the total depth or of the groundwater yield of the wells. Sulfate concentrations in these wells of 1,540 and 1,670 milligrams per liter (mg/L) are approximately two and one-half times the New Mexico standard for a domestic water supply (for sulfate of 600 mg/L). Chloride and nitrate in these wells are present in concentrations near the New Mexico standard for these two constituents. No water quality analyses are available for well 310 in Section 5. Stock well 420 in Section 16 is located approximately 2 miles southwest of PCA Junction. The depth to water in this well is approximately 30 feet bgs. The sulfate concentration in this well is 1,860 mg/L, approximately three times the New Mexico standard. The depth to groundwater in this well (29.9 feet bgs) is nearly equivalent to that of the monitoring wells (22 feet bgs). Wells 120 and 130 are both located in Section 20, approximately 3 miles southwest of PCA Junction. Both of these are domestic wells. No analytical data is available for well 120. Well 120 has a depth to water of 29.3 feet while well 130 has a depth to water of 45.3 feet bgs, and a sulfate concentration of 1590 mg/L, which exceeds the New Mexico standard by more than two times.

Finally, Well 440 is a stock well with a depth to water of 203.8 feet. This well is located approximately five miles south southwest of PCA Junction. Analyses show a sulfate concentration of 1960 mg/L in this well, which is more than three times the New Mexico standard. This high sulfate concentration is notable in that this well is much deeper than the other wells in the township. In this case, the deeper zone contains water that is less potable than the water in the shallow playa lake zones, as opposed to better water at depth, as is often the case in deeper aquifers within an alluvial setting.

5.2 PCA JUNCTION SITE BACKGROUND GROUNDWATER QUALITY

Monitoring wells MW-2, 3, 4, 5, and 6 all contain groundwater with a water table surface at approximately 22 feet bgs. As of the date of this report, none of them contain petroleum

hydrocarbons, based on analytical results of sampling in April 2002 and September 2003. MW-1 contains free product condensate, so the water geochemistry has not been analyzed.

The average sulfate concentration for the five wells is 1496 mg/L, which is more than twice the New Mexico standard of 600 mg/L. The concentration of chloride is also elevated in the monitoring wells with an average of 494 mg/L. This is nearly twice the standard of 250 mg/L. The chloride concentrations vary significantly within the five wells, with a high of 1410 mg/L in MW-5 driving the average up. The reason for these variations is not known but may suggest that the groundwater in the wells is not connected in a single aquifer but rather is present in thin saturated zones that are part of separate playa lake sediments. Details of the groundwater quality assessment are presented in the PCA site Report of Findings, Groundwater Investigation Report (Maxim 2002).

5.3 BACKGROUND GROUNDWATER QUALITY SUMMARY

Playa lake silts and clays are the predominant sediment types in the vicinity of PCA Junction. These sediments are most likely laterally discontinuous, reflecting deposition in individual closed topographic depressions in the landscape. Silty zones between the playa clays may yield groundwater that is suitable for livestock, but is unsuited for human consumption. This is supported by chemical analyses tabulated in Ground-Water Report 3 (Hendrickson and Jones, 1952) and by analyses of groundwater from five monitoring wells on the PCA Junction site.

Water quality in monitoring wells and local wells accessing the shallow perched groundwater zones is characterized by elevated concentrations of sulfate, chloride, and TDS. The groundwater in the depth range from 22 to 45 feet bgs contains high concentrations of sulfate, and to a lesser extent, chloride. These constituents are derived from dissolution of naturally occurring minerals such as gypsum and halite. Evidence for the natural occurrence of these minerals may be seen as white encrustations on the margins of the shallow playa lakes in the site vicinity. Because the infiltration of precipitation leaches soluble minerals from the rock and soil there is an abundance of sulfate, chloride, and other ions in the perched water zones. A high rate of evapo-transpiration in this arid region also likely concentrates minerals. Nitrate levels are variable with high concentrations, near drinking water quality standards, occurring naturally (no manmade source identified). Even the water quality in livestock well 440-33, with a "depth to groundwater" of 203 feet, has high TDS. Concentrations of sulfate are also elevated, compared to the New Mexico standard, in deeper wells such as stock well 440 in Section 33. This suggests that water quality does not improve with depth but in fact may contain higher sulfate concentrations compared with the shallow zones. Site water quality data is consistent with other regional groundwater quality data reported by the USGS but not summarized here. USGS labels this region as having widely dispersed undesignated groundwater resources containing over 3,000 mg/L of TDS (NM NRCS). USGS groundwater maps also show there is no large aquifer in Eddy County, NM (NM NRCS).

6.0 RISK ASSESSMENT

One objective of the monitoring and remediation process is to evaluate all potential human health or ecological risks resulting from environmental impacts at the PCA Junction site. This section presents a qualitative assessment of the likelihood of human or ecological receptors being at risk of an ill health effect due to the presence of contaminants in groundwater at the site. The methodology applied maintains that the magnitude of risk depends upon each of the specific components evaluated in the risk assessment all being present under site conditions. These components are; the likelihood or possibility of exposure, the potential amount of exposure or intake, and the toxicity of the constituents present. The potential for exposure to and subsequent risk from site-specific conditions are qualitatively evaluated in this risk assessment summary.

6.1 CONCEPTUAL SITE MODEL

General information gathered during monitoring and site characterization is used to develop a risk assessment CSM. Based on the site map the site consists of two 500-barrel tanks (condensate and water) associated with underground natural gas collection pipelines in the area. The tanks themselves occupy a small fenced area of privately owned land leased by ConocoPhillips. The land immediately around the site is minimally used for livestock grazing. Livestock grazing, potash mining and petroleum production are the main land uses in the region.

No wildlife or plant community surveys were conducted specific to the site but information derived from Natural Resources Conservation Service (NRCS) identifies the site as part of the Chihuahuan Region, which is semi-desert grassland (NRCS web site). The arid environment is vegetated with desert-shrubs, some cactus, and grasses with an average annual rainfall of 9 inches (see photos below). Temperatures range from just above freezing in winter months up to 100 degrees Fahrenheit in the summer. There is low relative humidity and extreme variability in precipitation events. No riparian or marshy areas exist near the site. Wildlife possible at the site would include those common in the Chihuahuan biotic province including migrant antelope and coyote along with rabbit and rodent populations of varying size. The region is known to be a wintering ground for grassland birds. Specific insect populations would also be expected at the site.

As described previously, groundwater in this area is widely dispersed as small perched zones, with no significant movement or connection between zones. Groundwater yields are low and inconsistent. There is no large aquifer in Eddy County, New Mexico. Wells in the area indicate the presence of both shallow (water levels < 30 feet bgs) and deeper (water levels >100 feet bgs) perched zones. Surface water exists in closed basins where surface runoff collects in low areas with the quantity and presence of surface water fluctuating seasonally. No standing surface water bodies exist at the PCA site or in the vicinity.


CAUTION

Eddy County is 4,182 square miles with a population size of 51,067 (US Census). The county is sparsely populated with residences and businesses concentrated mainly in two-non-metropolitan cities, Artesia and Carlsbad. There are no known residences within the 2-mile area surrounding the site. A few businesses are located along the main interstate highways approximately 4 miles to the south and 2 miles to the west of the site. Population size for Eddy County has declined since 2000 (US Census Bureau).

While the only known release was a leaking aboveground condensate tank, two field investigations have been performed at the site to determine if petroleum product leakage away from the facility has occurred and to what extent. It was determined through these investigations that condensate was present in subsurface soil and groundwater to a distance of approximately fifty feet from the original location of the leaking tank. The extent of the contamination is limited and does not appear to be migrating. Surface soils do not appear to be affected. Remediation has reduced the volume of petroleum product present and reduced the possibility of contaminant migration off site.

These site characteristics are summarized into the CSM shown in Figure 3. The CSM depicts the nature of the contamination and identifies affected media, potential contaminant migration pathways, and possible exposure pathways and routes of exposure for human or animal contact with the contaminated media. Current and future land use scenarios, and potential receptors are also depicted. Potential exposure point concentrations and measurable risks to human health or the environment are qualitatively evaluated in the exposure assessment that follows data evaluation and identification of COPCs.

6.2 DATA EVALUATION

Environmental sampling and laboratory analysis of groundwater was conducted according to NMAC Rule 19, Exemption 19D(g) and OCD Guidelines for Remediation of Leaks, Spills, and Releases (1993). Physical parameters measured included pH, TDS, specific conductivity, alkalinity, and temperature. Inorganic analyses included chloride, nitrate, sulfate, mercury in liquid waste, and NMWQCC metals (silver, arsenic, barium, calcium, cadmium, chromium, magnesium, sodium, lead, selenium). Organic analyses included BTEX.

A review of analytical data for the site determined the presence and extent of contamination. The results of past site characterization activities as summarized in Section 2 delineate site contamination (the current source term) as a groundwater plume approximately 16,000 square feet in area and 23 feet bgs. Due to the presence of petroleum product in the groundwater at this well, remediation via continuous groundwater skimming was initiated and has reduced the amount of this source term by over 50 percent. The potential for migration of this plume has also been reduced (Section 3.2). No exposure point concentration data for hydrocarbons exist for the site since only petroleum product was detected.

Inorganic water quality data from site wells along with a review of historical data provides a reasonable indicator of background water quality conditions and groundwater uses in the area. Existing wells nearest the site are identified as livestock watering wells, and no drinking water wells exist within several miles of the site (Section 4.1). The statistical summary of site

monitoring data (inorganic analyses) and historic data from 1952, presented in Appendix B, represents the background groundwater quality for the site and surrounding area. High TDS renders the water undesirable for potable purposes. In addition, groundwater yield is reported as limited (<150 gpm.) from these shallow disconnected sources. Yield tests were not conducted on monitoring wells but experience at the site indicate that the perched zones here are also low yielding which would limit its use. The extent of use of this groundwater for human drinking water is limited due to the quality and quantity problems associated with it. This supports the known uses of groundwater in the area, and will likely limit any other future uses of the groundwater.

6.3 CONTAMINANTS OF POTENTIAL CONCERN

Based on the fact that natural gas condensate is the known contaminant released, the potential COPCs for the site are the BTEX parameters. Inorganic (metals and TDS) parameter analyses, although required by OCD Guidelines, and potentially toxic at specific concentrations, are not expected condensate constituents. Analyses verify that the concentrations of inorganics at the site are at naturally occurring levels. These data are important to document the naturally occurring water quality in the region and are not considered COPCs associated with the condensate contamination.

Concentrations of COPCs in affected media and/or exposure point concentrations (EPC) for selected receptor locations and exposure scenarios become the basis for a quantitative assessment of risk to human health or the environment. However, a qualitative assessment of the potential for exposure was conducted for the PCA site because only free product was detected in MW-1. Without contaminant concentrations at an EPC, no dose or potential intake can be estimated. Only if potential pathways to groundwater exist will it be necessary to estimate EPCs for the PCA site. Where pathways are not complete and no reasonable receptor scenario exists, a qualitative risk assessment is used to assess current or future contact with existing contamination and specific health risk estimates or remediation goals do not apply. Possible receptors and the likelihood of a completed exposure scenario are discussed below in the exposure assessment.

6.4 EXPOSURE ASSESSMENT

The exposure assessment provides a narrative of any current or likely future (hypothetical) potential contaminant migration pathway, and uses site-specific data to identify which of those pathways are complete and which are incomplete. To be considered a completed exposure pathway there must be a contaminant source, a route of migration to a potential receptor, a reasonable route of exposure (typically, ingestion, inhalation, or dermal contact), and a measurable dose at the point of exposure in order to evaluate the possibility for risk to human health.

6.4.1 Source Terms

The initial source of contamination was a leaking aboveground condensate collection tank that has since been removed. Surface soil contamination was restricted to the area within the

earthen berm surrounding the tank. At the time of the leak, the presence of the leaking tank provided the below ground "flow" which moved the condensate into the perched groundwater currently delineated by data from MW-1, SVB 16 and SVB 17 sampling locations (Figure 2). Within the perched zone, the minimal groundwater movement defined by variable and limited precipitation recharge and a discontinuous saturated zone, is not likely to further "move" the contamination. Percolation of contaminants downward into a deeper aquifer is not expected since no deeper continuous aquifer of drinking water quality and quantity is known to exist that could be detrimentally impacted. This is also unlikely due to the limited size of the source term. Water quality in a deeper zone is also expected to be similar to that reported elsewhere in Eddy County, high TDS and low yield. Remedial actions have further limited possible movement of contaminants in subsurface soil and groundwater (Section 3.2). Therefore, contaminated groundwater near the site is the only source term under assessment for environmental exposures.

6.4.2 Exposure Pathways

Potential exposure pathways are initially assessed using the CSM. Based on physical characteristics of a site some pathways are eliminated as incomplete pathways (i.e. no surface water exists therefore surface water exposure is an incomplete pathway). Other possible pathways are further assessed to determine if they would be associated with current or potential future exposure scenarios.

The release of contaminated ground water via connection with surface water and/or seeps is not a pathway since surface water and/or down gradient seeps do not exist at or near the site. Surface soils are not contaminated which eliminates direct contact exposure pathways such as soil ingestion, dermal contact, inhalation of contaminated dusts or volatile organic vapors. The possibility for deep-rooted plants contacting contaminants in soil and then being subsequently ingested by wildlife was considered. However, since hydrocarbons do not bioaccumulate in plants this would be an incomplete pathway (Howard, 1990). Future site-related construction activities such as drilling or natural gas pipeline installation which could introduce an exposure pathway to contaminated subsurface soils and direct contact with contaminated groundwater are considered the only possible exposure pathways for the site.

The next step in evaluating the likelihood of a completed exposure pathway is to investigate current and potential future land use.

6.4.3 Land Use Scenarios and Receptors

Currently the PCA Junction site is a small fenced area containing two 500-barrel tanks on the ground surface surrounded by an unlined earthen berm. Natural gas pipelines exiting the ground and entering into the tanks are also present. Activities at the site are limited to a few maintenance visits per year.

Future land uses expected include continued maintenance for these natural gas operations. Cattle grazing is expected to continue on private and Bureau of Land Management (BLM) land surrounding the site. Residential development of the area around or near the site is not

expected. Other industries in the area include operations at a Potash mine, which will likely continue. The land is expected to remain native rangeland. Trespassers are not likely due to the remote nature of the site.

Groundwater associated with the contaminant plume is not used and no private access wells exist. No reasonable potential receptors exist at the site so the potential to come in contact with the contaminated groundwater or subsurface soils is very unlikely now or in the foreseeable future. Any future construction associated with the tanks or earthen dams in the area of contamination could expose workers and the appropriate health and safety equipment as was applied during site characterization activities would be required. If the PCA site were to undergo closure, other ODC requirements would apply concerning site reclamation. Therefore, the potential exposure pathways; direct ingestion of groundwater at the site; and dermal contact or inhalation of volatile organics from subsurface soils are unlikely to be completed under current land use scenarios. Land use at the site is not expected to change according to historic information on groundwater quality, site physical characteristics, and the extent of the contamination that indicates there is a lack of a complete exposure pathway to impose any adverse health or ecological impacts.

6.5 RISK ASSESSMENT

The risk assessment process followed is generally consistent with the USEPA guidance on conducting risk assessments. It is intended to identify the potential for human health impacts due to the condensate leak at the PCA Junction site and to help determine the need for corrective remediation. The health risk assessment is based on the premise that exposure to a chemical in an environmental medium is proportional to the concentration of the chemical in the medium, rate of contact with the medium, and the duration of exposure. Risk can occur only when there is a mechanism for released constituents to be transported to a receptor and when there is the potential for a receptor to directly contact those released constituents. This is partially dependent on the physical and chemical properties of the constituent itself and the characteristics of the surrounding environment.

For a risk to occur there must be an activity (receptor) and a point of contact (exposure) associated with the contamination on site. An assessment of groundwater at the PCA site revealed that the groundwater is of poor drinking water quality and quantity and that the spatial extent of the contaminated water was not accessible by any stock or drinking water wells. A physical survey of the site revealed there is no connection between the limited extent of contaminated groundwater and any surface water or larger groundwater source. This isolates the contaminant source and eliminates any contaminant migration offsite. Current human receptors would be limited to maintenance workers at the site but these receptors are not actually contacting groundwater or subsurface soils. Potential future human receptors could include construction workers exposed to subsurface impacts during excavation activities. However, excavation/construction workers could be protected under occupational health and safety protection guidelines. Ecological receptors could include native rodents, grazing cattle, or migrant coyote or antelope. Their limited intake of potentially contaminated food and any potential impacts would not be measurable.

Levels of organic constituents above ODC action levels are the COPCs for human health associated with potential soil or groundwater exposure pathways. Previous removal of the contaminant source has prevented any increase in contaminant levels. Groundwater remediation has reduced the plume as a source term for migration of contaminants. Continued sampling would only serve to verify the isolated nature of the plume. Any future excavation activities at the site would be controlled by the site operator to avoid possible exposures to maintenance workers. Human or animal trespassers in the vicinity of the site will not have direct contact with contamination and therefore, there is no health risk. The potential for contaminants to migrate into a deeper groundwater resource is unlikely given the geologic characteristics of the perched groundwater zones.

In conclusion, the presence of contamination above ODC action levels is not necessarily indicative of a health risk. Site characterization, remediation, and risk assessment support the conclusion that further remediation directed at eliminating risk to protect human health and the environment is not warranted. If impacted media are isolated and exposures cannot occur at the site then the development of remediation goals protective of human health and the environment are not necessary. Results from this risk assessment along with results from the current remediation program support "no further action" at the PCA site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This report presents data and interpretations based on groundwater monitoring, remedial action, groundwater quality analysis and risk assessment.

- Two rounds of groundwater monitoring have shown that only MW-1 has been impacted by condensate.

- The site hydrogeologic model indicates that the aquifer is perched and a drawdown and recovery test indicates the groundwater has estimated average velocity of 4 ft/yr toward the west.

- Pumping of the free product condensate in MW-1 for a period of approximately three months recovered approximately 200 gallons of condensate. The ability to recover additional product will continue to decrease and will have little effect on the size of the plume. There is an estimated 300 gallons of possibly recoverable product remaining in place, but extracting this last volume is impractical due to diminishing returns related to the fine-grained characteristics of the aquifer. The condensate presence appears to be in equilibrium with the groundwater on the downstream side, resulting in no net movement over time.

- Groundwater quality in the area is poor, based on State of New Mexico reports. In on-site wells, sulfate averages 1496 mg/L and chlorde averages 494 mg/L, both above the NM standards of 600 mg/L and 250 mg/L for sulfate and chloride, respectively.

- The risk assessment findings suggest that the condensate presence is isolated and that pathways for exposure do not occur. Therefore, there is no risk to human health or the environment.

Based on the above findings, ConocoPhillips requests that the "no further action" be required for the PCA Junction site and that the OCD provide approval of the following "path forward."

Leave the six monitoring wells in place for the duration of the facility operation. At the time of facility closure (tank removal, etc.), groundwater monitoring will be conducted in the existing wells. The monitoring data will be filed as a part of the site's permanent record.

ConocoPhillips requests concurrence by the OCD with this path forward.

8.0 REFERENCES

Freeze, A. R., and Cherry, J. A., 1979. Groundwater. Prentice-Hall, Inc., Englewood, New Jersey. 604 p.

Hendrickson, G. E., and Jones, R. S., 1952, Geology and Ground-Water Resources of Eddy County, New Mexico, Ground-Water Report 3, New Mexico Bureau of Mines and Mineral Resources (Report 3).

Howard, P. H., 1990, Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol. II, Solvents, Lewis Publishers.

Huntley, David and Beckett, G. D. (December 2002), "Persistence of LNAPL sources: Relationship between Risk Reduction and LNAPL Recovery," *Journal of Contaminant Hydrology,* Vol. 59, pp. 3-26.

