REPORT

DPE PILOT TEST WELL AS-BUILT AND PILOT TEST COMPLETION REPORT

Lovington 66, PSTB Facility #1489
424 South Main Street,
Lovington, Lea County, New Mexico

Submitted To:
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New Mexico Environment Department
Petroleum Storage Tank Bureau
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November 9, 2015

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Golder Associates

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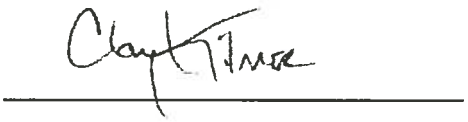
Date of Report:	November 9, 2015
Date of Confirmation of Release:	December 5, 1991

STATEMENT OF FAMILIARITY

I, the undersigned, am personally familiar with the information submitted in this report and the attached documents and attest that it is true and complete.

Signature: 

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1.0 INTRODUCTION

On behalf of Jack Walstad Oil Company, Golder Associates Inc. (Golder) has completed well installation activities, Dual Phase Extraction (DPE) pilot testing, and non-aqueous phase liquids (NAPL) bail testing at the former Walstad Lovington 66 Site. The work was completed in accordance with the *Work Plan for Dual Phase Extraction Pilot Test, Lovington 66 Site (LUST ID1182), Lovington, New Mexico* dated May 7, 2014. This work was completed in accordance with the requirements set forth in the New Mexico Administrative Code, Title 20, Chapter 5, Section 12 and the New Mexico Environment Department (NMED) Petroleum Storage Tank Bureau (PSTB) Guidelines for Corrective Action. The work plan was approved by the NMED PSTB on May 14, 2014 under work plan identification number (WPID # 17138). This submittal satisfies scope of work identified in WPID #17138, and is identified as deliverable ID 17138-4.

1.1 Site Description and Previous Corrective Actions

The former Lovington 66 Site (the site) is located at 424 South Main Street, in Lovington, Lea County, in southeastern New Mexico (**Figure 1**). **Figure 2**. Locations of the groundwater monitoring well network for the Lovington 66 site are also shown. The site is bounded by on the south by New Mexico Highway 83 (Avenue D) and Main Street on the east. Avenue C is north of the site and west of the site is a commercial property. Southeast of the site is an Allsup's convenience store and self-service gasoline station (Allsup's #109), which is also a leaking underground storage tank (UST) site. A self-service gasoline station was formerly located south of the site. The Lovington 66 station has been demolished and a McDonald's restaurant operation is now located on the former Lovington 66 tract, as well as the adjoining tract to the north. The Lovington 66 station was in the area that is now developed as a driveway and parking area for McDonald's.

Fuel from the Lovington 66 site has migrated southeast in the direction of the Allsup's #109 site. Significant thicknesses of NAPL have been noted in monitoring well Nos. W-1, W-2, and W-3. Well installation and pilot testing activities were performed in the area of known NAPL accumulation at the site.

During Golder's negotiation for a site access agreement with Pearson Oil Company, Keith Pearson indicated that a fuel remediation system had previously been placed and operated at the site. Golder has not reviewed documentation of placement or operation of a remediation system at the site; however, during site activities conducted pursuant to completing well installation and pilot testing, Golder personnel observed underground conveyance line penetrations into well vaults for wells W-1, W-2 and W-3, shown in Photographs 34 and 35 in **Appendix A**. Wells W-1, W-2 and W-3 are completed with four-inch polyvinyl chloride (PVC) casing; the other network wells are completed with two-inch PVC casing.

Prior corrective action activities completed at the site include the following:

- July 1991 – AEI Tank, Inc. (AEI) conducted a site assessment that included seven soil borings advanced within the underground storage tank (UST) backfill or UST perimeter, and five borings in or near product pipe trenches. Hydrocarbon contamination was observed.
- November 1991 – AEI removed five USTs that contained diesel, unleaded fuels, and used oil, as well as the associated product piping and fuel dispensers. Hydrocarbon contamination was observed in the location of the dispensers and the location of the diesel tank. It was determined that a release likely occurred from overfilling the USTs and from the dispensers and product lines (a large section of product piping had been replaced).
- November and December 1991 – AEI excavated approximately 600 cubic yards of contaminated soil from product line trenches, dispenser islands and tank excavations.
- December 1991 – AEI attempted to delineate the vertical extent of contamination by installing one soil boring. The location of this soil boring was never documented. During the drilling of the boring, auger refusal was encountered at 40 feet below ground surface (bgs).
- February 1992 – AEI installed one groundwater monitoring well (W-1). Groundwater sample results indicated that groundwater contamination was present above New Mexico Water Quality Control Commission (NMWQCC) standards.
- March 1992 – AEI installed two additional monitor wells (W-2 and W-3) to determine the extent of dissolved phase hydrocarbon contamination. Both wells had dissolved phase hydrocarbon concentrations well above NMWQCC standards.
- June 1992 – Billings & Associates, Inc (BAI) completed an Interim Hydrogeologic Investigation Report (On-site). During this investigation six soil borings (B-4 through B-9) were advanced at the site to a depth of 40 feet bgs. Heated headspace measurements above action levels were present in all borings except B-8. NAPL was present in the three monitor wells installed by AEI. Three additional monitor wells W-4, W-5, and W-6 were installed. The three new wells exceeded NMWQCC standards.
- September 1993 – BAI completed a 2nd Interim Hydrogeologic Investigation Report. During this investigation free product recovery efforts commenced using BAI's Product Recovery Filter system. In addition six new monitor wells (W-7 through W-12) and vertical extent well V-1, were installed.
- June 1993 – BAI submitted the 3rd Interim Hydrogeologic Investigation Report. Five wells (W-13 through W-17) were installed to delineate the dissolved phase plume. NAPL was present in vertical extent well V-1, which Billings attributed to leaking well casing.
- August 2006 – Golder sampled the Lovington 66 wells as part of an investigation conducted at the Allsup's #109 site located downgradient from the Lovington 66 site.
- November 2007 – Golder completed a Continued Secondary Investigation in which three downgradient wells (W-19, W-20, and W-21) were installed and a NAPL bail down test was completed on wells W-2 and W-3. The downgradient extent of contamination was delineated.
- August 2008 – Golder completed four quarters of groundwater monitoring at the Lovington 66 site.
- February 2009 – Golder completed a biannual monitoring event and associated quarterly product recovery from wells W-1, W-2, W-3, and V-1. The site data for the first biannual groundwater monitoring report was completed in January 2009.

- August 2009 – Golder completed the second biannual monitoring event and associated quarterly product recovery from wells W-1, W-2 and W-3. The site data collection for the second biannual groundwater monitoring report was completed in July 2009.
- February 2014 – Golder completed a biannual monitoring event and associated quarterly product recovery from wells W-1, W-2 and W-3. The site data collection for the first biannual groundwater monitoring report was completed in January 2014.
- October 2014 – Golder completed a biannual monitoring event and associated quarterly product recovery from wells W-1, W-2 and W-3. The site data collection for the second biannual groundwater monitoring report was completed in October 2014.

2.0 ACTIONS COMPLETED DURING THE PROJECT

This section summarizes the list of activities performed during this project.

2.1 Site Access

Prior to the start of site work, Golder executed an access agreement with the current property owner, Pearson Oil Company, Hobbs, NM, with the McDonald's Corporation, current lessee of the property, and with Jack Walstad Oil Company, Responsible Party, to allow Golder and subcontractors to enter the property to perform well installation and pilot testing activities. A copy of the site access agreement is included with this submittal in **Appendix B**.

2.2 Pre-Testing - Monitor Wells W-1, W-2 and W-3

Work plan 17138 called for installing a new DPE extraction pilot test well (DPE-1) near the center of existing monitoring wells W-1, W-2 and W-3 and performing the extraction pilot test on DPE-1, observing vacuum and fluid level responses in DPE-1, as well as in wells W-1, W-2 and W-3. Available lithologic logs and completion details of Wells W-1, W-2 and W-3 provided by NMED-PSTB, as well as January 2014 groundwater gradient, dissolved volatile organic compound (VOC) and NAPL thickness maps are included with this submittal in **Appendix C**.