Huntley, David, and Beckett, G. D. (September 2002), *Evaluating Hydrocarbon Removal from Source Zones and Its Effect on Dissolved Plume Longevity and Magnitude,* American Petroleum Institute Publication No. 4715, 274 pp.

Maxim Technologies, Inc., 2002, Report of Findings Groundwater Investigation, Conoco PCA Junction, Eddy County, New Mexico.

Maxim Technologies, Inc., 2002, Workplan for Skimmer Pump Installation, Conoco PCA Junction, Eddy County, New Mexico.

Natural Resource Conservation Service, 2003, New Mexico Natural Resource Conservation Service web site, www.nm.nrcs.usda.gov.maps.

U.S. Census Bureau, 2003, Quick facts, Eddy County, New Mexico, web site, www.quickfacts.census.gov.

U.S. Department of Agriculture, 2001, Land photographs, Carlsbad Soil and Water Conservation District web site, www.carlsbadsoilandwater.org.

U.S. Geological Survey, 1985, Tower Hill North, New Mexico, 7.5-minute topographic map.

U.S. Geological Survey, 2003. Groundwater Maps of Yield and Aquifer Locations, www.nrcs.usda.gov.maps

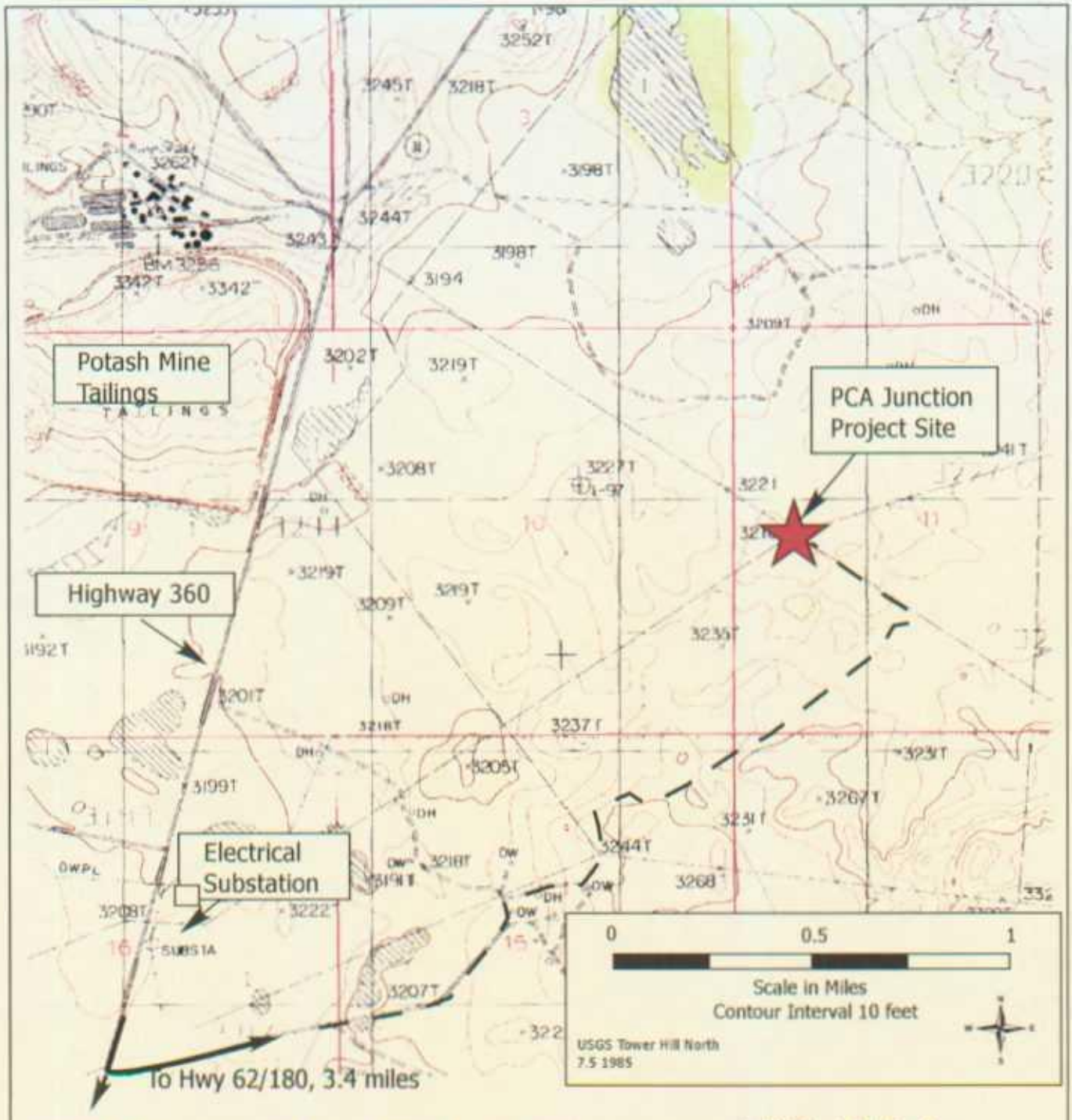
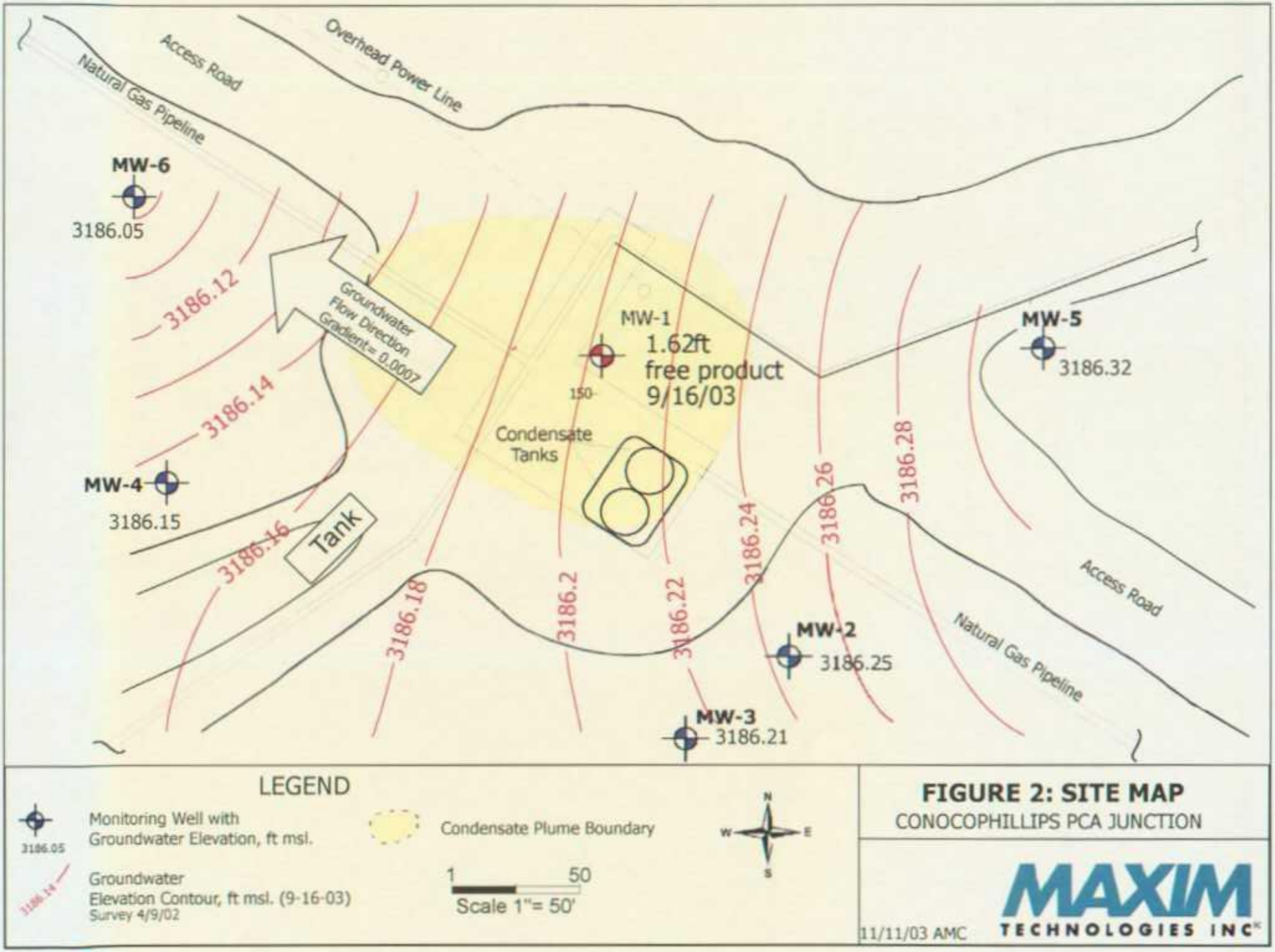


FIGURE 1: LOCATION MAP

CONOCOPHILLIPS PCA JUNCTION

11/11/03

MAXIM TECHNOLOGIES INC


Access Road
Overhead Power Line
Natural Gas Pipeline
MW-6
3186.05
3186.12
3186.14
Groundwater Flow Direction Gradient= 0.0007
MW-1
1.62ft free product 9/16/03
150
MW-5
3186.32
Condensate Tanks
MW-4
3186.15
3186.16
Tank
3186.18
3186.2
3186.22
3186.24
3186.26
3186.28
MW-2
3186.25
MW-3
3186.21
Access Road
Natural Gas Pipeline
LEGEND
Monitoring Well with Groundwater Elevation, ft msl.
3186.05
Groundwater Elevation Contour, ft msl. (9-16-03)
Survey 4/9/02
Condensate Plume Boundary
1
50
Scale 1"= 50'
N
W
E
S
FIGURE 2: SITE MAP
CONOCOPHILLIPS PCA JUNCTION
11/11/03 AMC
MAXIM TECHNOLOGIES INC

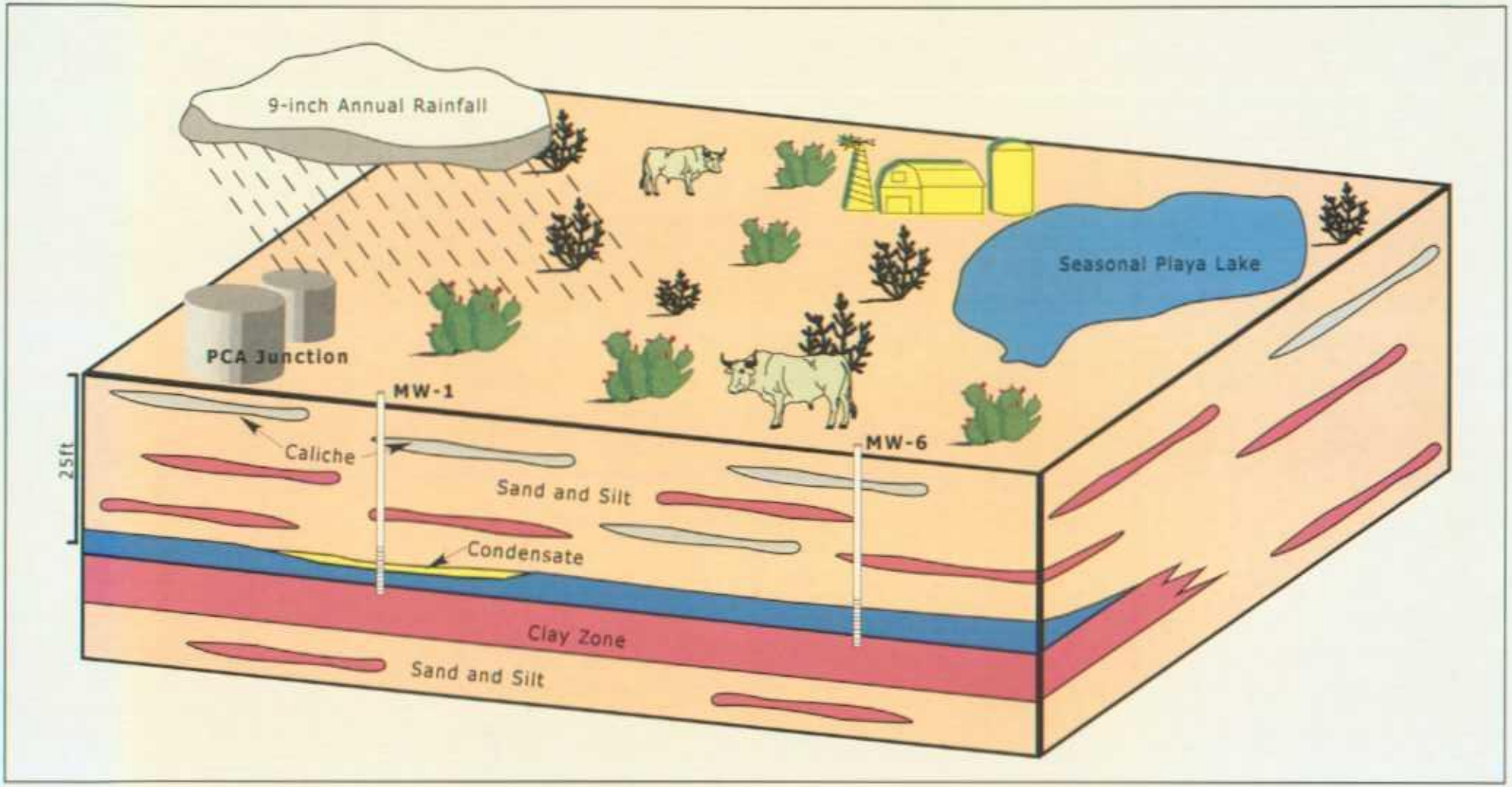


FIGURE 3: SITE CONCEPTUAL MODEL

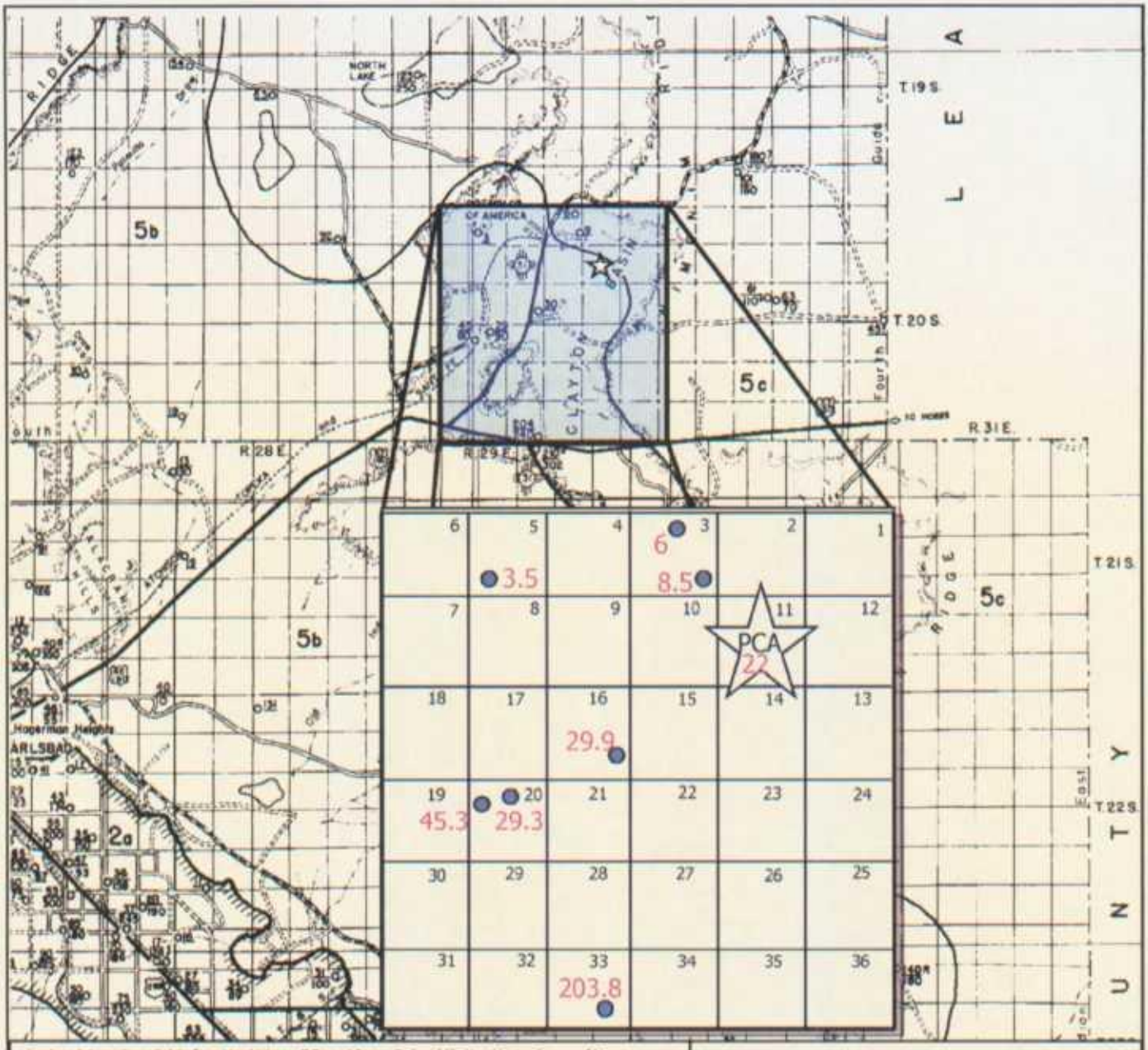
CONOCOPHILLIPS

PCA JUNCTION

CARLSBAD, NEW MEXICO

11/11/03 AMC

MAXIM TECHNOLOGIES INC



Stock and domestic well data from Hendrickson, G.E., and Jones, R. S., 1952, New Mexico Bureau of Mines and Mineral Resources, Geology and Ground-Water Resources of Eddy County, New Mexico Ground-Water Report 3

Monitoring well data from sampling by Maxim, April 2003

T 20 S, R 30 E

ID Section	Depth to GW bgs	Yield	Use	Specific Conductance	Sulfate	Chloride	Nitrate	TDS
223-3	6		Stock	2490	1540	29	1.4	2400
424-3	8.5		Stock	3290	1670	255	10	2930
310-5	3.5		Stock					
420-16	29.9		Stock	3930	1860	380	33	3370
120-20	29.3		Domestic					
130-20	45.3		Domestic	3560	1590	388	24	3050
440-33	203.8		Stock	4760	1960	620	29	3880
Average concentration in domestic and stock wells				3606	1724	334	19.48	3122
11								
MW-2	22		Monitoring	NA	1720	475	38.9	3940
MW-3	22		Monitoring	NA	1320	255	9.5	3160
MW-4	22		Monitoring	NA	1360	211	7.7	2930
MW-5	22		Monitoring	NA	1710	1410	14	5780
MW-6	22		Monitoring	NA	1370	120	5.2	2660
Average concentration in monitoring wells					1496	494.2	14.66	3694
NM Standard					**600**	**250**	**44***	

* Converted from 10 mg/L to 44 mg/L for Nitrate as NO3

FIGURE 4:

Regional Groundwater Quality Data

LEGEND

● 3 Well location and depth to water

0 1
Scale 1in=1mile

N W E S

ConocoPhillips

MAXIM TECHNOLOGIES INC

11/11/03 RMS

Table 1. ConocoPhillips PCS Junction Facility Groundwater Elevations and Well Specifications

Well ID	Date	Total Depth (feet bgs)	Screen Interval (feet bgs)	0.010 in. slot Screen Length (feet)	Casing Diameter (inches)	Elevation to Concrete Pad (feet above msl)	Elevation to Top of Casing (feet above msl)	Depth to Water (feet TOC)	Depth to Product (feet bgs)	Product Thickness (feet)	Groundwater Elevation (TOC) (feet above msl)
MW-1	05/09/01	26.00	16-26	10	2	3212.36	3212.13	23.1	NA	NA	3189.03
	05/29/01							23.25	NA	NA	3188.88
	03/25/02							25.82	23.68	2.14	3187.84*
	04/09/02							25.58	23.68	2.14	3187.81*
	09/16/03							27.15	25.53	1.62	3187.81*
MW-2	09/16/03	28.05	18.05-28.05	10	2	3211.29	3211.00	24.75	NA	NA	3186.25
MW-3	09/16/03	28.25	18.25-28.25	10	2	3210.80	3210.48	24.27	NA	NA	3186.21
MW-4	09/16/03	36.30	21.30-36.30	15	4	3211.78	3213.96	27.81	NA	NA	3186.15
MW-5	09/16/03	37.60	22.60-37.60	15	4	3214.36	3216.23	29.91	NA	NA	3186.32
MW-6	09/16/03	36.75	21.75-36.75	15	4	3212.42	3214.24	28.19	NA	NA	3186.05

bgs = below ground surface
TOC = Top of Well Casing
msl = mean sea level
* = Product thickness multiplied by product density factor of 0.73 to obtain estimated water level

Table 2. ConocoPhillips PCA Junction, Groundwater Analytical Results Summary

Sample Location	Date Sampled	ConocoPhillips PCA Junction ANALYSES FROM GW SAMPLING, April 9, 2002, and September 16, 2003																				
		SW846 8260B Micrograms per Liter (mg/L)				SW846 6010B Milligrams per Liter (mg/L)												MCAWW 300.0A (mg/L)			MCAWW 310.1 (mg/L)	MCAWW 160.1 (mg/L)
		Benzene	Toluene	Ethylbenzene	Xylenes	Mercury	Arsenic	Barium	Calcium	Cadmium	Chromium	Magnesium	Manganese	Selenium	Silver	Sodium	Lead	Chloride	Nitrate	Sulfate	Alkalinity	TDS
MW-1	NS	Not Sampled Due to Presence of Free Product																				
MW-2	04/09/02	<1.0	<1.0	<1.0	<2.0	<0.0020	<0.010	<0.20	1200	<0.0020	<0.0050	111	N/A	0.04	<0.0050	104	0.017	475	36.9	1720	74.7	3940
	09/16/03	ND	ND	ND	ND	ND	ND	1.41	1,530	ND	0.0192	N/A	0.392	0.0550	ND	160	ND	542	45	1,720	725	3,780
MW-3	04/09/02	<1.0	<1.0	<1.0	<2.0	<0.0020	<0.010	<0.20	846	<0.0020	<0.0050	11.5	N/A	0.010	<0.0050	12.3	0.0090	255	9.5	1320	91.5	3160
	09/16/03	ND	ND	ND	ND	ND	ND	3.37	2,410	ND	0.0327	N/A	0.704	ND	ND	13.3	ND	331	6.5	1,510	1,640	3,400
MW-4	04/09/02	<1.0	<1.0	<1.0	<2.0	<0.0020	<0.010	<0.20	716	<0.0020	<0.0050	40.7	N/A	0.017	<0.0050	10.5	0.0034	211	7.7	1360	107	2930
	09/16/03	ND	ND	ND	ND	ND	0.0086	0.970	1,150	ND	0.0116	N/A	0.314	0.0224	ND	9.61	ND	292	6.3	1,400	503	3,090
MW-5	04/09/02	<1.0	<1.0	<1.0	<2.0	<0.0020	<0.010	<0.20	943	<0.0020	<0.0050	301	N/A	0.029	<0.0050	291	0.0096	1410	14.0	1710	68.1	5780
	09/16/03	2	ND	ND	ND	ND	0.0147	0.227	973	ND	0.0050	N/A	0.148	0.0278	ND	272	ND	1,610	14.5	1,750	95.1	5,720
MW-6	04/09/02	<1.0	<1.0	<1.0	<2.0	<0.0020	<0.010	<0.20	652	<0.0020	<0.0050	43.4	N/A	<0.0050	<0.0050	10.5	0.011	120	5.2	1370	81.6	2660
	09/16/03	ND	ND	ND	ND	ND	0.0152	0.462	713	ND	0.0082	N/A	0.249	0.0062	ND	11.2	ND	81.3	4.0	1,440	158	2,490
NMWQCC Groundwater Standards for Human Health		10	750	750	620	0.002	0.1	1.0	NE	0.01	0.05	NE	0.2	0.05	0.05	NE	0.05	250	44*	600	NE	1000

MW Monitoring Well
SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates
MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions
NMWQCC New Mexico Water Quality Control Commission
NA Not Analyzed
ND Not detected above laboratory detection limits
NE Not established by NMWQCC
TDS Total Dissolved Solids
NS Not Sampled
* Converted from 10 mg/L to 44 mg/L for Nitrate as NO3

Table 3. MW-1 Pumping Recovery Data

Period	No. of Days	Pumping Rate[1] (Cycle/Duration)	Volume Pumped (gallons)	Volume/Day (gallons)	Thickness of Product[2] in Well (feet)
12/9	NA	Before Pumping	NA	NA	1.94
12/9 – 12/12	3.75	2 hr/ 30 min	16.2	4.32	1.01
12/12 – 12/16	4	4 hr/ 10 min	13.9	3.48	1.07
12/16 – 12/20	4	4 hr/ 10 min	8.3	2.08	0.53
12/20 – 12/30	10	Pump Off	--	--	1.6
12/30 – 1/10	11	4 hr/ 10 min	31.2	2.84	0.45
1/10 – 1/23	13	4 hr/ 10 min	26.5	2.04	0.41
1/23 – 1/29	6	4 hr/ 10 min	9.4	1.57	0.42
1/29 – 2/20	22	8 hr/ 10 min	18.3	0.83	1.32
2/20 – 2/28	8	Pump Off	--	--	1.51
2/28 – 3/12	12	8 hr/ 10 min	11.4	0.95	1.38
3/12 – 3/20	8	8 hr/ 20 min	14.3	1.79	0.3
3/20 – 4/23	34	8 hr/ 10 min	26.4	0.78	1.15
4/23 – 4/30	7	8 hr/ 20 min	9.9	1.41	0.65
4/30 – 5/19	19	8 hr/ 10 min	14.4	0.73	1.2
		Total	**200.2**		

Note: [1] Cycle – period between pumping; Duration – duration of pumping

[2] Thickness of product at end of period and before pumping cycle

*Table based on recovery test data results (**Appendix A**).*

APPENDIX A

Groundwater Analytical Results

Lancaster Laboratories

ANALYTICAL RESULTS

Prepared for:

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252
832-379-6415

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

SAMPLE GROUP

The sample group for this submittal is 867300. Samples arrived at the laboratory on Wednesday, September 17, 2003. The PO# for this group is 4501480787 and the release number is NEAL GOATES.

Client Description	Lancaster Labs Number
MW-3 Grab Water Sample	4123496
MW-2 Grab Water Sample	4123497
MW-5 Grab Water Sample	4123498
MW-6 Grab Water Sample	4123499
Duplicate Grab Water Sample	4123500
Trip Blank Water Sample	4123501
MW-4 Grab Water Sample	4123502

ELECTRONIC COPY TO	Maxim Technologies	Attn: Kelly Henderson
1 COPY TO	Maxim Technologies	Attn: Robert Sengebush

Lancaster Laboratories

Questions? Contact your Client Services Representative
Danette S Blystone at (717) 656-2300.

Respectfully Submitted,

Max E. Snavely
Sr. Chemist

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123496

Collected:09/16/2003 10:00 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-3 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-3

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	N.D.	0.00016	mg/l	1
01750	Calcium	7440-70-2	2,410.	0.247	mg/l	5
01767	Sodium	7440-23-5	13.3	2.32	mg/l	5
07035	Arsenic	7440-38-2	N.D.	0.0245	mg/l	5
07036	Selenium	7782-49-2	N.D.	0.0235	mg/l	5
07046	Barium	7440-39-3	3.37	0.0024	mg/l	5
07049	Cadmium	7440-43-9	N.D.	0.0044	mg/l	5
07051	Chromium	7440-47-3	0.0327	0.0110	mg/l	5
07055	Lead	7439-92-1	N.D.	0.0465	mg/l	5
07058	Manganese	7439-96-5	0.704	0.0026	mg/l	5
07066	Silver	7440-22-4	N.D.	0.0090	mg/l	5
00201	Alkalinity to pH 8.3	n.a.	N.D.	0.41	mg/l as CaCO3	1
00202	Alkalinity to pH 4.5	n.a.	1,640.	0.41	mg/l as CaCO3	1
00212	Total Dissolved Solids	n.a.	3,400.	77.6	mg/l	1
00219	Nitrite Nitrogen	14797-65-0	N.D.	0.015	mg/l	1
00220	Nitrate Nitrogen	14797-55-8	6.5	0.20	mg/l	5
00224	Chloride	16887-00-6	331.	60.0	mg/l	200
00228	Sulfate	14808-79-8	1,510.	60.0	mg/l	200
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	09/20/2003 11:21	Damary Valentin	1
01750	Calcium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
01767	Sodium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07035	Arsenic	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123496

Collected:09/16/2003 10:00 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-3 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-3

07036	Selenium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07046	Barium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07049	Cadmium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07051	Chromium	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07055	Lead	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07058	Manganese	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
07066	Silver	SW-846 6010B	1	09/20/2003 03:37	Donna R Sackett	5
00201	Alkalinity to pH 8.3	EPA 310.1	1	09/22/2003 19:57	Elaine F Stoltzfus	1
00202	Alkalinity to pH 4.5	EPA 310.1	1	09/22/2003 19:57	Elaine F Stoltzfus	1
00212	Total Dissolved Solids	EPA 160.1	1	09/20/2003 07:55	Susan A Engle	1
00219	Nitrite Nitrogen	EPA 353.2	1	09/17/2003 21:08	Kyle W Eckenroad	1
00220	Nitrate Nitrogen	EPA 353.2	2	09/27/2003 09:24	Michelle A Bolton	5
00224	Chloride	EPA 300.0	1	09/20/2003 03:10	Shannon L Phillips	200
00228	Sulfate	EPA 300.0	1	09/20/2003 03:10	Shannon L Phillips	200
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 15:59	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 15:59	Marla S Lord	n.a.
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	09/18/2003 20:15	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	09/19/2003 13:15	Damary Valentin	1

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123497

Collected:09/16/2003 11:20 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-2 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-2

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	N.D.	0.00016	mg/l	1
01750	Calcium	7440-70-2	1,530.	0.247	mg/l	5
01767	Sodium	7440-23-5	160.	2.32	mg/l	5
07035	Arsenic	7440-38-2	N.D.	0.0245	mg/l	5
07036	Selenium	7782-49-2	0.0550	0.0235	mg/l	5
07046	Barium	7440-39-3	1.41	0.0024	mg/l	5
07049	Cadmium	7440-43-9	N.D.	0.0044	mg/l	5
07051	Chromium	7440-47-3	0.0192	0.0110	mg/l	5
07055	Lead	7439-92-1	N.D.	0.0465	mg/l	5
07058	Manganese	7439-96-5	0.392	0.0026	mg/l	5
07066	Silver	7440-22-4	N.D.	0.0090	mg/l	5
00201	Alkalinity to pH 8.3	n.a.	N.D.	0.41	mg/l as CaCO3	1
00202	Alkalinity to pH 4.5	n.a.	725.	0.41	mg/l as CaCO3	1
00212	Total Dissolved Solids	n.a.	3,780.	77.6	mg/l	1
00219	Nitrite Nitrogen	14797-65-0	N.D.	0.015	mg/l	1
00220	Nitrate Nitrogen	14797-55-8	45.0	0.80	mg/l	20
00224	Chloride	16887-00-6	542.	60.0	mg/l	200
00228	Sulfate	14808-79-8	1,720.	60.0	mg/l	200
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	09/20/2003 11:22	Damary Valentin	1
01750	Calcium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
01767	Sodium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07035	Arsenic	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123497

Collected:09/16/2003 11:20 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-2 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-2

07036	Selenium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07046	Barium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07049	Cadmium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07051	Chromium	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07055	Lead	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07058	Manganese	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
07066	Silver	SW-846 6010B	1	09/20/2003 03:43	Donna R Sackett	5
00201	Alkalinity to pH 8.3	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00202	Alkalinity to pH 4.5	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00212	Total Dissolved Solids	EPA 160.1	1	09/20/2003 07:55	Susan A Engle	1
00219	Nitrite Nitrogen	EPA 353.2	1	09/17/2003 21:09	Kyle W Eckenroad	1
00220	Nitrate Nitrogen	EPA 353.2	1	09/25/2003 13:45	Venia B McFadden	20
00224	Chloride	EPA 300.0	1	09/20/2003 04:20	Shannon L Phillips	200
00228	Sulfate	EPA 300.0	1	09/20/2003 04:20	Shannon L Phillips	200
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 16:25	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 16:25	Marla S Lord	n.a.
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	09/18/2003 20:15	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	09/19/2003 13:15	Damary Valentin	1

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123498

Collected:09/16/2003 14:00 by KH

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-5 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

Account Number: 11288

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-5

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	N.D.	0.00016	mg/l	1
01750	Calcium	7440-70-2	973.	0.494	mg/l	10
01767	Sodium	7440-23-5	272.	4.63	mg/l	10
07035	Arsenic	7440-38-2	0.0147	0.0049	mg/l	1
07036	Selenium	7782-49-2	0.0278	0.0047	mg/l	1
07046	Barium	7440-39-3	0.227	0.00048	mg/l	1
07049	Cadmium	7440-43-9	N.D.	0.00087	mg/l	1
07051	Chromium	7440-47-3	0.0050	0.0022	mg/l	1
07055	Lead	7439-92-1	N.D.	0.0093	mg/l	1
07058	Manganese	7439-96-5	0.148	0.00051	mg/l	1
07066	Silver	7440-22-4	N.D.	0.0018	mg/l	1
00201	Alkalinity to pH 8.3	n.a.	N.D.	0.41	mg/l as CaCO3	1
00202	Alkalinity to pH 4.5	n.a.	95.1	0.41	mg/l as CaCO3	1
00212	Total Dissolved Solids	n.a.	5,720.	194.	mg/l	1
00219	Nitrite Nitrogen	14797-65-0	N.D.	0.015	mg/l	1
00220	Nitrate Nitrogen	14797-55-8	14.5	0.40	mg/l	10
00224	Chloride	16887-00-6	1,610.	150.	mg/l	500
00228	Sulfate	14808-79-8	1,750.	75.0	mg/l	250
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	2.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	09/20/2003 11:23	Damary Valentin	1
01750	Calcium	SW-846 6010B	1	09/21/2003 00:51	Donna R Sackett	10
01767	Sodium	SW-846 6010B	1	09/20/2003 06:54	Joanne M Gates	10
07035	Arsenic	SW-846 6010B	1	09/20/2003 06:48	Joanne M Gates	1

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123498

Collected:09/16/2003 14:00 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-5 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-5

07036	Selenium	SW-846 6010B	1	09/21/2003 00:45	Donna R Sackett	1
07046	Barium	SW-846 6010B	1	09/20/2003 06:48	Joanne M Gates	1
07049	Cadmium	SW-846 6010B	1	09/21/2003 00:45	Donna R Sackett	1
07051	Chromium	SW-846 6010B	1	09/20/2003 06:48	Joanne M Gates	1
07055	Lead	SW-846 6010B	1	09/21/2003 00:45	Donna R Sackett	1
07058	Manganese	SW-846 6010B	1	09/20/2003 06:48	Joanne M Gates	1
07066	Silver	SW-846 6010B	1	09/20/2003 06:48	Joanne M Gates	1
00201	Alkalinity to pH 8.3	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00202	Alkalinity to pH 4.5	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00212	Total Dissolved Solids	EPA 160.1	1	09/20/2003 07:55	Susan A Engle	1
00219	Nitrite Nitrogen	EPA 353.2	1	09/17/2003 21:11	Kyle W Eckenroad	1
00220	Nitrate Nitrogen	EPA 353.2	1	09/25/2003 11:03	Venia B McFadden	10
00224	Chloride	EPA 300.0	1	09/22/2003 15:01	Shannon L Phillips	500
00228	Sulfate	EPA 300.0	1	09/20/2003 04:34	Shannon L Phillips	250
02300	DST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 17:43	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 17:43	Marla S Lord	n.a.
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	09/18/2003 20:15	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	09/19/2003 13:15	Damary Valentin	1

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123499

Collected:09/16/2003 15:15 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-6 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-6

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	N.D.	0.00016	mg/l	1
01750	Calcium	7440-70-2	713.	0.494	mg/l	10
01767	Sodium	7440-23-5	11.2	0.463	mg/l	1
07035	Arsenic	7440-38-2	0.0152	0.0049	mg/l	1
07036	Selenium	7782-49-2	0.0062	0.0047	mg/l	1
07046	Barium	7440-39-3	0.462	0.00048	mg/l	1
07049	Cadmium	7440-43-9	N.D.	0.00087	mg/l	1
07051	Chromium	7440-47-3	0.0082	0.0022	mg/l	1
07055	Lead	7439-92-1	N.D.	0.0093	mg/l	1
07058	Manganese	7439-96-5	0.249	0.00051	mg/l	1
07066	Silver	7440-22-4	N.D.	0.0018	mg/l	1
00201	Alkalinity to pH 8.3	n.a.	N.D.	0.41	mg/l as CaCO3	1
00202	Alkalinity to pH 4.5	n.a.	158.	0.41	mg/l as CaCO3	1
00212	Total Dissolved Solids	n.a.	2,490.	38.8	mg/l	1
00219	Nitrite Nitrogen	14797-65-0	N.D.	0.015	mg/l	1
00220	Nitrate Nitrogen	14797-55-8	4.0	0.040	mg/l	1
00224	Chloride	16887-00-6	81.3	6.0	mg/l	20
00228	Sulfate	14808-79-8	1,440.	60.0	mg/l	200
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	09/20/2003 11:25	Damary Valentin	1
01750	Calcium	SW-846 6010B	1	09/21/2003 01:03	Donna R Sackett	10
01767	Sodium	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1
07035	Arsenic	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123499

Collected:09/16/2003 15:15 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:23
Discard: 10/30/2003
MW-6 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-6

07036	Selenium	SW-846 6010B	1	09/21/2003 00:57	Donna R Sackett	1
07046	Barium	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1
07049	Cadmium	SW-846 6010B	1	09/21/2003 00:57	Donna R Sackett	1
07051	Chromium	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1
07055	Lead	SW-846 6010B	1	09/21/2003 00:57	Donna R Sackett	1
07058	Manganese	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1
07066	Silver	SW-846 6010B	1	09/20/2003 07:06	Joanne M Gates	1
00201	Alkalinity to pH 8.3	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00202	Alkalinity to pH 4.5	EPA 310.1	1	09/23/2003 18:05	Elaine F Stoltzfus	1
00212	Total Dissolved Solids	EPA 160.1	1	09/20/2003 07:55	Susan A Engle	1
00219	Nitrite Nitrogen	EPA 353.2	1	09/17/2003 22:00	Kyle W Eckenroad	1
00220	Nitrate Nitrogen	EPA 353.2	1	09/25/2003 10:48	Venia B McFadden	1
00224	Chloride	EPA 300.0	1	09/20/2003 04:48	Shannon L Phillips	20
00228	Sulfate	EPA 300.0	1	09/20/2003 05:02	Shannon L Phillips	200
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 18:09	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 18:09	Marla S Lord	n.a.
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	09/18/2003 20:15	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	09/19/2003 13:15	Damary Valentin	1

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123500

Collected:09/16/2003 15:00 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:24
Discard: 10/30/2003
Duplicate Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-D

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 18:35	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 18:35	Marla S Lord	n.a.

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123501

Collected:09/16/2003 16:00

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:24
Discard: 10/30/2003
Trip Blank Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-T

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 19:02	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 19:02	Marla S Lord	n.a.