Due to the age of existing monitoring wells W-1, W-2 and W-2 (completed in 1991 and 1992), Work plan 17138 included scope to perform short duration vacuum flow and impedance tests of wells W-1, W-2 and W-3 to confirm that each well was in open communication with the subsurface and that representative responses could be expected from each during the vacuum extraction test of the new well.

Golder conducted monitor well pre-testing on March 29, 2015 on wells W-1, W-2, and W-3. Well testing included short vacuum extraction tests of each well, vacuum pumping to stability at several successively higher vacuum rates, and noting the flow and impedance at each extraction well and vacuum responses at the other two wells. Produced vapor concentrations were monitored with a photo-ionization detector (PID); vapor temperatures were measured with an infrared spot meter. Produced vapors were abated with a 180-pound granular activated charcoal filtration canister. Testing results indicated that wells W-1, W-2 and W-3 would provide acceptable observation well data for the DPE pilot test. The data records and results from the monitoring well pre-testing are shown in **Appendix D**.

2.3 NAPL Bail-Down and Recovery Testing

Responding to a request from NMED-PSTB for out-of-scope testing, Golder gained approval for contingency budget expenditure (WPID 17138-5) to perform NAPL bail-down and recovery testing and analysis on wells W-1, W-2 and W-3 in accordance with ASTM Method Designation ES-2856-13 "Standard Guide for Estimation of LNAPL Transmissivity," the API LNAPL Transmissivity Workbook, and the Gruszenski method for determination NAPL thickness. Golder's subcontractor, Clayton M. Barnhill,

Roswell, New Mexico conducted the NAPL bail-down and recovery tests of wells W-1, W-2, and W-3 on June 2-4, 2015. The NAPL bail-down and recovery tests were completed by removing the NAPL from each well with a bailer, then recording the water level, NAPL level, and time at regular intervals to measure the oil-water contact and NAPL level responses to bailing and recovery. Copies of the test data and results from the NAPL bail-down and recovery tests are included in **Appendix E**. Discussion of results is presented in a later section of this report.

2.4 DPE Pilot Test Well Installation

Golder contracted HCI Drilling Inc., Lubbock Texas (HCI) to install the well (DPE-1) for the DPE testing at the site. A permit to drill the well was obtained from the New Mexico Office of the State Engineer and a copy of the permit is included in **Appendix F**. The location of DPE-1 was selected such that wells W-1, W-2 and W-3 would be located at three successively greater distances from the DPE test well. The site layout showing the existing monitoring well locations and the location of DPE-1 is shown on **Figure 3**. The DPE-1 well location was marked with white paint two weeks prior to drilling, and Golder filed a New Mexico 811 One-Call locate request to clear underground utilities on June 4, 2015. The utilities were cleared on June 8, 2015. No underground utilities were identified near the proposed location for DPE-1.

On June 14, 2015, HCI drilled and completed DPE-1 to a depth of 75 feet using air rotary drilling methods. The well was drilled with a 7-7/8" outside diameter drill bit using an air-rotary circulation. HCI installed a four-inch Schedule 40 PVC well casing. The well was screened from 45 to 75 feet bgs with 0.010-inch slotted casing. An annular filter pack was placed around the well from 41 to 75 feet bgs using 20/40 silica sand. A hydrated bentonite seal was placed from 1 to 41 feet bgs. The well was completed with an eight-inch diameter traffic grade vault placed in concrete and finished flush to surrounding asphalt grade. The top of the casing was cut approximately six inches bgs. Photographs of the installation of DPE-1 are shown in **Appendix A**.

Golder personnel logged the borehole for lithology, grain size, color, moisture content, cohesiveness, odor, and estimated groundwater level. The boring log and well construction details are shown on **Figure 4**. Golder collected and screened the air-rotary circulated drill cuttings at 5-foot intervals using a PID and heated headspace methodology. The PID readings were utilized to determine the zone of highest residual fuel content and to collect a soil sample from that zone to submit for lab testing. Soil cuttings were contained in 55-gallon steel drums and sent for proper disposal by Gandy Corporation (Gandy). After the well was completed, HCI used an electric submersible pump to purge and develop the well to clear fine material from the sand pack around the well. The well was pumped until water was free from observed suspended solids. Approximately 150 gallons of water was purged from the well during development. Development water was pumped into a tanker truck for proper disposal. Disposal manifests for the soil cuttings and development water are included in **Appendix G**. A soil sample was collected from