Analysis Report

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123502

Collected:09/16/2003 16:15 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:24
Discard: 10/30/2003
MW-4 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-4

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Method Detection Limit	Units	Dilution Factor
00259	Mercury	7439-97-6	N.D.	0.00016	mg/l	1
01750	Calcium	7440-70-2	1,150.	0.494	mg/l	10
01767	Sodium	7440-23-5	9.61	0.463	mg/l	1
07035	Arsenic	7440-38-2	0.0086	0.0049	mg/l	1
07036	Selenium	7782-49-2	0.0224	0.0047	mg/l	1
07046	Barium	7440-39-3	0.970	0.00048	mg/l	1
07049	Cadmium	7440-43-9	N.D.	0.00087	mg/l	1
07051	Chromium	7440-47-3	0.0116	0.0022	mg/l	1
07055	Lead	7439-92-1	N.D.	0.0093	mg/l	1
07058	Manganese	7439-96-5	0.314	0.00051	mg/l	1
07066	Silver	7440-22-4	N.D.	0.0018	mg/l	1
00201	Alkalinity to pH 8.3	n.a.	N.D.	0.41	mg/l as CaCO3	1
00202	Alkalinity to pH 4.5	n.a.	503.	0.41	mg/l as CaCO3	1
00212	Total Dissolved Solids	n.a.	3,090.	77.6	mg/l	1
00219	Nitrite Nitrogen	14797-65-0	N.D.	0.015	mg/l	1
00220	Nitrate Nitrogen	14797-55-8	6.3	0.20	mg/l	5
00224	Chloride	16887-00-6	292.	60.0	mg/l	200
00228	Sulfate	14808-79-8	1,400.	60.0	mg/l	200
02300	UST-Unleaded Waters by 8260B					
05401	Benzene	71-43-2	N.D.	0.5	ug/l	1
05407	Toluene	108-88-3	N.D.	0.7	ug/l	1
05415	Ethylbenzene	100-41-4	N.D.	0.8	ug/l	1
06310	Xylene (Total)	1330-20-7	N.D.	0.8	ug/l	1

Laboratory Chronicle

CAT No.	Analysis Name	Method	Trial#	Analysis Date and Time	Analyst	Dilution Factor
00259	Mercury	SW-846 7470A	1	09/20/2003 11:26	Damary Valentin	1
01750	Calcium	SW-846 6010B	1	09/21/2003 01:15	Donna R Sackett	10
01767	Sodium	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1
07035	Arsenic	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1

Lancaster Laboratories

Lancaster Laboratories Sample No. WW 4123502

Collected: 09/16/2003 16:15 by KH

Account Number: 11288

Submitted: 09/17/2003 09:35
Reported: 09/29/2003 at 12:24
Discard: 10/30/2003
MW-4 Grab Water Sample
Site #NG00005
PCA Junction - Carlsbad, NM

ConocoPhillips
P.O. Box 2197; 5027 TN

Houston TX 77252

PCA-4

07036	Selenium	SW-846 6010B	1	09/21/2003 01:09	Donna R Sackett	1
07046	Barium	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1
07049	Cadmium	SW-846 6010B	1	09/21/2003 01:09	Donna R Sackett	1
07051	Chromium	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1
07055	Lead	SW-846 6010B	1	09/21/2003 01:09	Donna R Sackett	1
07058	Manganese	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1
07066	Silver	SW-846 6010B	1	09/20/2003 07:18	Joanne M Gates	1
00201	Alkalinity to pH 8.3	EPA 310.1	1	09/22/2003 19:57	Elaine F Stoltzfus	1
00202	Alkalinity to pH 4.5	EPA 310.1	1	09/22/2003 19:57	Elaine F Stoltzfus	1
00212	Total Dissolved Solids	EPA 160.1	1	09/20/2003 07:55	Susan A Engle	1
00219	Nitrite Nitrogen	EPA 353.2	1	09/17/2003 22:04	Kyle W Eckenroad	1
00220	Nitrate Nitrogen	EPA 353.2	1	09/26/2003 13:42	Michelle A Bolton	5
00224	Chloride	EPA 300.0	1	09/22/2003 15:42	Shannon L Phillips	200
00228	Sulfate	EPA 300.0	1	09/22/2003 15:42	Shannon L Phillips	200
02300	UST-Unleaded Waters by 8260B	SW-846 8260B	1	09/23/2003 19:28	Marla S Lord	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	09/23/2003 19:28	Marla S Lord	n.a.
01848	WW SW846 ICP Digest (tot rec)	SW-846 3005A	1	09/18/2003 20:15	James L Mertz	1
05713	WW SW846 Hg Digest	SW-846 7470A	1	09/19/2003 13:15	Damary Valentin	1

Lancaster Laboratories

Quality Control Summary

Client Name: ConocoPhillips Group Number: 867300
Reported: 09/29/03 at 12:24 PM

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 03260105101A	Sample number(s): 4123496-4123499							
Nitrite Nitrogen	N.D.	0.015	mg/l	93		89-110		
Batch number: 03260105101B	Sample number(s): 4123502							
Nitrite Nitrogen	N.D.	0.015	mg/l	93		89-110		
Batch number: 032611848005	Sample number(s): 4123496-4123499,4123502							
Calcium	N.D.	0.0494	mg/l	101		93-113		
Sodium	N.D.	0.463	mg/l	105		89-112		
Arsenic	N.D.	0.0049	mg/l	100		92-109		
Selenium	N.D.	0.0047	mg/l	100		91-111		
Barium	N.D.	0.00048	mg/l	102		93-109		
Cadmium	N.D.	0.00087	mg/l	105		97-111		
Chromium	N.D.	0.0022	mg/l	104		95-112		
Lead	N.D.	0.0093	mg/l	103		93-110		
Manganese	N.D.	0.00051	mg/l	103		93-110		
Silver	N.D.	0.0018	mg/l	103		96-114		
Batch number: 03261401103B	Sample number(s): 4123496-4123499							
Chloride	N.D.	0.30	mg/l	98		90-110		
Sulfate	N.D.	0.30	mg/l	99		89-110		
Batch number: 032625713001	Sample number(s): 4123496-4123499,4123502							
Mercury	N.D.	0.00016	mg/l	97		84-124		
Batch number: 03263021201A	Sample number(s): 4123496-4123499,4123502							
Total Dissolved Solids	N.D.	9.7	mg/l	103		80-120		
Batch number: 03265020201A	Sample number(s): 4123496,4123502							
Alkalinity to pH 4.5				99		98-103		
Batch number: 03265401101A	Sample number(s): 4123502							
Chloride	N.D.	0.30	mg/l	99		90-110		
Sulfate	N.D.	0.30	mg/l	99		89-110		
Batch number: 03266020201A	Sample number(s): 4123497-4123499							
Alkalinity to pH 4.5				100		98-103		
Batch number: 03268106101B	Sample number(s): 4123497-4123499							
Nitrate Nitrogen	N.D.	0.040	mg/l	102		89-110		
Batch number: 03269106101B	Sample number(s): 4123502							
Nitrate Nitrogen	N.D.	0.040	mg/l	100		89-110		
Batch number: 03270106101A	Sample number(s): 4123496							
Nitrate Nitrogen	N.D.	0.040	mg/l	98		89-110		

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

Lancaster Laboratories

Quality Control Summary

Client Name: ConocoPhillips Group Number: 867300
Reported: 09/29/03 at 12:24 PM

Laboratory Compliance Quality Control

Analysis Name	Blank Result	Blank MDL	Report Units	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: T032661AA	Sample number(s): 4123496-4123502							
Benzene	N.D.	0.5	ug/l	98		85-117		
Toluene	N.D.	0.7	ug/l	99		85-115		
Ethylbenzene	N.D.	0.8	ug/l	96		82-119		
Xylene (Total)	N.D.	0.8	ug/l	100		84-120		

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 03260105101A	Sample number(s): 4123496-4123499								
Nitrite Nitrogen	103		90-110			N.D.	N.D.	0 (1)	20
Batch number: 03260105101B	Sample number(s): 4123502								
Nitrite Nitrogen	93		90-110			N.D.	N.D.	0 (1)	20
Batch number: 032611848005	Sample number(s): 4123496-4123499,4123502								
Calcium	(2)	(2)	78-122	0	20	19.2	19.1	0	20
Sodium	(2)	(2)	75-125	2	20	58.0	57.1	2	20
Arsenic	101	101	86-119	0	20	N.D.	N.D.	0 (1)	20
Selenium	100	100	75-125	0	20	N.D.	N.D.	0 (1)	20
Barium	103	102	82-113	1	20	0.0337	0.0332	1	20
Cadmium	104	104	87-117	0	20	N.D.	N.D.	0 (1)	20
Chromium	105	104	86-118	1	20	N.D.	N.D.	0 (1)	20
Lead	104	104	87-118	0	20	N.D.	N.D.	0 (1)	20
Manganese	104	103	85-111	1	20	0.0076	0.0071	7 (1)	20
Silver	106	105	75-125	1	20	N.D.	N.D.	0 (1)	20
Batch number: 03261401103B	Sample number(s): 4123496-4123499								
Chloride	98		90-110			331.	341.	3 (1)	3
Sulfate	98		90-110			1,510.	1,530.	1	3
Batch number: 032625713001	Sample number(s): 4123496-4123499,4123502								
Mercury	106	98	80-120	8	20	N.D.	N.D.	183* (1)	20
Batch number: 03263021201A	Sample number(s): 4123496-4123499,4123502								
Total Dissolved Solids	94	99	60-140	2	5	3,080.	2,990.	3	5
Batch number: 03265020201A	Sample number(s): 4123496,4123502								
Alkalinity to pH 8.3						N.D.	N.D.	0 (1)	4
Alkalinity to pH 4.5	98	97	64-130	1	2	156.	155.	0	4
Batch number: 03265401101A	Sample number(s): 4123502								
Chloride	95		90-110			13.7	13.8	1	3

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

Lancaster Laboratories

Quality Control Summary

Client Name: ConocoPhillips Group Number: 867300
Reported: 09/29/03 at 12:24 PM

Sample Matrix Quality Control

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD MAX	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Sulfate	95		90-110			5.7	4.7	21* (1)	3
Batch number: 03266020201A	Sample number(s): 4123497-4123499								
Alkalinity to pH 8.3						N.D.	N.D.	0 (1)	4
Alkalinity to pH 4.5	99	99	64-130	0	2	90.2	92.1	2	4
Batch number: 03268106101B	Sample number(s): 4123497-4123499								
Nitrate Nitrogen	64*		90-110			2.6	2.6	1	2
Batch number: 03269106101B	Sample number(s): 4123502								
Nitrate Nitrogen	106		90-110			6.3	6.1	3*	2
Batch number: 03270106101A	Sample number(s): 4123496								
Nitrate Nitrogen	103		90-110			N.D.	N.D.	0 (1)	2
Batch number: T032661AA	Sample number(s): 4123496-4123502								
Benzene	101	96	83-128	5	30				
Toluene	99	96	83-127	4	30				
Ethylbenzene	94	93	82-129	1	30				
Xylene (Total)	97	94	82-130	4	30				

Surrogate Quality Control

Analysis Name: UST-Unleaded Waters by 8260B
Batch number: T032661AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
4123496	107	103	96	94
4123497	107	100	96	94
4123498	107	102	96	94
4123499	106	98	97	95
4123500	107	99	97	95
4123501	106	99	98	96
4123502	109	100	97	93
Blank	107	105	96	93
LCS	97	97	104	106
MS	100	99	104	104
MSD	96	97	103	102
Limits:	81-120	82-112	85-112	83-113

*- Outside of specification
(1) The result for one or both determinations was less than five times the LOQ.
(2) The background result was more than four times the spike added.

ConocoPhillips Analysis Request/Chain of Custody

Lancaster Laboratories

Acct. #: 11288 | For Lancaster Laboratories use only Group # 867300 Sample #: 4123496-502 | SCR#: 182086

Consultant Office: Maxim Tech PM: Robert Sengebush

Consultant Phone #: (505) 237-8440 Fax #: 8656

Site #: _____ Lab PO #: _____

Site Address: Carlsbad, NM

WNO#: _____ DWT: _____

Sampler: Kelly Henderson / Frank Lichnovsky

Matrix: ☐ Potable ☐ NPDES; Soil ☐ Water ☐ Oil ☐ Air ☐

Analyses Requested — List total number of containers in the box under each analysis.

Preservation Codes: O = O; J = J; K = K; I = I; N = N; H = H

Sample Identification	Date Collected	Time Collected	Grab	Composite	NO3 (O)	TBD (J)	NO2 (K)	UST-MN BTEX (I)	Na, Ca, Mn, Hg, Ba, Cd, Cr (N)	TDS (N)	EPA 624 (H)	AIK (H)	Remarks
MW-3	9-16-03	1006	X	X	X	X	X	X	X	X	X	X	
MW-2	9-16-03	1120	X		X	X	X	X	X	X	X	X	
MW-5	9-16-03	1400	X		X	X	X	X	X	X	X	X	
MW-6	9-16-03	1515	X		X	X	X	X	X	X	X	X	
duplicate	9-16-03	1560	X		X			X					
trip blank	9-16-03	1600	X		X			X					
MW-4 重	9-16-03	1615	X		X	X	X	X	X	X	X	X	

Preservative Codes: H = HCl; T = Thiosulfate; N = HNO_3; B = NaOH; S = H_2SO_4; O = Other

Turnaround Time Requested in Business Days (TAT) (please circle):

STD. TAT | 5 day | 48 hour | 24 hour | other _____

Reporting Requirements (please circle)

NJ Reduced | NY ASP Cat. A | Raw Data | NY ASP Cat. B | Full Type I | Other _____

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	9/20/03	1630	Kelly E. Henderson	9-15-03	16
Kelly E. Henderson	9-16-03	1700			
			Kathy Binkley	9-17-03	09

Relinquished by Commercial Carrier: UPS _____ FedEx ✓ Other _____

Temperature Upon Receipt 3.0 C°

APPENDIX B

Aquifer Test Analysis Data

Conoco Phillips PCA Junction
Summary of Aquifer Test Analysis Results
Drawdown and Recovery Test
MW-3 Test on September 17, 2003
Well depth: 30 ft **Aquifer thickness: 10 ft** **Constant flow rate: 0.43 gpm**
Aquifer is unconfined.
Analyzed with Waterloo Hydrogeologic AquiferTest
R. Sengebush October, 2003

Method	Transmissivity (cm^2/sec)	Transmissivity (ft^2/min)	Hydraulic Conductivity K, (K=T/b), (cm/sec)
Drawdown			
Theis (unconf.)	7.08E-01	4.57E-02	2.32E-03
Theis (conf.)		4.57E-02	
Cooper Jacob		1.85E-02	
Neuman		4.57E-02	
Recovery			
Theis Jacob	3.84E-01		1.26E-03
Average	5.46E-01	3.89E-02	1.79E-03

Calculation of estimated average groundwater velocity using the average K:

Average Velocity $v = Ki/n$

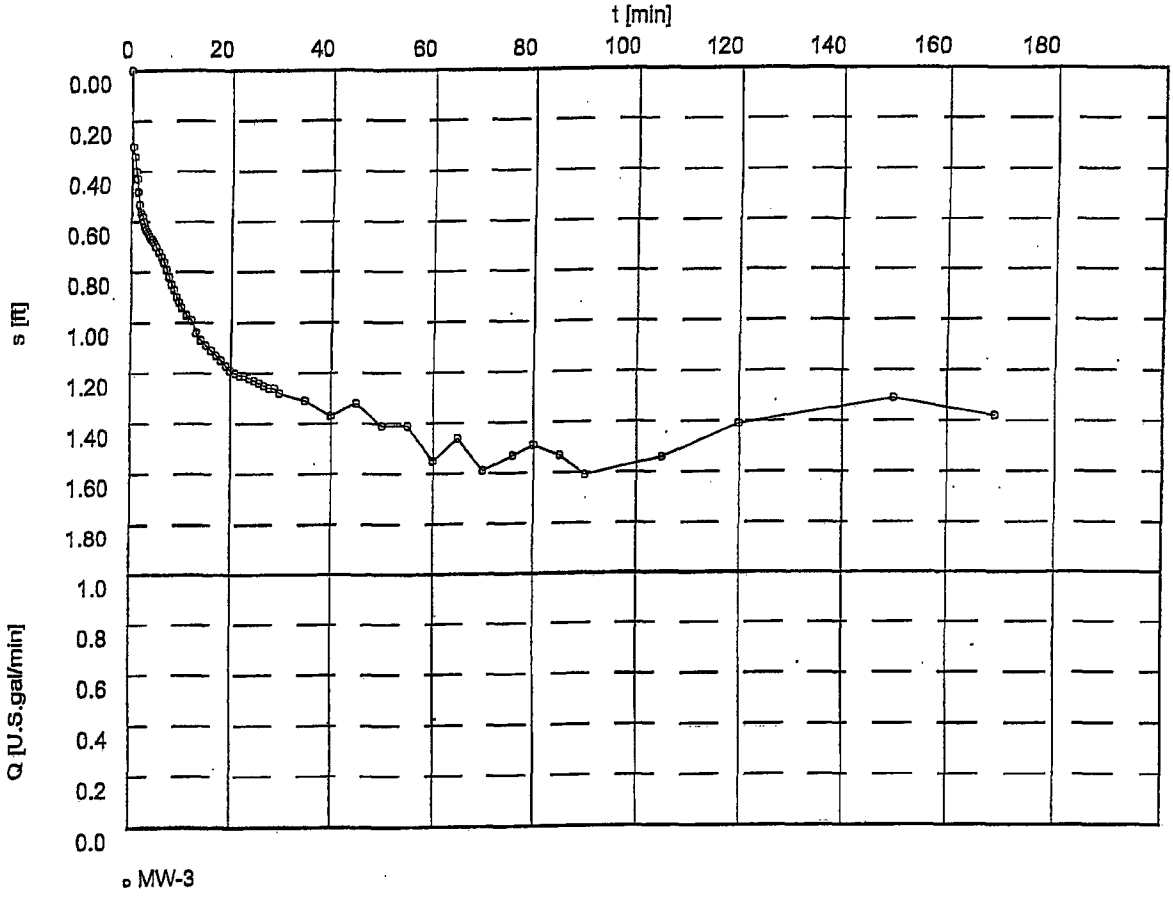
v =average velocity
Average K =hydraulic conductivity 1.79E-03 cm/sec
9/16/03 I =groundwater gradient 0.0007
n =aquifer porosity 0.3

v = 4.18E-06 cm/sec

conversions cm/sec x 1.97 = ft/min 8.23E-06 ft/min
ft/min x 1440 = ft/day 1.18E-02 ft/day
ft/day x 365 = ft/yr 4.32E+00 ft/yr

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	



Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
1	0.00	24.26	0.00	
2	0.25	24.56	0.30	
3	0.50	24.60	0.34	
4	0.75	24.66	0.40	
5	1.00	24.69	0.43	
6	1.25	24.74	0.48	
7	1.50	24.79	0.53	
8	1.75	24.82	0.56	
9	2.00	24.83	0.57	
10	2.25	24.84	0.58	
11	2.50	24.86	0.60	
12	2.75	24.88	0.62	
13	3.00	24.89	0.63	
14	3.25	24.90	0.64	
15	3.50	24.91	0.65	
16	3.75	24.92	0.66	
17	4.00	24.93	0.67	
18	4.25	24.93	0.67	
19	4.50	24.94	0.68	
20	4.75	24.95	0.69	
21	5.00	24.96	0.70	
22	5.50	24.98	0.72	
23	6.00	25.00	0.74	
24	6.50	25.02	0.76	
25	7.00	25.05	0.79	
26	7.50	25.08	0.82	
27	8.00	25.11	0.85	
28	8.50	25.13	0.87	
29	9.00	25.16	0.90	
30	9.50	25.18	0.92	
31	10.00	25.20	0.94	
32	11.00	25.23	0.97	
33	12.00	25.25	0.99	
34	13.00	25.30	1.04	
35	14.00	25.33	1.07	
36	15.00	25.35	1.09	
37	16.00	25.37	1.11	
38	17.00	25.39	1.13	
39	18.00	25.41	1.15	
40	19.00	25.43	1.17	
41	20.00	25.45	1.19	
42	21.00	25.46	1.20	
43	22.00	25.47	1.21	
44	23.00	25.47	1.21	
45	24.00	25.48	1.22	
46	25.00	25.49	1.23	
47	26.00	25.50	1.24	
48	27.00	25.51	1.25	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

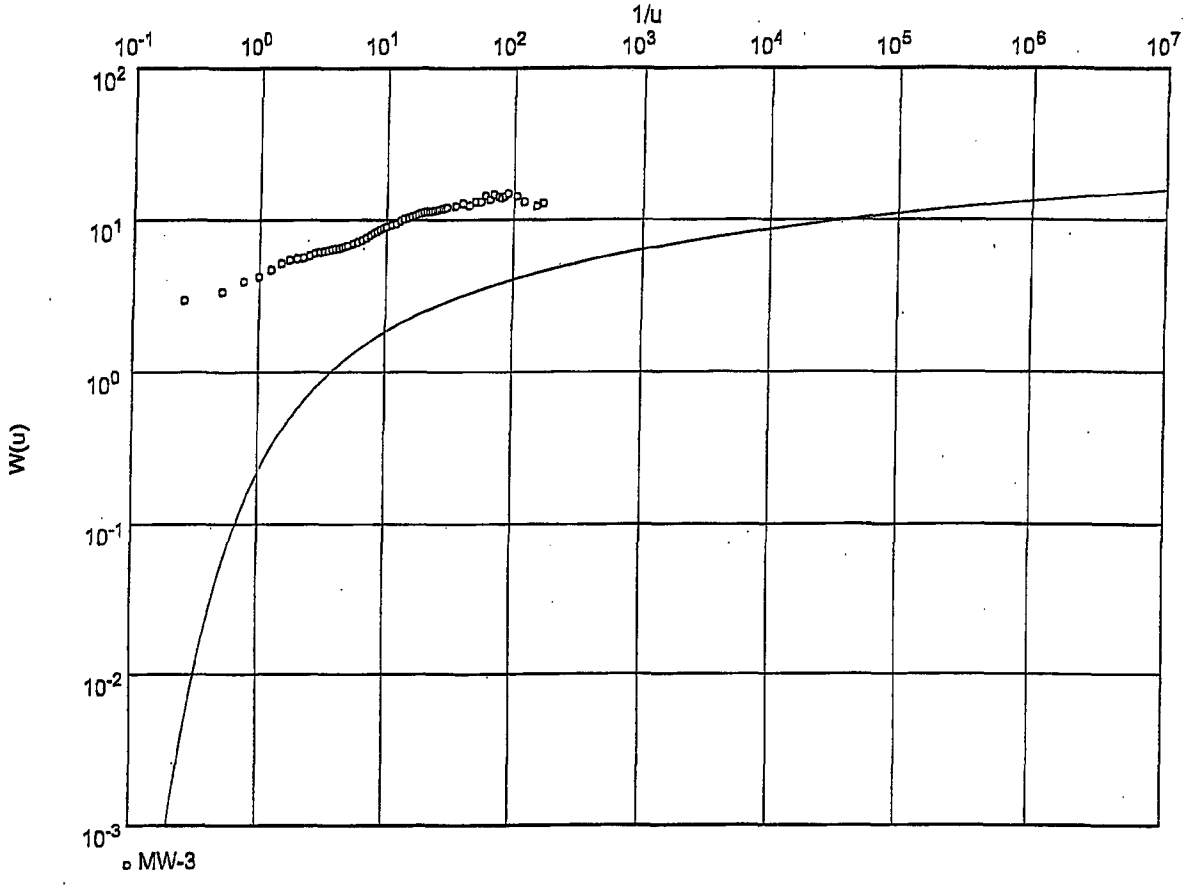
Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]
51	30.00	25.54	1.28
52	35.00	25.57	1.31
53	40.00	25.63	1.37
54	45.00	25.58	1.32
55	50.00	25.67	1.41
56	55.00	25.67	1.41
57	60.00	25.81	1.55
58	65.00	25.72	1.46
59	70.00	25.85	1.59
60	76.00	25.79	1.53
61	80.00	25.75	1.49
62	85.00	25.79	1.53
63	90.00	25.87	1.61
64	105.00	25.80	1.54
65	120.00	25.67	1.41
66	150.00	25.57	1.31
67	169.00	25.64	1.38

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method *Unconfined aquifer*	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	
Discharge 0.43 U.S.gal/min	



Transmissivity [cm²/s]: 7.08×10^{-1}

Hydraulic conductivity [cm/s]: 2.32×10^{-3}

Aquifer thickness [cm]: 304.8

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Unconfined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 30.5 cm

Static water level: 739.4 cm below datum

	Pumping test duration [s]	Water level [cm]	Drawdown [cm]	Corrected drawdown [cm]
2	15	748.6	9.1	9.0
3	30	749.8	10.4	10.2
4	45	751.6	12.2	11.9
5	60	752.6	13.1	12.8
6	75	754.1	14.6	14.3
7	90	755.6	16.2	15.7
8	105	756.5	17.1	16.6
9	120	756.8	17.4	16.9
10	135	757.1	17.7	17.2
11	150	757.7	18.3	17.7
12	165	758.3	18.9	18.3
13	180	758.6	19.2	18.6
14	195	759.0	19.5	18.9
15	210	759.3	19.8	19.2
16	225	759.6	20.1	19.5
17	240	759.9	20.4	19.7
18	255	759.9	20.4	19.7
19	270	760.2	20.7	20.0
20	285	760.5	21.0	20.3
21	300	760.8	21.3	20.6
22	330	761.4	21.9	21.2
23	360	762.0	22.6	21.7
24	390	762.6	23.2	22.3
25	420	763.5	24.1	23.1
26	450	764.4	25.0	24.0
27	480	765.4	25.9	24.8
28	510	766.0	26.5	25.4
29	540	766.9	27.4	26.2
30	570	767.5	28.0	26.8
31	600	768.1	28.7	27.3
32	660	769.0	29.6	28.1
33	720	769.6	30.2	28.7
34	780	771.1	31.7	30.1
35	840	772.1	32.6	30.9
36	900	772.7	33.2	31.4
37	960	773.3	33.8	32.0
38	1020	773.9	34.4	32.5
39	1080	774.5	35.1	33.0
40	1140	775.1	35.7	33.6
41	1200	775.7	36.3	34.1
42	1260	776.0	36.6	34.4
43	1320	776.3	36.9	34.6
44	1380	776.3	36.9	34.6
45	1440	776.6	37.2	34.9
46	1500	776.9	37.5	35.2
47	1560	777.2	37.8	35.5
48	1620	777.5	38.1	35.7

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Unconfined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

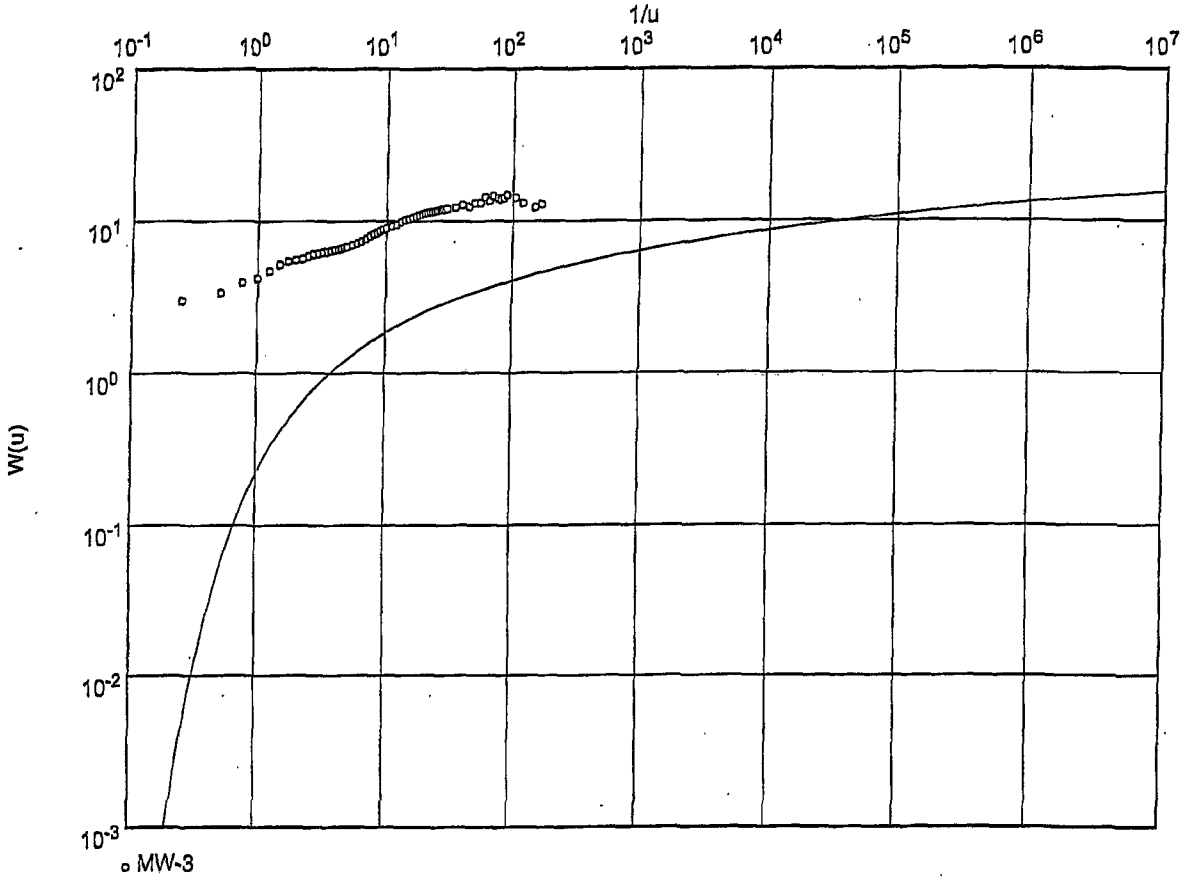
Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 30.5 cm

Static water level: 739.4 cm below datum

	Pumping test duration [s]	Water level [cm]	Drawdown [cm]	Corrected drawdown [cm]
51	1800	778.5	39.0	36.5
52	2100	779.4	39.9	37.3
53	2400	781.2	41.8	38.9
54	2700	779.7	40.2	37.6
55	3000	782.4	43.0	39.9
56	3300	782.4	43.0	39.9
57	3600	786.7	47.2	43.6
58	3900	783.9	44.5	41.3
59	4200	787.9	48.5	44.6
60	4560	786.1	46.6	43.1
61	4800	784.9	45.4	42.0
62	5100	786.1	46.6	43.1
63	5400	788.5	49.1	45.1
64	6300	786.4	46.9	43.3
65	7200	782.4	43.0	39.9
66	9000	779.4	39.9	37.3
67	10140	781.5	42.1	39.2

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Unconfined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	
Discharge 0.43 U.S.gal/min	



Transmissivity [ft²/min]: 4.57×10^{-2}

Hydraulic conductivity [ft/min]: 4.57×10^{-3}

Aquifer thickness [ft]: 10.00

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Unconfined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft
Static water level: 24.26 ft below datum	

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	Corrected drawdown [ft]
2	0.25	24.56	0.30	0.30
3	0.50	24.60	0.34	0.33
4	0.75	24.66	0.40	0.39
5	1.00	24.69	0.43	0.42
6	1.25	24.74	0.48	0.47
7	1.50	24.79	0.53	0.52
8	1.75	24.82	0.56	0.54
9	2.00	24.83	0.57	0.55
10	2.25	24.84	0.58	0.56
11	2.50	24.86	0.60	0.58
12	2.75	24.88	0.62	0.60
13	3.00	24.89	0.63	0.61
14	3.25	24.90	0.64	0.62
15	3.50	24.91	0.65	0.63
16	3.75	24.92	0.66	0.64
17	4.00	24.93	0.67	0.65
18	4.25	24.93	0.67	0.65
19	4.50	24.94	0.68	0.66
20	4.75	24.95	0.69	0.67
21	5.00	24.96	0.70	0.68
22	5.50	24.98	0.72	0.69
23	6.00	25.00	0.74	0.71
24	6.50	25.02	0.76	0.73
25	7.00	25.05	0.79	0.76
26	7.50	25.08	0.82	0.79
27	8.00	25.11	0.85	0.81
28	8.50	25.13	0.87	0.83
29	9.00	25.16	0.90	0.86
30	9.50	25.18	0.92	0.88
31	10.00	25.20	0.94	0.90
32	11.00	25.23	0.97	0.92
33	12.00	25.25	0.99	0.94
34	13.00	25.30	1.04	0.99
35	14.00	25.33	1.07	1.01
36	15.00	25.35	1.09	1.03
37	16.00	25.37	1.11	1.05
38	17.00	25.39	1.13	1.07
39	18.00	25.41	1.15	1.08
40	19.00	25.43	1.17	1.10
41	20.00	25.45	1.19	1.12
42	21.00	25.46	1.20	1.13
43	22.00	25.47	1.21	1.14
44	23.00	25.47	1.21	1.14
45	24.00	25.48	1.22	1.15
46	25.00	25.49	1.23	1.15
47	26.00	25.50	1.24	1.16
48	27.00	25.51	1.25	1.17

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Unconfined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

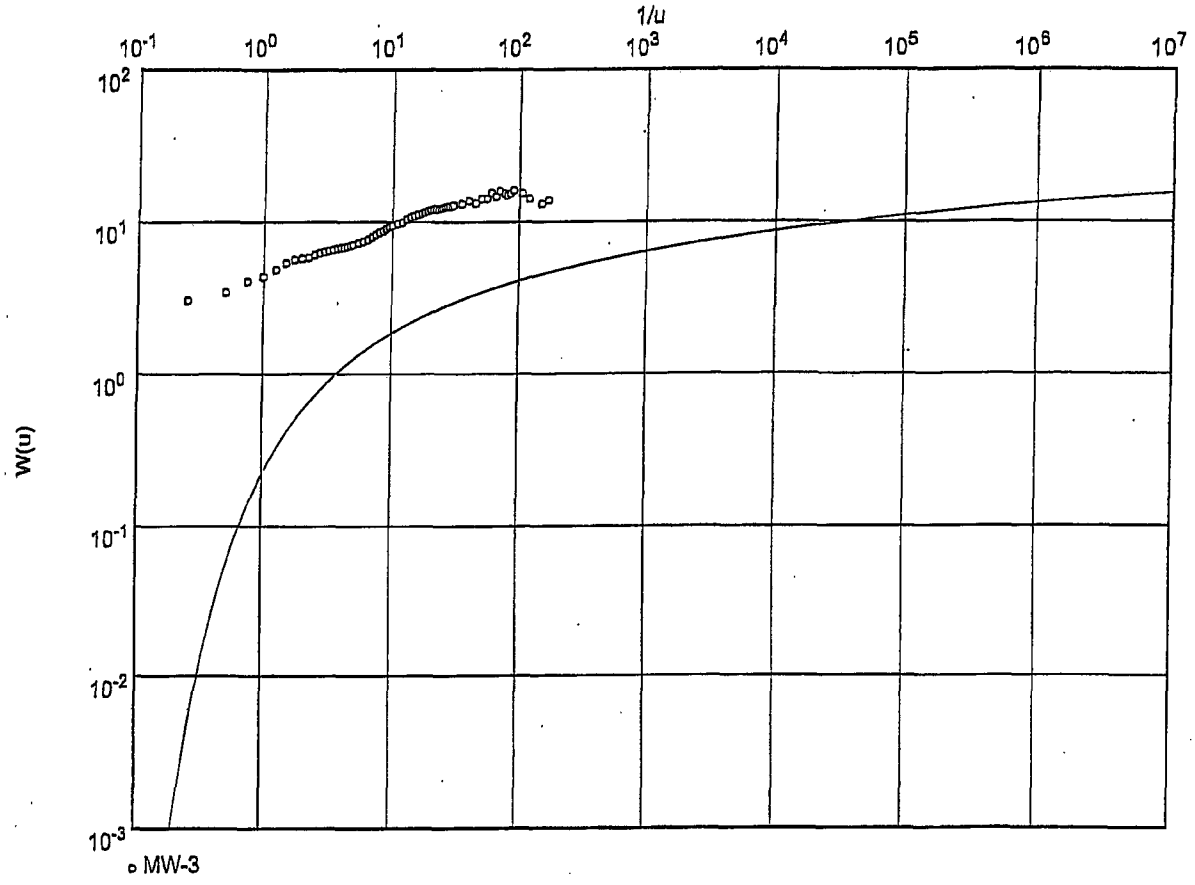
Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	Corrected drawdown [ft]
51	30.00	25.54	1.28	1.20
52	35.00	25.57	1.31	1.22
53	40.00	25.63	1.37	1.28
54	45.00	25.58	1.32	1.23
55	50.00	25.67	1.41	1.31
56	55.00	25.67	1.41	1.31
57	60.00	25.81	1.55	1.43
58	65.00	25.72	1.46	1.35
59	70.00	25.85	1.59	1.46
60	76.00	25.79	1.53	1.41
61	80.00	25.75	1.49	1.38
62	85.00	25.79	1.53	1.41
63	90.00	25.87	1.61	1.48
64	105.00	25.80	1.54	1.42
65	120.00	25.67	1.41	1.31
66	150.00	25.57	1.31	1.22
67	169.00	25.64	1.38	1.28

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	
Discharge 0.43 U.S.gal/min	



Transmissivity [ft²/min]: 4.57×10^{-2}

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft
Static water level: 24.26 ft below datum	

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
2	0.25	24.56	0.30	
3	0.50	24.60	0.34	
4	0.75	24.66	0.40	
5	1.00	24.69	0.43	
6	1.25	24.74	0.48	
7	1.50	24.79	0.53	
8	1.75	24.82	0.56	
9	2.00	24.83	0.57	
10	2.25	24.84	0.58	
11	2.50	24.86	0.60	
12	2.75	24.88	0.62	
13	3.00	24.89	0.63	
14	3.25	24.90	0.64	
15	3.50	24.91	0.65	
16	3.75	24.92	0.66	
17	4.00	24.93	0.67	
18	4.25	24.93	0.67	
19	4.50	24.94	0.68	
20	4.75	24.95	0.69	
21	5.00	24.96	0.70	
22	5.50	24.98	0.72	
23	6.00	25.00	0.74	
24	6.50	25.02	0.76	
25	7.00	25.05	0.79	
26	7.50	25.08	0.82	
27	8.00	25.11	0.85	
28	8.50	25.13	0.87	
29	9.00	25.16	0.90	
30	9.50	25.18	0.92	
31	10.00	25.20	0.94	
32	11.00	25.23	0.97	
33	12.00	25.25	0.99	
34	13.00	25.30	1.04	
35	14.00	25.33	1.07	
36	15.00	25.35	1.09	
37	16.00	25.37	1.11	
38	17.00	25.39	1.13	
39	18.00	25.41	1.15	
40	19.00	25.43	1.17	
41	20.00	25.45	1.19	
42	21.00	25.46	1.20	
43	22.00	25.47	1.21	
44	23.00	25.47	1.21	
45	24.00	25.48	1.22	
46	25.00	25.49	1.23	
47	26.00	25.50	1.24	
48	27.00	25.51	1.25	