the zone of greatest field screened VOC concentration, as determined by the PID, and submitted to Hall Laboratory in Albuquerque for analysis of Total Petroleum Hydrocarbon (TPH) for Gasoline Range Organics and for VOCs using Environmental Protection Agency (EPA) Methods 8015B and 8260B, respectively. The sample was also tested by EPA Method 6010B for total lead. Sample containers, preservatives, analytical methods, and holding times are summarized in **Table 1**. Results of laboratory tests of the soil samples are summarized in **Table 2**. Copies of the laboratory reports and associated chain-of-custody records are included in **Appendix H**.

2.5 Dual Phase Extraction Pilot Testing

Golder contracted AcuVac Remediation, L.L.C (AVR) to perform DPE pilot testing in accordance with commitments set forth in Work plan 17138. The purpose of the DPE pilot testing is to determine vacuum, impedance and flow characteristics of subsurface soil vapor and fluids, and to establish subsurface hydraulic properties adequately to allow detailed plans for selection, design and operation of an active remediation system at the site to be prepared.

The DPE testing was conducted with AVR's I-6 system. The key components of the I-6 testing system are:

- Roots RAI-33 and RAI-22 blowers;
- Horiba® Vapor Analyzer;
- Solinst interface probes;
- Lumidor O_2 meter;
- Vapor flow gauges;
- Liquid volume/flow meter;
- Barometric pressure meter;
- V-1 vacuum box;
- Redi-Flo 2 total fluids submersible electric pump;
- Internal combustion engine; and
- Moisture knockout tank;

Groundwater extraction during testing was accomplished using a Grundfos Redi-Flo 2 pump and fluid production was monitored with a totalizing volume meter. The discharge from the well was pumped into a tanker truck for proper offsite disposal. Disposal manifests for the extracted groundwater are shown in **Appendix G**. The vacuum extraction pump was connected to well DPE-1 and fuel vapors were routed to an internal combustion engine. Volatized hydrocarbons were passed through the engine and burned as part of the normal combustion process. Emissions from the internal combustion engine were passed through three catalytic converters to ensure maximum destruction of hydrocarbon vapors. The I-6 system

allows independent control of the vacuum and groundwater extraction flow rates. Photographs documenting the pilot test and event tests are included in **Appendix A**.

The pilot testing was conducted in two phases. The initial pilot testing phase (Mobile Dual Phase Pilot Test DPE-1) was completed on July 12, 2015 and consisted of an eight-hour, four step-rate vapor and liquid extraction test of well DPE-1, with measurements of fluid level and vacuum responses in well DPE-1 and in wells W-1, W-2 and W-3, as well as measurements of produced water and NAPL. The focus of Mobile Dual Phase Pilot Test DPE-1 was to establish the geometry of the propagated vacuum envelope by measuring vacuum responses in observation wells W-1, W-2 and W-3, as well as to determine vacuum air flow-impedance relationships and fluid extraction and water level drawdown in well DPE-1.

The second phase of pilot testing (Dual Phase Tests W-1, W-2, & DPE-1) was completed on July 13, 2015. This testing phase consisted of one-hour DPE tests of wells W-1 and W-2 and a six-hour DPE test of well DPE-1. The focus this testing was to determine vapor and fluid flow and impedance relationships, as well as to determine production rates for water and NAPL.

2.5.1 Dual Phase Pilot Test of Well DPE-1

AVR conducted an eight hour Mobile Dual Phase (MDP) pilot test on July 12, 2015 on DPE-1 (referenced in the AVR report as well A-1). During the initial two hour step of the test, induced vacuum was maintained at 40 inches of water (inches H_2O), producing a vapor flow rate of 12.19 standard cubic feet per minute (SCFM); water was pumped at a rate of 3.5 gallons per minute (gpm), producing a fluid level drawdown of 5.5 feet in the well. At test hour two, the vacuum was increased to 60 inches H_2O, producing a vapor flow rate of 19.88 scfm, and the pumping rate of 4.3 gpm and 5.5 feet of water level decline was maintained. At test hour 5.5, the vacuum was increased to 75 inches H_2O, producing a vapor flow rate of 21.34 scfm, and the pumping rate was increased to 4.6 gpm to maintain a 5.5-foot fluid level drawdown. At test hour seven, the vacuum was increased to 90 inches H_2O, producing a vapor flow rate of 27.95 scfm, and the pumping rate was increased to 5.20 gpm to maintain a 5.5-foot fluid level decline. Fluid levels, pumping rate, total volume, and pressure were measured on 30 minute intervals. Groundwater depths and vacuum pressures were measured in W-1, W-2, and W-3 during the test to determine radius of influence and vacuum communication. At periodic intervals, total fluid samples were also periodically collected in a 2,000-milliliter beaker and allowed to phase-separate to provide estimates of the proportion of NAPL present in the emulsified total produced fluids during the test. The report and test data from AVR is included in **Appendix I**.

Near the conclusion of the initial test of DPE-1, phase-separated water samples were collected for analyses of VOCs and TPH-GRO using EPA Methods 8260B and 8015B, respectively, and for total lead by EPA Method 6010B. A vapor sample was also collected and submitted for testing to be analyzed for

VOCs by EPA 8260B. Analytical media testing performed for this project is summarized in **Table 1**. Results of testing of groundwater and soil vapor samples are summarized in **Table 3** and **Table 4**, respectively.

2.5.2 Dual Phase Tests of Wells W-1, W-2, & DPE-1

AVR conducted individual DPE tests of W-1, W-2 and DPE-1 on July 13, 2015 (one hour on W-1, one hour on W-2, and six hours on DPE-1). The objectives of the individual DPE tests were to evaluate the potential for removing liquid and vapor phase LNAPL from groundwater and subsurface soils, expose the capillary fringe zone to increase the groundwater and contaminant yields, and induce hydraulic gradients toward each well during testing. During each test, AVR recorded water levels, pumping rate, total volume, and pressure on 30-minute intervals. Total fluid samples were also periodically collected in a 2,000-milliliter beaker and allowed to phase-separate to provide estimates of the proportion of NAPL present in the emulsified total produced fluids during the test. The report and test data from the July 13, 2015 tests are included in **Appendix I**.

3.0 RESULTS OF INVESTIGATIONS

This section summarizes the combined findings of soil boring and well installation activities, pilot testing, and laboratory testing of media samples.

3.1 Pre-Testing – Wells W-1, W-2 and W-3

Results of pre-testing of wells W-1, W-2, and W-3 conducted on March 29, 2015 indicated that these wells were in hydraulic communication with subsurface sediments and were suitable for use as observation wells during the planned pilot testing. Consequently, no additional observation wells were installed for the pilot testing. Data from the pretests is included in **Appendix D**.

3.2 NAPL Bail-Down and Recovery Tests

The results of the NAPL bail-down and recovery tests are summarized in **Table 5**. The average NAPL Transmissivity values obtained by the tests ranged from 0.24 square feet per day (ft^2/d) in well W-3 to 0.66 ft^2/d in well W-1. The NAPL Storage Coefficient values obtained by testing ranged from 0.000046 (dimensionless) in well W-2 to 0.074 in well W-1, based upon the Cooper-Jacob analytical method. The Cooper, Bredehoeft and Papadopulos method produced Storage Coefficient values ranging from 0.39 in well W-2 to 0.53 in well W-3. The Gruszenski analytical method for determining formation NAPL thickness indicated that formation NAPL thickness ranged from 0.06 feet in well W-1 to 0.44 feet in well W-3. Copies of the NAPL bail down and recovery data, as well as the ASTM-API data interpretations and the Gruszenski method interpretations are included in **Appendix E**.

3.3 Pilot Test Well DPE-1 Installation

Well DPE-1 penetrated approximately 60 feet of caliche of variable texture and cohesion before striking silty sand in the saturated zone to total depth of 75 feet bgs. Groundwater saturation was noted at approximately 59 feet bgs. The static water level was sounded in the completed well at a depth of 64.08 feet below top of casing. Soil PID screening data indicated that high soil VOC vapors were noted between approximately 52 feet and 75 feet bgs. The highest zone of contamination was observed in the interval from 55 to 60 feet bgs with a PID reading of 2,709 parts per million (ppm). Laboratory sample results showed elevated concentrations of fuel constituents and lead. **Table 2** summarizes the analytical test results for the soil samples collected during drilling of DPE-1. A copy of the laboratory report on soil testing is included in **Appendix H**.