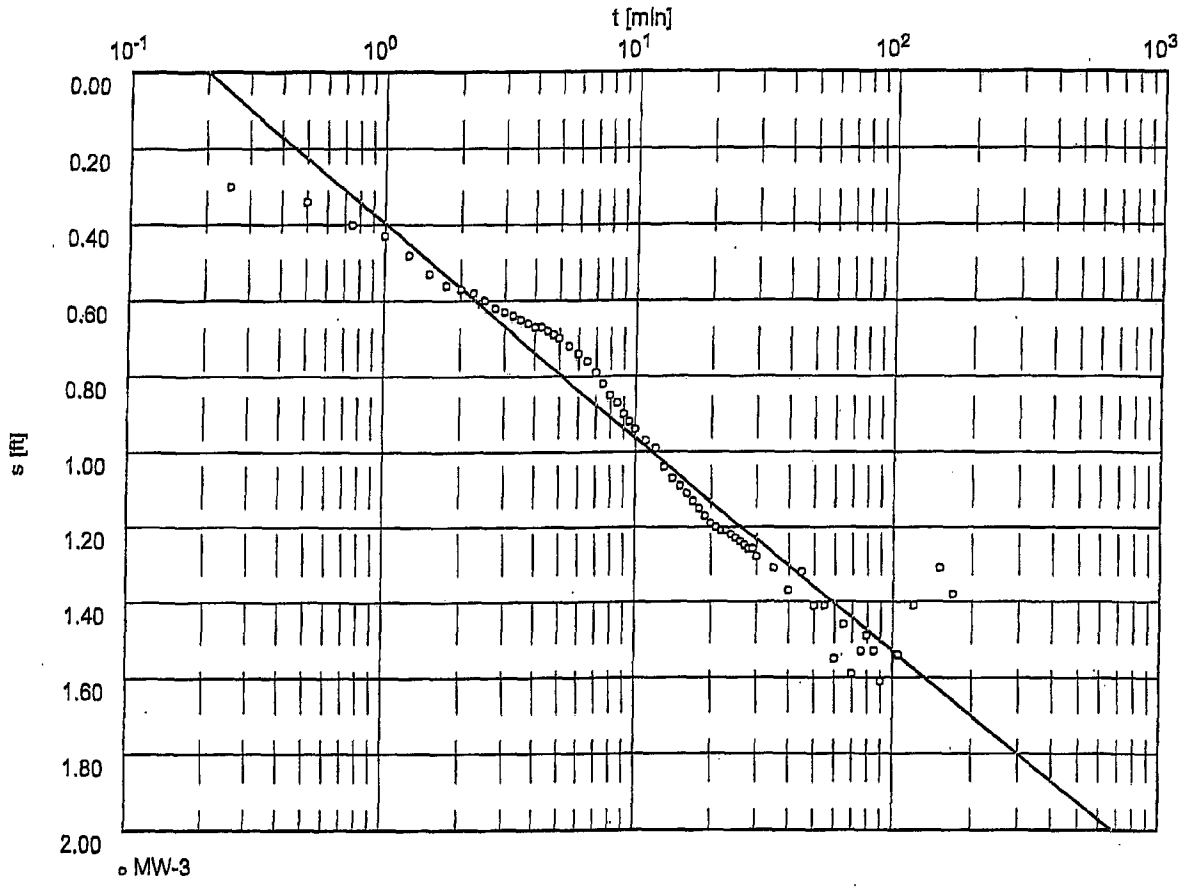
Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Theis analysis method Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
51	30.00	25.54	1.28	
52	35.00	25.57	1.31	
53	40.00	25.63	1.37	
54	45.00	25.58	1.32	
55	50.00	25.67	1.41	
56	55.00	25.67	1.41	
57	60.00	25.81	1.55	
58	65.00	25.72	1.46	
59	70.00	25.85	1.59	
60	76.00	25.79	1.53	
61	80.00	25.75	1.49	
62	85.00	25.79	1.53	
63	90.00	25.87	1.61	
64	105.00	25.80	1.54	
65	120.00	25.67	1.41	
66	150.00	25.57	1.31	
67	169.00	25.64	1.38	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown-method after COOPER & JACOB Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	
Pumping Test No. No. 1		Test conducted on: September 17, 2003	
MW-3			
Discharge 0.43 U.S.gal/min			



Transmissivity [ft²/min]: 1.85×10^{-2}

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown-method after COOPER & JACOB Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

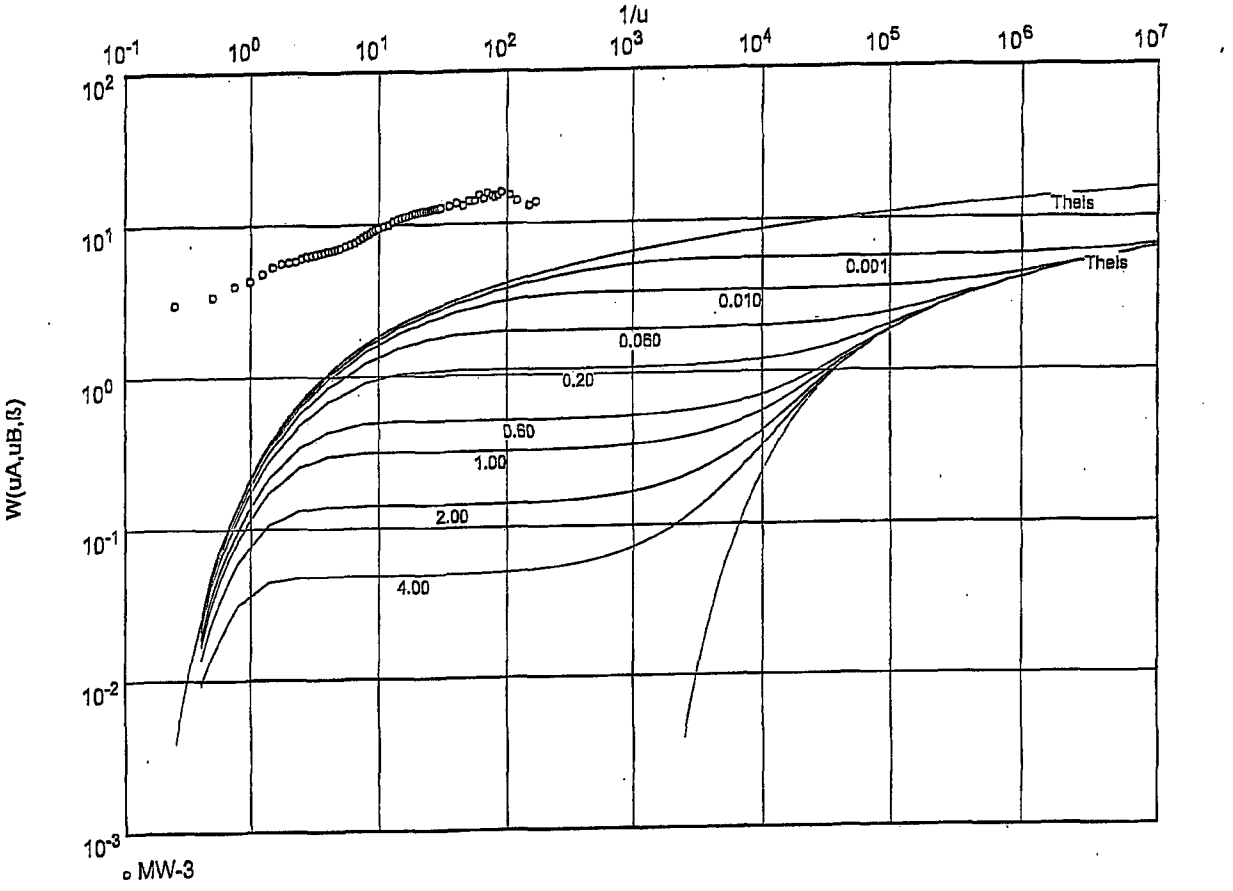
	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
2	0.25	24.56	0.30	
3	0.50	24.60	0.34	
4	0.75	24.66	0.40	
5	1.00	24.69	0.43	
6	1.25	24.74	0.48	
7	1.50	24.79	0.53	
8	1.75	24.82	0.56	
9	2.00	24.83	0.57	
10	2.25	24.84	0.58	
11	2.50	24.86	0.60	
12	2.75	24.88	0.62	
13	3.00	24.89	0.63	
14	3.25	24.90	0.64	
15	3.50	24.91	0.65	
16	3.75	24.92	0.66	
17	4.00	24.93	0.67	
18	4.25	24.93	0.67	
19	4.50	24.94	0.68	
20	4.75	24.95	0.69	
21	5.00	24.96	0.70	
22	5.50	24.98	0.72	
23	6.00	25.00	0.74	
24	6.50	25.02	0.76	
25	7.00	25.05	0.79	
26	7.50	25.08	0.82	
27	8.00	25.11	0.85	
28	8.50	25.13	0.87	
29	9.00	25.16	0.90	
30	9.50	25.18	0.92	
31	10.00	25.20	0.94	
32	11.00	25.23	0.97	
33	12.00	25.25	0.99	
34	13.00	25.30	1.04	
35	14.00	25.33	1.07	
36	15.00	25.35	1.09	
37	16.00	25.37	1.11	
38	17.00	25.39	1.13	
39	18.00	25.41	1.15	
40	19.00	25.43	1.17	
41	20.00	25.45	1.19	
42	21.00	25.46	1.20	
43	22.00	25.47	1.21	
44	23.00	25.47	1.21	
45	24.00	25.48	1.22	
46	25.00	25.49	1.23	
47	26.00	25.50	1.24	
48	27.00	25.51	1.25	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown-method after COOPER & JACOB Confined aquifer	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft
Static water level: 24.26 ft below datum	

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
51	30.00	25.54	1.28	
52	35.00	25.57	1.31	
53	40.00	25.63	1.37	
54	45.00	25.58	1.32	
55	50.00	25.67	1.41	
56	55.00	25.67	1.41	
57	60.00	25.81	1.55	
58	65.00	25.72	1.46	
59	70.00	25.85	1.59	
60	76.00	25.79	1.53	
61	80.00	25.75	1.49	
62	85.00	25.79	1.53	
63	90.00	25.87	1.61	
64	105.00	25.80	1.54	
65	120.00	25.67	1.41	
66	150.00	25.57	1.31	
67	169.00	25.64	1.38	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis NEUMAN's method Unconfined aquifer with delayed watertable response	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	
Pumping Test No. No. 1		Test conducted on: September 17, 2003	
MW-3			
Discharge 0.43 U.S.gal/min			



Transmissivity [ft²/min]: 4.57×10^{-2}

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis NEUMAN's method Unconfined aquifer with delayed watertable response	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
2	0.25	24.56	0.30	
3	0.50	24.60	0.34	
4	0.75	24.66	0.40	
5	1.00	24.69	0.43	
6	1.25	24.74	0.48	
7	1.50	24.79	0.53	
8	1.75	24.82	0.56	
9	2.00	24.83	0.57	
10	2.25	24.84	0.58	
11	2.50	24.86	0.60	
12	2.75	24.88	0.62	
13	3.00	24.89	0.63	
14	3.25	24.90	0.64	
15	3.50	24.91	0.65	
16	3.75	24.92	0.66	
17	4.00	24.93	0.67	
18	4.25	24.93	0.67	
19	4.50	24.94	0.68	
20	4.75	24.95	0.69	
21	5.00	24.96	0.70	
22	5.50	24.98	0.72	
23	6.00	25.00	0.74	
24	6.50	25.02	0.76	
25	7.00	25.05	0.79	
26	7.50	25.08	0.82	
27	8.00	25.11	0.85	
28	8.50	25.13	0.87	
29	9.00	25.16	0.90	
30	9.50	25.18	0.92	
31	10.00	25.20	0.94	
32	11.00	25.23	0.97	
33	12.00	25.25	0.99	
34	13.00	25.30	1.04	
35	14.00	25.33	1.07	
36	15.00	25.35	1.09	
37	16.00	25.37	1.11	
38	17.00	25.39	1.13	
39	18.00	25.41	1.15	
40	19.00	25.43	1.17	
41	20.00	25.45	1.19	
42	21.00	25.46	1.20	
43	22.00	25.47	1.21	
44	23.00	25.47	1.21	
45	24.00	25.48	1.22	
46	25.00	25.49	1.23	
47	26.00	25.50	1.24	
48	27.00	25.51	1.25	

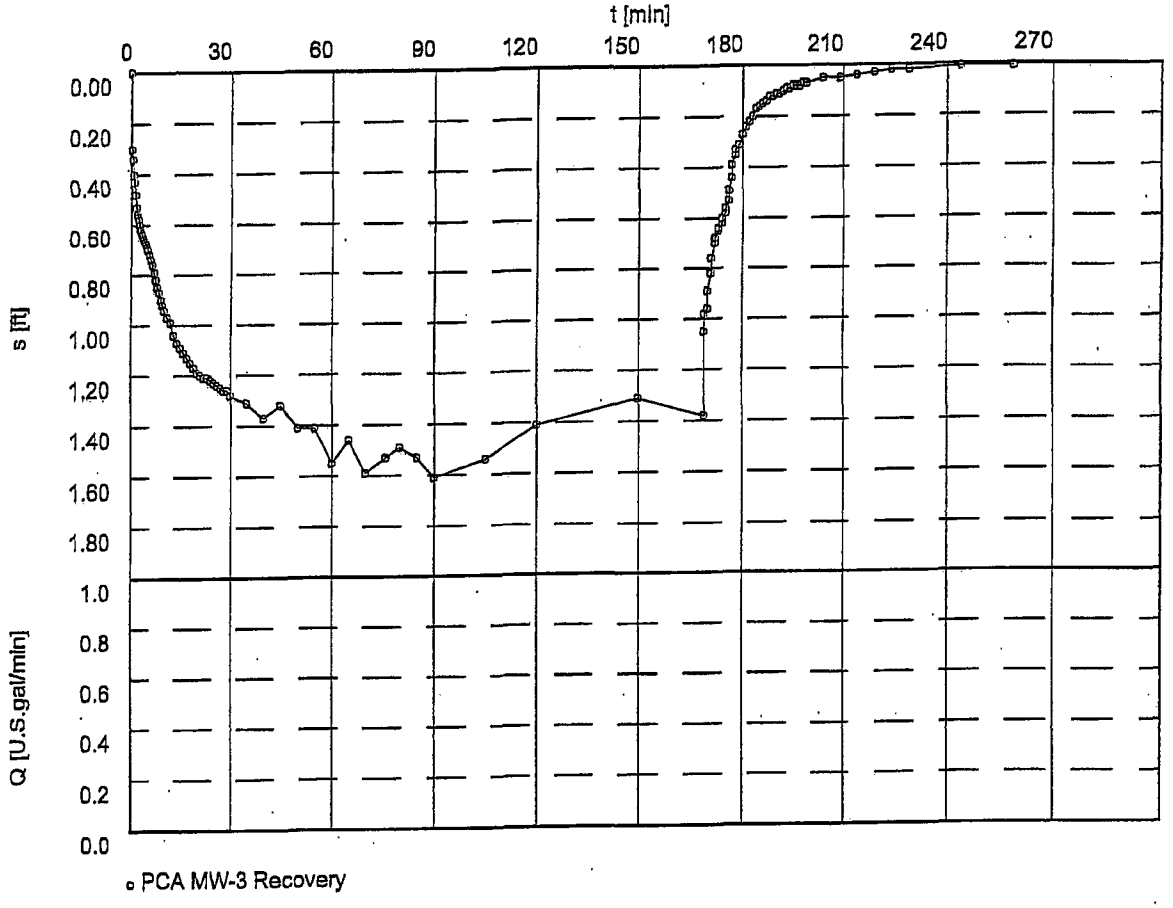
Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis NEUMAN's method Unconfined aquifer with delayed watertable response	Date: 22.10.2003	Comprehensive Report
		Project: PCA Junction	
		Evaluated by: RMS	

Pumping Test No. No. 1	Test conducted on: September 17, 2003
MW-3	MW-3
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
51	30.00	25.54	1.28	
52	35.00	25.57	1.31	
53	40.00	25.63	1.37	
54	45.00	25.58	1.32	
55	50.00	25.67	1.41	
56	55.00	25.67	1.41	
57	60.00	25.81	1.55	
58	65.00	25.72	1.46	
59	70.00	25.85	1.59	
60	76.00	25.79	1.53	
61	80.00	25.75	1.49	
62	85.00	25.79	1.53	
63	90.00	25.87	1.61	
64	105.00	25.80	1.54	
65	120.00	25.67	1.41	
66	150.00	25.57	1.31	
67	169.00	25.64	1.38	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 24.10.2003	Report, Page 1
		Project: PCA	
		Evaluated by: RMS	
Pumping Test No. Recovery 1		Test conducted on: 9/17/03	
MW-3			



Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 24.10.2003	Report, Page 2
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	PCA MW-3 Recovery
	Distance from the pumping well 1.00 ft

Static water level; 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
1	0.00	24.26	0.00	
2	0.25	24.56	0.30	
3	0.50	24.60	0.34	
4	0.75	24.66	0.40	
5	1.00	24.69	0.43	
6	1.25	24.74	0.48	
7	1.50	24.79	0.53	
8	1.75	24.82	0.56	
9	2.00	24.83	0.57	
10	2.25	24.84	0.58	
11	2.50	24.86	0.60	
12	2.75	24.88	0.62	
13	3.00	24.89	0.63	
14	3.25	24.90	0.64	
15	3.50	24.91	0.65	
16	3.75	24.92	0.66	
17	4.00	24.93	0.67	
18	4.25	24.93	0.67	
19	4.50	24.94	0.68	
20	4.75	24.95	0.69	
21	5.00	24.96	0.70	
22	5.50	24.98	0.72	
23	6.00	25.00	0.74	
24	6.50	25.02	0.76	
25	7.00	25.05	0.79	
26	7.50	25.08	0.82	
27	8.00	25.11	0.85	
28	8.50	25.13	0.87	
29	9.00	25.16	0.90	
30	9.50	25.18	0.92	
31	10.00	25.20	0.94	
32	11.00	25.23	0.97	
33	12.00	25.25	0.99	
34	13.00	25.30	1.04	
35	14.00	25.33	1.07	
36	15.00	25.35	1.09	
37	16.00	25.37	1.11	
38	17.00	25.39	1.13	
39	18.00	25.41	1.15	
40	19.00	25.43	1.17	
41	20.00	25.45	1.19	
42	21.00	25.46	1.20	
43	22.00	25.47	1.21	
44	23.00	25.47	1.21	
45	24.00	25.48	1.22	
46	25.00	25.49	1.23	
47	26.00	25.50	1.24	
48	27.00	25.51	1.25	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo, Ontario, Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 24.10.2003	Report, Page 3
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	PCA MW-3 Recovery
	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
51	30.00	25.54	1.28	
52	35.00	25.57	1.31	
53	40.00	25.63	1.37	
54	45.00	25.58	1.32	
55	50.00	25.67	1.41	
56	55.00	25.67	1.41	
57	60.00	25.81	1.55	
58	65.00	25.72	1.46	
59	70.00	25.85	1.59	
60	76.00	25.79	1.53	
61	80.00	25.75	1.49	
62	85.00	25.79	1.53	
63	90.00	25.87	1.61	
64	105.00	25.80	1.54	
65	120.00	25.67	1.41	
66	150.00	25.57	1.31	
67	169.00	25.64	1.38	
68	169.01	25.31	1.05	
69	169.02	25.24	0.98	
70	170.00	25.22	0.96	
71	170.01	25.15	0.89	
72	171.00	25.08	0.82	
73	171.01	25.02	0.76	
74	172.00	24.96	0.70	
75	172.01	24.94	0.68	
76	173.00	24.91	0.65	
77	173.01	24.90	0.64	
78	174.00	24.88	0.62	
79	174.01	24.86	0.60	
80	175.00	24.84	0.58	
81	175.01	24.82	0.56	
82	176.00	24.79	0.53	
83	176.01	24.75	0.49	
84	177.00	24.70	0.44	
85	177.01	24.65	0.39	
86	178.00	24.61	0.35	
87	178.01	24.59	0.33	
88	179.00	24.57	0.31	
89	180.00	24.53	0.27	
90	181.00	24.50	0.24	
91	182.00	24.48	0.22	
92	183.00	24.46	0.20	
93	184.00	24.43	0.17	
94	185.00	24.42	0.16	
95	186.00	24.41	0.15	
96	187.00	24.40	0.14	
97	188.00	24.38	0.12	
98	189.00	24.38	0.12	