3.4 Dual Phase Extraction Pilot Testing

AVR completed the DPE pilot testing on July 12-13, 2015 and submitted their findings to Golder on July 15, 2015. The DPE findings are summarized in this section.

3.4.1 Dual Phase Pilot Test of Well DPE-1

The AVR interpretation of the results of the test indicate that DPE-1 had an effective vacuum radius of influence (0.75% of induced vacuum) of 25.91 to 32.64 feet, with an extraction well flow of 22.0 to 24.0 scfm, and a vacuum between 80 to 85 inches H_2O. DPE-1 had an effective vacuum radius of influence (1% of induced vacuum) of 22.02 to 24.53 feet, with an extraction well flow of 22.0 to 24.0 scfm, and an extraction well vacuum between 80 to 85 inches H_2O on the second run. Fluid pumping and level measurements indicated that the pumping rate of 4.0 to 4.3 gallons per minute propagated an effective induced hydraulic gradient of approximately 31.0 feet.

During the DPE-1 pilot test, a total liquid volume of 2,048 gallons was recovered. Of the total volume recovered, approximately 67.1gallons were gasoline. Additionally, AVR reported that approximately 22.63 gallons of gasoline vapor was removed and burned as part of the test. ***The total volume of gasoline removed was 86.27 gallons or 10.78 gallons per hour during the test.*** Groundwater recovery was monitored for 30 minutes after the completion of the test. Emission data collected from the Horiba vapor tester during the test showed an average hydrocarbon level of 69,142 ppmv.

The AVR interpretations of the test results indicate the following:

- Wells W-1, W-2, and W-3 were in vacuum communication with DPE;
- The sub-surface medium is most likely isotropic;
- An average induced vacuum of 60.3" H_2O was required to produce a well flow of 18.83 scfm;
- The ratio of DPE-1 induced vacuum to DPE-1 well flow was 3.21:1;
- The average vapor flow per foot of DPE-1 well screen was 0.96 scfm with a maximum of 1.42 scfm;
- The average groundwater pumping rate was 4.22 gpm with a maximum of 5.20 gpm;
- The average groundwater depression was 5.50 feet below static water level; and
- An LNAPL thickness of 6.68 feet was measured prior to the test and a thickness of 0.04 feet was measured after the test.

Laboratory sampling from the water collected during the pilot test showed high levels of dissolved fuel constituents; lead was also detected. Laboratory sampling from the vapor collected during the pilot test showed high levels of contamination for fuel constituents. **Table 3** and **Table 4** contain summary results of laboratory testing of water and vapor samples collected during the test. A copy of the laboratory report on testing of water and vapor samples is contained in **Appendix H**.

Golder utilized the AVR dataset to calculate radius of influence (RO)I and soil permeability; copies of the Golder calculation sheets are included in **Appendix J**. The effective ROI for DPE-1 was observed to be 10.5, 8.4, 5.9, and 7.4 feet at applied wellhead vacuums of 40, 60, 75, and 90 inches H_2O, respectively.

Using the NMED standard of 3 percent of the applied wellhead vacuum, the greatest ROIs were generally achieved at the lower applied wellhead vacuum settings (40 and 60 inches H_2O). As such, the recommended wellhead vacuum setting for soil vapor extraction would be between 40 and 50 inches H_2O. A higher ROI would be anticipated during a continuous full-scale operation; therefore, Golder recommends an effective ROI of 15 feet. Calculated soil permeabilities for DPE-1 were 1.26, 1.36, 1.16, and 1.24 darcys, respectively, for the aforementioned applied wellhead vacuums. The overall average soil permeability observed during the pilot study was 1.26 darcys. ROI and soil permeability calculations for DPE-1 can be found in **Appendix J**.

Vapor flow rates were calculated using the average soil permeability of 1.26 darcys at ROIs of 10 feet and 15 feet. An applied wellhead vacuum of 45 inches H_2O was selected for each calculation. Based on these inputs, the calculated vapor flow rates were 16 scfm (approximately 0.8 scfm per foot of well screen) using an ROI of 10 feet and 14 scfm (approximately 0.7 scfm per foot of well screen) using an ROI of 15 feet. The calculated flow rates were also consistent with the flow rates measured during the pilot study. The vapor flow rate calculations are included in **Appendix J**.

An approximation of the hydraulic gradient was obtained by plotting the drawdown depths at wells W-1, W-2, and W-3 versus their distance from extraction well DPE-1. Based on the resulting plot and trendline equation, groundwater drawdown depths of approximately 1.02 feet and 0.76 feet were calculated for radial distances of 10 feet and 15 feet, respectively, from the extraction well. The drawdown versus distance plot and the resulting calculations are included in **Appendix J**.

3.4.2 Dual Phase Test of Well W-1

During the DPE test on W-1 (one hour), a total liquid volume of 201 gallons was recovered. Of the total volume recovered, AVR reported that approximately 47.61 gallons were gasoline. Additionally, AVR reported that approximately 1.84 gallons of gasoline vapor were removed. ***The total equivalent volume (liquid and vapor) of gasoline removed was 49.45 gallons.*** Emission data collected from the Horiba vapor detector during the test indicated an average hydrocarbon level of 85,750 (parts per million by volume) ppmv. Other key observations from W-1:

- The average vacuum induced was 60" H_2O;
- The average W-1 vapor flow was 9.51 scfm;
- The average groundwater pump rate was 3.47 gpm with a maximum of 3.70 gpm;
- The average groundwater depression was 5.50 feet below static water level;
- A LNAPL thickness of 6.84 feet was measured prior to the test and a thickness of 0.04-ft was measured after the test;
- LNAPL recovery was measured 7.5 hours later and was 1.01 feet, indicating a rebound of 14.77%; and

- A layer of biomass was initially observed on the collected groundwater/NAPL sample.

3.4.3 Dual Phase Test of Well W-2

During the DPE test on W-2 (one hour), a total liquid volume of 192 gallons was recovered. Of the total volume recovered, AVR reported that approximately 25.92 gallons were gasoline. Additionally, AVR reported that approximately 1.97 gallons of gasoline vapor was removed. ***The total equivalent volume (liquid and vapor) of gasoline removed was 27.89 gallons.*** Emission data collected from the Horiba vapor detector during the test indicated an average hydrocarbon level of 95,790 ppmv. Other key observations from W-2:

- The average vacuum induced was 60" H_2O;
- The average W-2 vapor flow was 9.51 scfm;
- The average groundwater pump rate was 3.20 gpm with a maximum of 3.20 gpm;
- The average groundwater depression was 5.50-ft below static water level;
- An LNAPL thickness of 6.54 feet was measured prior to the test and no LNAPL thickness was measured after the test; and
- LNAPL recovery was measured 6.25 hours later and was 4.40 feet indicating a rebound of 67.28%.

3.4.4 Dual Phase Test of well DPE-1

During the event test on DPE-1 (six hours), a total liquid volume of 1,553 gallons was recovered. Of the total volume recovered, approximately 36.53 gallons were gasoline. Additionally, approximately 29.36 gallons of gasoline vapor was removed. The ***total equivalent volume (liquid and vapor) of gasoline removed was 65.88 gallons or 10.98 gals/hr***. Emission data, collected from the Horiba vapor detector during the test, showed an average hydrocarbon level of 64,480 ppmv.

Key observations comparing the pilot test from the event test on DPE-1:

- The average hydrocarbon levels decreased 4,662 ppmv;
- The average vacuum induced was 68.46" H_2O; an increase of 8.16" H_2O;
- The average well vapor flow was 23.01 scfm; an increase of 4.18 scfm;
- The average groundwater pumping rate was 4.35 gpm with a maximum of 4.50 gpm;
- The average groundwater depression was 5.50-ft below static water level; and
- A LNAPL thickness of 5.52-ft was measured prior to the test and a thickness of 0.13-ft was measured after the test.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions and recommendations based on the DPE-1 well installation and pilot testing conducted at the Lovington 66 site.