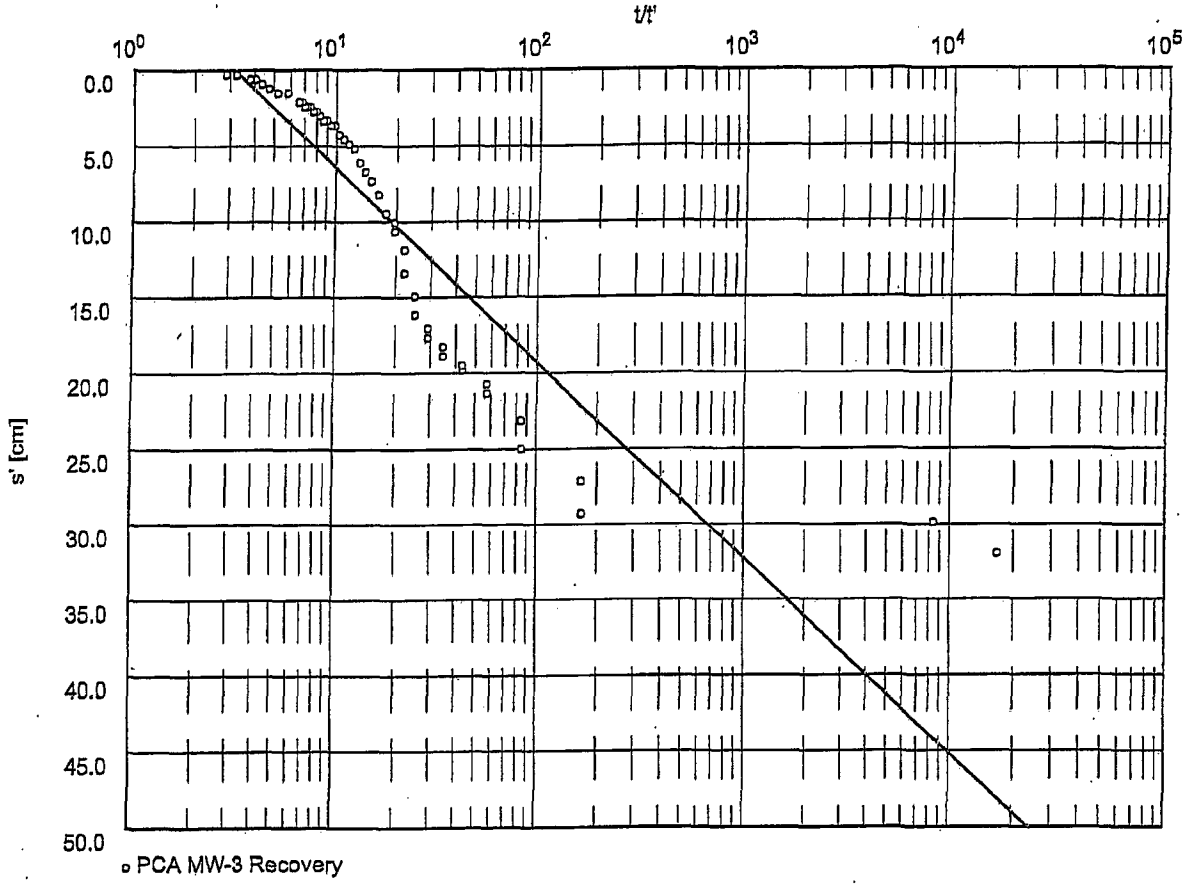
Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Time-Drawdown plot with discharge	Date: 24.10.2003	Report, Page 4
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	PCA MW-3 Recovery
	Distance from the pumping well 1.00 ft

Static water level: 24.26 ft below datum

	Pumping test duration [min]	Water level [ft]	Drawdown [ft]	
101	192.00	24.36	0.10	
102	193.00	24.35	0.09	
103	194.00	24.35	0.09	
104	195.00	24.34	0.08	
105	196.00	24.34	0.08	
106	197.00	24.34	0.08	
107	198.00	24.33	0.07	
108	199.00	24.33	0.07	
109	204.00	24.31	0.05	
110	209.00	24.31	0.05	
111	214.00	24.30	0.04	
112	219.00	24.29	0.03	
113	224.00	24.28	0.02	
114	229.00	24.28	0.02	
115	244.00	24.27	0.01	
116	259.00	24.27	0.01	

Waterloo Hydrogeologic *180 Columbia St. W.* Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Date: 24.10.2003	Report, Page 1
		Project: PCA	
		Evaluated by: RMS	
Pumping Test No. Recovery 1		Test conducted on: 9/17/03	
MW-3			
Discharge 0.43 U.S.gal/min			
		Pumping test duration: 10140 s	



▫ PCA MW-3 Recovery

Transmissivity [cm²/s]: 3.84×10^{-1}

Hydraulic conductivity [cm/s]: 1.26×10^{-3}

Aquifer thickness [cm]: 304.8

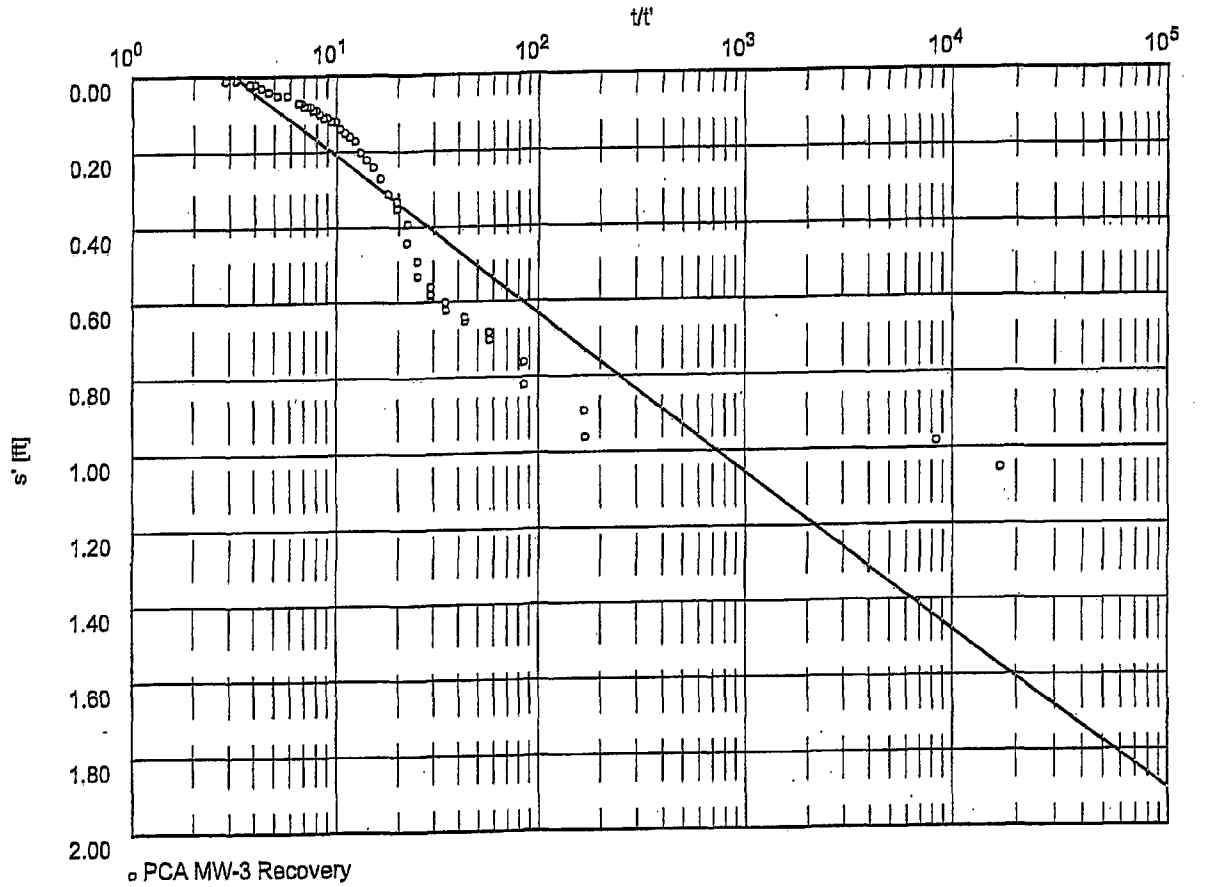
Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Date: 24.10.2003	Report, Page 2
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	PCA MW-3 Recovery
Discharge 0.43 U.S.gal/min	Distance from the pumping well 30.5 cm
Static water level: 739.4 cm below datum	Pumping test duration: 10140 s

	Time from end of pumping [s]	Water level [cm]	Residual drawdown [cm]	
1	1	771.4	32.0	
2	1	769.3	29.9	
3	60	768.7	29.3	
4	61	766.6	27.1	
5	120	764.4	25.0	
6	121	762.6	23.2	
7	180	760.8	21.3	
8	181	760.2	20.7	
9	240	759.3	19.8	
10	241	759.0	19.5	
11	300	758.3	18.9	
12	301	757.7	18.3	
13	360	757.1	17.7	
14	361	756.5	17.1	
15	420	755.6	16.2	
16	421	754.4	14.9	
17	480	752.9	13.4	
18	481	751.3	11.9	
19	540	750.1	10.7	
20	541	749.5	10.1	
21	600	748.9	9.4	
22	660	747.7	8.2	
23	720	746.8	7.3	
24	780	746.2	6.7	
25	840	745.5	6.1	
26	900	744.6	5.2	
27	960	744.3	4.9	
28	1020	744.0	4.6	
29	1080	743.7	4.3	
30	1140	743.1	3.7	
31	1200	743.1	3.7	
32	1260	742.8	3.4	
33	1320	742.8	3.4	
34	1380	742.5	3.0	
35	1440	742.2	2.7	
36	1500	742.2	2.7	
37	1560	741.9	2.4	
38	1620	741.9	2.4	
39	1680	741.9	2.4	
40	1740	741.6	2.1	
41	1800	741.6	2.1	
42	2100	741.0	1.5	
43	2400	741.0	1.5	
44	2700	740.7	1.2	
45	3000	740.4	0.9	
46	3300	740.1	0.6	
47	3600	740.1	0.6	
48	4500	739.7	0.3	

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada ph.(519)746-1798	*Pumping test analysis* Recovery method after THEIS & JACOB Confined aquifer	Date: 24.10.2003	Report, Page 1
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	
Discharge 0.43 U.S.gal/min	
	Pumping test duration: 169.00 min



▫ PCA MW-3 Recovery

Transmissivity [ft²/min]: 2.48×10^{-2}

Hydraulic conductivity [ft/min]: 2.48×10^{-3}

Aquifer thickness [ft]: 10.00

Waterloo Hydrogeologic *180 Columbia St. W.* Waterloo,Ontario,Canada ph.(519)746-1798	Pumping test analysis *Recovery method after* THEIS & JACOB Confined aquifer	Date: 24.10.2003	Report, Page 2
		Project: PCA	
		Evaluated by: RMS	

Pumping Test No. Recovery 1	Test conducted on: 9/17/03
MW-3	PCA MW-3 Recovery
Discharge 0.43 U.S.gal/min	Distance from the pumping well 1.00 ft
Static water level: 24.26 ft below datum	Pumping test duration: 169.00 min

	Time from end of pumping [min]	Water level [ft]	Residual drawdown [ft]
1	0.01	25.31	1.05
2	0.02	25.24	0.98
3	1.00	25.22	0.96
4	1.01	25.15	0.89
5	2.00	25.08	0.82
6	2.01	25.02	0.76
7	3.00	24.96	0.70
8	3.01	24.94	0.68
9	4.00	24.91	0.65
10	4.01	24.90	0.64
11	5.00	24.88	0.62
12	5.01	24.86	0.60
13	6.00	24.84	0.58
14	6.01	24.82	0.56
15	7.00	24.79	0.53
16	7.01	24.75	0.49
17	8.00	24.70	0.44
18	8.01	24.65	0.39
19	9.00	24.61	0.35
20	9.01	24.59	0.33
21	10.00	24.57	0.31
22	11.00	24.53	0.27
23	12.00	24.50	0.24
24	13.00	24.48	0.22
25	14.00	24.46	0.20
26	15.00	24.43	0.17
27	16.00	24.42	0.16
28	17.00	24.41	0.15
29	18.00	24.40	0.14
30	19.00	24.38	0.12
31	20.00	24.38	0.12
32	21.00	24.37	0.11
33	22.00	24.37	0.11
34	23.00	24.36	0.10
35	24.00	24.35	0.09
36	25.00	24.35	0.09
37	26.00	24.34	0.08
38	27.00	24.34	0.08
39	28.00	24.34	0.08
40	29.00	24.33	0.07
41	30.00	24.33	0.07
42	35.00	24.31	0.05
43	40.00	24.31	0.05
44	45.00	24.30	0.04
45	50.00	24.29	0.03
46	55.00	24.28	0.02
47	60.00	24.28	0.02
48	75.00	24.27	0.01

10-27-03 PCA JCt.

$$\frac{cm}{sec} \rightarrow \frac{ft}{min}$$

cm → ft $\quad 1\,cm \times \frac{1\,in}{2.54\,cm} \times \frac{1\,ft}{12\,in} = \frac{1}{2.54 \times 12} = 0.0328\ ft$

sec → min $\quad 1\,sec \times \frac{1\,min}{60\,sec} = 0.0166\ min$

$$= \frac{0.0328}{0.0166} = 1.97\ \frac{ft}{min}$$

$$\frac{ft}{min} \times \frac{60\,min}{1\,hr} \times \frac{24\,hr}{1\,day} = 1440\ \frac{ft}{day}$$

$$\frac{ft}{day} \times \frac{365\,day}{yr} = 365\ \frac{ft}{yr}$$

$1.97 \times 1440 \times 365 = 1035432$

$\times \quad 4.18 \times 10^{-6} = 4.32\ ft/yr$

10-27-03 RMS PCA JCJ

$\frac{cm}{sec} \rightarrow \frac{ft}{sec}$

$cm \rightarrow ft$

$1\,cm = \frac{1\,in}{2.54\,cm} \times \frac{1\,ft}{12\,in} = \frac{1}{30.48} = 0.0328$

$\frac{ft}{sec} \rightarrow \frac{ft}{min}$

$0.0328\,\frac{ft}{sec} \times \frac{60\,sec}{1\,min} = 60 \times 0.0328 = 1.97$

$\frac{cm}{sec} \rightarrow \frac{ft}{min}$

$\frac{cm}{sec} \times \frac{60\,sec}{1\,min} \times \frac{1\,in}{2.54\,cm} \times \frac{1\,ft}{12\,in} = \frac{60}{2.54 \times 12}\,\frac{ft}{min}$

$\frac{cm}{sec} \rightarrow \frac{ft}{yr}$

$\frac{cm}{sec} \times \frac{1\,in}{2.54\,cm} \times \frac{1\,ft}{12\,in} \times \frac{60\,sec}{1\,min} \times \frac{60\,min}{1\,hr} \times \frac{24\,hr}{1\,day} \times \frac{365\,day}{1\,yr}$

$= \frac{60 \times 60 \times 24 \times 365}{2.54 \times 12} = \frac{31536000}{30.48}$

$= 1,034,645$

APPENDIX C

Remediation and Volume Calculations

Effective Hydraulic Conductivity of Free Product

1. $$Q_o = \frac{2\pi\,(1-\rho_{ro})\,\rho_{ro} b_o^{\,2} K_w k_{ro}}{\mu_{ro}\,\ln(r_i/r_w)}$$

From API Publication 4715
Append. B (Skimmer Well)

Q_o = Volumetric flow rate of oil phase (LNAPL)
ρ_{ro} = Relative density of LNAPL
μ_{ro} = Relative viscosity of LNAPL
b_o = Thickness of LNAPL
k_{ro} = Average relative permeability of LNAPL (wrt K_w)
K_w = Water-saturated hydraulic conductivity of soil
r_i = Radius of influence of well
r_w = Radius of well

substitute $K_e = K_w\, k_{ro} \frac{\rho_{ro}}{\mu_{ro}}$

K_e = Effecitve hydraulic conductivity of soil with respect to LNAPL

Rearrange:

2. $$K_e = \frac{Q_o\,[\ln(r_i/r_w)]}{2\pi\,(1-\rho_{ro})\,b_o^{\,2}}$$

MAXIM
TECHNOLOGIES INC

JOB NO. 1690021 JOB TITLE PCA JUNCTION DATE 6/13/03 BY JMcBEE

SUBJECT Effective Hydraulic Conductivity CHECKED _____ SHEET 2 OF 2

$$K_e = \frac{Q_o[\ln(r_i/r_w)]}{2\pi(1-P_{ro})b_o^2}$$ where $r_i = 30$ ft, $r_w = 0.08$ ft, $P_{ro} = 0.73$

DECEMBER, 2002

$Q_o = 4.32$ gal/day

$b_o = 2$ ft

$$K_e = \frac{(4.32 \text{ gal/day})[\ln(30 \text{ ft}/0.08 \text{ ft})]}{2\pi(1-0.73)(2 \text{ ft})^2}$$

$K_e = 3.88$ gal/day/ft^2 conversion 1 gpd/ft^2 = 4.72×10^{-5} cm/s

$K_e = 1.8 \times 10^{-4}$ cm/sec

say $K_e = 2 \times 10^{-4}$ cm/s

MAY, 2003

$Q_o = 0.73$ gal/day ; $b_o = 1.5$ ft

$$K_e = \frac{(0.73 \text{ gal/day})[\ln(30 \text{ ft}/0.08 \text{ ft})]}{2\pi(1-0.73)(1.5 \text{ ft})^2}$$

$K_e = 1.16$ gal/day/ft^2

$= 5.5 \times 10^{-5}$ cm/sec

say $K_e = 6 \times 10^{-5}$ cm/s

MAXIM TECHNOLOGIES INC

JOB NO. 1690021 JOB TITLE PCA JUNCTION DATE 6/13/03 BY J McGEE

SUBJECT LNAPL VOLUMES CHECKED _____ SHEET 1 OF 1

EST. VOLUME OF LNAPL

Areal extent of plume estimated to extend half-way from MW-1 to adjacent monitoring wells (Fig. 2). with dimensions of 165 ft x 125 ft.

Assume area of circle w/ dimensions of 145' with an average thickness of 1 foot (2 ft to 0) and porosity of 0.25.

Vol of Liquid = $\pi(72.5\text{ft})^2 \times (1\text{ ft}) \times .25 \times 7.48\text{ gal/ft}^3 = 30,879$ gal

Assume 31,000 gallons (Liquid = BOTH LNAPL + WATER)

From API Publication 4715, Sep 2002 (Fig. 3-11): The relative saturation for a 0.8m (2.6ft) measured thickness of LNAPL is from 0 to 15% (LNAPL saturation relative to water above LNAPL/Water interface)

Assume average saturation of 7.5%

Vol. of LNAPL = 31,000 gal x 0.075 = 2325 gallons

From Huntley + Beckett, Journal of Contam. Hydrology 59 (2002) page 18, results of modeling smear removal of total LNAPL in a silty sand is 13%.

Possible Recoverable LNAPL = 2325 gal x 0.13 = 307 gal.

Say 300 gal

PCA JUNCTION MW -1

DATE	12/9/02	12/10/02	12/10/02	12/12/02	12/12/02	12/16/02	12/16/02	12/20/02	12/20/02	12/30/02
TIME	19:00	10:00	13:10*	13:10	16:09*	8:20	9:12	8:39	9:12	8:40
Depth to Product	24.51	24.90	24.76	24.87	24.82	24.74	24.90	24.89	24.97	24.51
Depth to Water	26.45	25.03	25.49	24.88 ?	25.38	25.81	25.31	25.42	25.21	26.11
Thickness of Product	1.94'	0.13	0.73	0.01 ?	0.56	1.07	0.41	0.53	0.24	1.60'
Time between pump cycles	NA	0:02	3:10	1:40	1:09	3:10	0:02	3:29	0:02	10 days
Pump cyle/duration	NA	2 hr/30min	NA	2 hr/10min	NA	4 hr/10min	NA	4 hr/10min	NA	PUMP OFF
Nitrogen Pressure	1350		1950 - start of new tank	700	New Tank	725	New Tank			
Ht. of Product in Drum	1"	6.5"	NA	9.7"	NA	18"	Measured Volume	23"	NA	NA
Volume pumped	NA	9.2 gal	NA	5.3 gal	NA	13.9 gal	0.5 gal	8.3	NA	NA
Total Pumping	NA	4:00	4:00	8:00		12:00	12:10	16:00	16:10	16:10
Pumping Rate		4.9 oz/min		2.8 oz/min		7.4 oz/min		4.4 oz/min		NA
Total Volume Pumped	1.7	10.9	NA	16.2	NA	30.1	NA	38.4	NA	NA

NOTES:

1" = 1.67 Gal
* Recovery measurements
? Questionable measurement
** Manifold connecting two tanks
1 Put product in first drum. Measured during one pumping cycle.
2 Second drum
^^ Power outage night of 4/15/2003 (wind storm)
3 Third drum
4 Fourth drum
^ When going to the 8 hr cycle; time was set to 11:00 AM.
** Pump shut down 2/19/03 due to malfunction. Pump restarted 2/28/03.
Condensate thickness measured on 2/27/03 (0840) was 1.56'.
*** May be overestimate of volume due to recent rains. Barrel #5 had 10" of water in it.
5 Fifth drum: barrel started out with 10" of water due to recent rains

PCA JUNCTION MW -1

DATE	12/30/02	1/3/03	1/3/03	1/7/03	1/7/03	1/10/03	1/10/03	1/15/03	1/15/03	1/23/03
TIME	9:12	8:40	9:14	8:40	9:13	8:40	9:12	8:40	9:13	8:40
Depth to Product	24.66	24.80	24.98	24.81	24.92	24.87	24.96	24.74	24.81	24.91
Depth to Water	25.72	25.58	25.22	25.69	25.39	25.32	25.12	25.47	25.28	25.32
Thickness of Product	1.06'	0.78'	0.24'	0.88'	0.47'	0.45'	0.16'	0.73'	0.47'	0.41'
Time between pump cycles	0:02	3:40	0:04	3:40	0:03	3:40	0:02	3:40	0:03	3:40
Pump cyle/duration	10 min	4 hr/10min	NA	4 hr/10min	NA	4 hr/10min	NA	4 hr/10min	NA	4 hr/10min
Nitrogen Pressure	2100 psi [2] tanks**	1500**	1500**	950	950	600	600	1400	1400	200
Ht. of Product in Drum	23.5"	8" [2]		13.75" [2]		17.5" [2]		23" [2]		10" [3]
Volume pumped	~ 0.8 gal	13.4	0.53 gal [1]	9.6	0.36 gal [1]	6.3	0.26 gal [1]	9.2	0.31 gal [1]	16.7
Total Pumping	16:20	20:10	20:20	24:10	24:20	27:10	27:20	32:10	32:20	40:10
Pumping Rate	~ 10.2 oz/m	7.4 oz/min	~ 6.8 oz/m	5.3 oz/min	~ 4.6 oz/m	4.5 oz/m	~ 3.4 oz/m	4.05 oz/m	~ 3.6 oz/m	4.5 oz/m
Total Volume Pumped	39.2	52.6	53.1	62.7	63.1	69.4	69.6	78.8	79.1	95.8

NOTES:

1" = 1.67 Gal

* Recovery measurements

? Questionable measurement

** Manifold connecting two tanks

1 Put product in first drum. Measured during one pumping cycle.

2 Second drum

^^ Power outage night of 4/15/2003 (wind storm)

3 Third drum

4 Fourth drum

^ When going to the 8 hr cycle; time was set to 11:00 AM.

** Pump shut down 2/19/03 due to malfunction. Pump restarted 2/28/03.
Condensate thickness measured on 2/27/03 (0840) was 1.56'.

*** May be overestimate of volume due to recent rains. Barrel #5 had 10" of water in it.

5 Fifth drum: barrel started out with 10" of water due to recent rains

PCA JUNCTION MW -1

DATE	1/23/03	1/29/03	1/29/03	2/10/03	2/10/03	2/17/03	2/17/03	2/28/03	2/28/03	3/12/03
TIME	9:12	8:40	9:12	8:40	9:12	8:40	9:12	11:08	11:27	12:20
Depth to Product	24.97	24.86	24.92	24.62	24.71	24.57	24.65	24.47	24.58	24.48
Depth to Water	25.20	25.28	25.13	25.89	25.68	25.89	25.70	25.98	25.71	25.86
Thickness of Product	0.23'	0.42'	0.21'	1.27'	0.97'	1.32'	1.05'	1.51' [5]	1.13'	1.38'
Time between pump cycles	0:02	3:40	0:02	5:40 ^	0:02	5:40	0:02	8+ days[5]	0:02	5:40
Pump cyle/duration	NA	4 hr/10min	NA	8 hr/10min	NA	8 hr/10min	NA	8 hr/10min	8 hr/10min	8 hr/10min
Nitrogen Pressure	1400	2000	2000	1000	1000	600	1000	700	2100	1200
Ht. of Product in Drum		15.5" [3]		6.6" [4]		18.75" [3]		19.5" [3]	19.5" [3]	18.75" [3]
Volume pumped	0.25 gal [1]	9.2	0.25 gal [1]	11.1	0.26 gal [1]	5.4	0.25 gal [1]	~1.25	0.26 gal [1]	10.7
Total Pumping	40:20	46:10	46:20	52:20	52:30	55:50	56:00	57:11**	57:21	63:21
Pumping Rate	~ 3.2 oz/m	3.4 oz/m	~ 3.2 oz/m	3.9 oz/m	~ 3.4 oz/m	3.3 oz/m	~ 3.2 oz/m	Not calc'd	~ 3.4 oz/m	3.8 oz/m
Total Volume Pumped	96.1	105.3	105.5	116.6	116.8	122.2	122.5	123.8	124.0	134.7

NOTES:
1" = 1.67 Gal
* Recovery measurements
? Questionable measurement
** Manifold connecting two tanks
1 Put product in first drum. Measured during one pumping cycle.
2 Second drum
^^ Power outage night of 4/15/2003 (wind storm)
3 Third drum
4 Fourth drum
^ When going to the 8 hr cycle; time was set to 11:00 AM.
** Pump shut down 2/19/03 due to malfunction. Pump restarted 2/28/03.
Condensate thickness measured on 2/27/03 (0840) was 1.56'.
*** May be overestimate of volume due to recent rains. Barrel #5 had 10" of water in it.
5 Fifth drum: barrel started out with 10" of water due to recent rains

PCA JUNCTION MW -1

DATE	3/12/03	3/20/03	3/20/03	3/27/03	3/27/03	4/8/03	4/8/03	4/16/03	4/23/03	4/23/03
TIME	1:02	8:19	9:02	8:31	9:03	8:31	9:03	8:31	15:53	16:22
Depth to Product	24.64	24.82	24.87	24.51	24.62	24.69	24.77	24.53	24.53	24.65
Depth to Water	25.48	25.12	25.01	25.61	25.36	25.92	25.71	25.92	25.68	25.41
Thickness of Product	0.84'	0.30'	0.14'	1.10'	0.74'	1.23'	0.94'	1.39'	1.15'	0.76'
Time between pump cycles	0:02	3:40	0:02	7:30	0:03	7:30	0:03	15:30	~7:00	0:02
Pump cyle/duration	NA	8 hr/20min	NA	8 hr/10min	NA	8 hr/10min	NA	8 hr/10min	8 hr/10min	NA
Nitrogen Pressure	1000	200	2100		1700		900	400/2200	1600	
Ht. of Product in Drum	13.0" [4]	21.5" [4]	10.0" [5]	12.5" [5]	12.5" [5]	18.0" [5]	18.0" [5]	21.75" [5]	4.0" [6]	4.0" [6]
Volume pumped	0.53gal [1]	14.2***	0.15gal [1]	4.2	0.33gal [1]	9.2	0.25gal [1]	6.25	6.7	0.45gal
Total Pumping	63:41	71:21	71:41	74:21	74:31	81:21	81:31	84:51^^	88:31	88:51
Pumping Rate	~ 3.4 oz/m	3.95 oz/m	1.0 oz/m	3.35 oz/m	4.2 oz/m	2.9 oz/m	3.2 oz/m	4.0 oz/m	3.9 oz/m	2.8 oz/m
Total Volume Pumped	135.2	149.4	149.5	153.7	154.0	162.2	162.5	168.7	175.4	175.9

NOTES:

1" = 1.67 Gal
* Recovery measurements
? Questionable measurement
** Manifold connecting two tanks
1 Put product in first drum. Measured during one pumping cycle.
2 Second drum
^^ Power outage night of 4/15/2003 (wind storm)
3 Third drum
4 Fourth drum
^ When going to the 8 hr cycle; time was set to 11:00 AM.
** Pump shut down 2/19/03 due to malfunction. Pump restarted 2/28/03.
Condensate thickness measured on 2/27/03 (0840) was 1.56'.
*** May be overestimate of volume due to recent rains. Barrel #5 had 10" of water in it.
5 Fifth drum: barrel started out with 10" of water due to recent rains

PCA JUNCTION MW -1

DATE	4/30/03	4/30/03	5/13/03	5/13/03	5/19/03	5/19/03
TIME	8:31	9:02	9:57	10:12	8:15	8:27
Depth to Product	24.71	24.80	24.63	24.72	24.77	24.87
Depth to Water	25.36	25.18	26.06	25.83	25.97	25.72
Thickness of Product	0.65'	0.38'	1.43'	1.11'	1.20'	0.85'
Time between pump cycles	~7:00	0:02	7:50	0:02	7:50	0:02
Pump cyle/duration	8 hr/20min	NA	8 hr/10min	NA	8 hr/10min	NA
Nitrogen Pressure	800		2400		2400	
Ht. of Product in Drum	9.75" [6]	9.75" [6]	15.25" [6]	15.25" [6]	18.0" [6]	18.0" [6]
Volume pumped	9.6	0.34gal	9.2	0.26gal	4.6	0.31gal
Total Pumping	95:21	95:31	101:10	101:20	104:10	104:20
Pumping Rate	3.15 oz/m	4.4 oz/m	3.45 oz/m	3.4 oz/m	3.45 oz/m	4.0 oz/m
Total Volume Pumped	185.5	185.8	195.0	195.3	199.9	200.2

NOTES:

1" = 1.67 Gal
* Recovery measurements
? Questionable measurement
** Manifold connecting two tanks
1 Put product in first drum. Measured during one pumping cycle.
2 Second drum
^^ Power outage night of 4/15/2003 (wind storm)
3 Third drum
4 Fourth drum
^ When going to the 8 hr cycle; time was set to 11:00 AM.
** Pump shut down 2/19/03 due to malfunction. Pump restarted 2/28/03.
Condensate thickness measured on 2/27/03 (0840) was 1.56'.
*** May be overestimate of volume due to recent rains. Barrel #5 had 10" of water in it.
5 Fifth drum: barrel started out with 10" of water due to recent rains

Condensate Volume Estimate
ConocoPhillips PCA Junction
August 25, 2003

Areal extent of plume:

= 16,777 ft^2

Note: Product measurement in only on well (MW-1), assume ½ distance to other wells

Measured thickness in MW-1 = 1.75 ft

Assume ½ thickness over entire plume

16,777 ft^2 x (1.75 ft x 0.5) = 14,680 ft^3

Assume porosity = 0.35

Volume of saturated thickenss = 14,680 ft3 x 0.35 = 5140 ft3

Maximum oil saturation with RT water = 0.15 (silty sand at 0.8 m) (API, 2003)

Est. 0.075 average saturation for thickness

5140 ft3 x 0.075 x 7.48 gal/ft3 = 2,880 gallons (total volume)

Recoverable volume estimated based on Huntley and Beckett (2002) for silty sand with less than 1 m thickness = 10%

2,880 x 0.1 = 288 gallons ≈ 300 gallons

APPENDIX D

Groundwater Sampling Field Forms

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. 169021-110 Page 6 of 6

Site Location PCA Junction Carlsbad, NM

Site/Well No. MW-1 Coded/ Replicate No. — Date 9-16-03

Weather hot Time Sampling Began — Time Sampling Completed —

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface _____ MP Elevation _____

Total Sounded Depth of Well Below MP _____ Water-Level Elevation _____

Held _____ Depth to ~~Water Below MP~~ 27.15 Diameter of Casing 2"

* DTP 25.53

Wet _____ Water Column in Well _____ Gallons Pumped/Bailed Prior to Sampling —

Gallons per Foot _____

Gallons in Well _____ Sampling Pump Intake Setting (feet below land surface) —

Purging Equipment —

SAMPLING DATA/FIELD PARAMETERS

Time	Temperature	pH	Conductivity	Turbidity	Other

Sampling Equipment —

Constituents Sampled	Container Description	Preservative

Remarks MW-1 Not Sampled due to presence of free product

Sampling Personnel ICH, PL

Well Casing Volumes				
1" = 0.041	1 1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. 169002I-110 Page 2 of 6

Site Location PCA Junction Carlsbad, NM

Site/Well No. MW-2 Coded/ Replicate No. — Date 9-16-03

Weather hot Time Sampling Began 1120 Time Sampling Completed 1125

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface _____ MP Elevation _____

* Total Sounded Depth of Well Below MP 28' Water-Level Elevation _____

Held _____ Depth to Water Below MP 24.75 Diameter of Casing 2"

Wet _____ Water Column in Well 3.25 Gallons Pumped/Bailed Prior to Sampling 3.5

Gallons per Foot .16

Gallons in Well 0.52 x 3 Sampling Pump Intake Setting (feet below land surface) 27'

Purging Equipment purge pump (4D factor) 1.5L

SAMPLING DATA/FIELD PARAMETERS TDS (ppt)

Time	Temperature	pH	Conductivity	Turbidity	Other
1112	23.0	7.20	4.39		2.19
1115	22.1	7.19	4.29		2.14
1118	21.5	7.20	4.28		2.14

Sampling Equipment disposable polyethylene bailer

Constituents Sampled	Container Description	Preservative

Remarks water is light orange & slightly silty

Sampling Personnel KH, FL

Well Casing Volumes

Gal./ft. 1 ¼" = 0.077 2" = 0.16 3" = 0.37 4" = 0.65

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. 169002L-LO Page 1 of 5

Site Location PCA Junction Carlsbad, NM

Site/Well No. MW-3 Coded/ Replicate No. — Date 9-16-03

Weather hot Time Sampling Began 1000 Time Sampling Completed 1005

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface _____ MP Elevation _____

* Total Sounded Depth of Well Below MP 28' Water-Level Elevation _____

Held _____ Depth to Water Below MP 24.27 Diameter of Casing 2"

Wet _____ Water Column in Well 3.73 Gallons Pumped/Bailed Prior to Sampling ~3.5 gallons

Gallons per Foot 0.16

Gallons in Well 0.59 x 3 = 1.79 Sampling Pump Intake Setting (feet below land surface) ~27'

Purging Equipment purge pump (40 footer) mS

SAMPLING DATA/FIELD PARAMETERS

TDS (ppt)

Time	Temperature	pH	Conductivity	Turbidity	Other
953	21.9	6.64	3.36		1.66
955	26.4	6.71	3.31		1.65
957	26.2	6.72	3.31		1.64

Sampling Equipment bailer (disposable)

Constituents Sampled	Container Description	Preservative

Remarks water is orangish colored & slightly silty

Sampling Personnel KH, FL

Well Casing Volumes

Gal./ft.	1 ¼" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
				6" = 1.46

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. 169002I-110 Page 5 of 6

Site Location PCA Junction

Site/Well No. MW-4 Coded/ Replicate No. — Date 9-16-03

Weather Hot Time Sampling Began 1615 Time Sampling Completed 1620

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface _____ *MP Elevation* _____

Total Sounded Depth of Well Below MP 36 Water-Level Elevation _____

Heid _____ Depth to Water Below MP 27.81 Diameter of Casing 4

Wel _____ Water Column in Well 8.19 Gallons Pumped/Bailed Prior to Sampling 20

Gallons per Foot 0.65

Gallons in Well 5.32 Sampling Pump Intake Setting (feet below land surface) _____

Purging Equipment bailers (disposable) X3 = 15.9

SAMPLING DATA/FIELD PARAMETERS

MS TDS

Time	Temperature	pH	Conductivity	Turbidity	Other
1600	24.5	7.12	3.02		1.51
1603	22.5	7.10	3.12		1.52
1608	21.9	7.11	3.14		1.54

Sampling Equipment disposable bailer

Constituents Sampled	Container Description	Preservative

Remarks _____

Sampling Personnel _____

Well Casing Volumes

Gal./ft.	1 ¼" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
			3" ¼ = 0.50	6" = 1.46

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. PCA Junction Carlsbad, NM Page 3 of 6

Site Location 169621-110

Site/Well No. MW-5 Coded/ Replicate No. — Date 9-16-03

Weather Hot Time Sampling Began 1400 Time Sampling Completed 1405

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface ____ MP Elevation ____

Total Sounded Depth of Well Below MP 37.6 Water-Level Elevation ____

Held ____ Depth to Water Below MP 29.91 Diameter of Casing 4"

Wet ____ Water Column in Well 7.69 Gallons Pumped/Bailed Prior to Sampling 15

Gallons per Foot .65

Gallons in Well 5 x3 = 15 Sampling Pump Intake Setting (feet below land surface) 35' to about 32'

Purging Equipment 40' & 80' purge pumps would not work. Battery booster quit working & then 12v car battery (extra one) quit too when hooked up to the 80' pump. Used 3 bailers hooked together to purge.

SAMPLING DATA/FIELD PARAMETERS TDS

Time	Temperature	pH	Conductivity	Turbidity	Other
1310	25.1	7.26	6.95		3.36
1345	24.3	7.25	6.65		3.32
1353	23.1	7.24	6.66		3.32

Sampling Equipment bailer (disposable)

Constituents Sampled	Container Description	Preservative

Remarks ____

Sampling Personnel KH, FL

Well Casing Volumes

Gal./ft.	1 ¼" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65

MAXIM TECHNOLOGIES INC

WATER SAMPLING FIELD FORM

Project No. 169021-116 Page 4 of 5

Site Location PCA Junction Carlsbad, NM

Site/Well No. MW-6 Coded/Replicate No. * duplicate Date 9-16-03

Weather Hot Time Sampling Began 1515 Time Sampling Completed 1520

EVACUATION DATA

Description of Measuring Point (MP) TOC

Height of MP Above/Below Land Surface _____ MP Elevation _____

Total Sounded Depth of Well Below MP 36.7 Water-Level Elevation _____

Heid _____ Depth to Water Below MP 28.19 Diameter of Casing 4"

Wet _____ Water Column in Well 8.51 Gallons Pumped/Bailed Prior to Sampling 16.5

Gallons per Foot 0.65

Gallons in Well 5.53 x 3 Sampling Pump Intake Setting (feet below land surface) 32'

Purging Equipment purge pumps would = 16.5 not work. used 3 bailers tied together

SAMPLING DATA/FIELD PARAMETERS

ms ppt TDS

Time	Temperature	pH	Conductivity	Turbidity	Other
1505	25.5	7.09			1.27
1507	23.6	7.24			1.24
1510	22.5	7.30			1.19

Sampling Equipment disposable bailer

Constituents Sampled	Container Description	Preservative

Remarks _____

Sampling Personnel KH, FL

Well Casing Volumes

Gal./ft.	1 ¼" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
			3" ¼ = 0.50	6" = 1.46