4.1 Conclusions

The NAPL bail-down and recovery tests of wells W-1, W-2 and W-3 indicate that formation NAPL thicknesses are significantly less than apparent NAPL thicknesses observed in these wells, ranging from 1% to 6% of the apparent NAPL thicknesses. Aquifer NAPL Transmissivity and Storativity values obtained from NAPL bail-recovery tests indicate that the moderate fluid-bearing properties are present in the water and NAPL-bearing zone at the site.

The lateral extent of NAPL at the site has not been established; therefore no estimate of NAPL in place is possible with existing data. The known distribution of NAPL relative to the former UST, service islands and wells W-1, W-2, W-3 and DPE-1 is shown in **Figure 2**. Based upon the gradient direction to the southeast, it is reasonable to expect that significant masses of adsorbed fuel and NAPL are present under Avenue D to the south of the site and under Main Street to the east of the site.

The DPE pilot testing of wells DPE-1, W-1, W-2 and W-3 indicate that subsurface materials are somewhat homogenous and modestly conductive. Moderate fluid and vapor flow rates were achieved with moderate impedance to flow during the testing. NAPL and vapor recovery rates during testing were significant; a total of 229.5 gallons of NAPL equivalent were recovered during 16.6 cumulative hours of DPE testing of wells DPE-1, W-1 and W-2, with a recovery rate of 13.8 equivalent NAPL gallons per hour. Recovered NAPL equivalent was approximately 5.7% of the 3,994 gallons of total fluids produced during the testing.

Based upon the results of pilot testing performed at the site, we conclude that site conditions are favorable for multiple remedial approaches, including simple NAPL recovery and water level suppression enhanced NAPL recovery. The site conditions are considered moderately favorable for dual-phase extraction. Site conditions are also considered favorable for secondary enhanced bioremediation using oxygen injection, once the NAPL has been recovered. Based on the anticipated horizontal and vertical extent of the contaminants and relatively low permeability, chemical oxidation is considered less favorable as a primary treatment method. Chemical oxidation may be considered as a secondary treatment method to polish residual dissolved hydrocarbons in localized areas. Since fuel contaminants included leaded gasoline (and likely the lead scavenger EDB), implementing remedial actions will likely require that effluent streams (water) will require treatment for lead, as well as petroleum contaminants.

Due to the modest permeability of the impacted zone, as well as the depth and geometry of the impacted media (much of it being located beneath Avenue D and Main Street), we anticipate that costs of remediation will be high.

4.2 Recommendations

Prior to implementation of a remedial strategy, Golder recommends that additional site characterization activities be conducted to further delineate the horizontal extent of the NAPL plume. As discussed in Section 3.4.1, the effective ROI for a dual-phase extraction approach would be approximately 10 feet at an applied wellhead vacuum of 45 inches H_2O, indicating a maximum well spacing of approximately 20 feet. A higher ROI could potentially be achieved during a continuous full-scale operation. Significant cost reductions could be realized if the horizontal extent of the NAPL plume could be adequately defined prior to full-scale remedial design and if extraction well spacing could be increased. Once the extent of NAPL has been defined, dual-phase extraction should be considered as the primary remedial strategy for this site. Enhanced bioremediation using oxygen injection should be considered as a secondary strategy.

Based on the rates of NAPL recovery that were observed during the pilot testing, Golder recommends that total fluid recovery and disposal events be performed at the site to maximize contaminant reduction during the time required to plan, install, and operate capital remediation equipment at the site.

5.0 REFERENCES

American Petroleum Institute, September 2012, User Guide for the API LNAPL Transmissivity Workbook: a tool for baildown test analysis: API Regulatory and Scientific Affairs Department, API Publication 46xx(prepublication draft).

ASTM International, 2015, Standard Guide for Estimation of LNAPL Transmissivity: ASTM Designation E2856-13.

Gruszenski, 1987, Method for Determination of NAPL thickness *in* Testa and Winegardner, 1991, "Restoration of Contaminated Aquifers: Petroleum Hydrocarbons and Organic Compounds, p. 122.

TABLES

Table 1: Summary of Sample Analytical Media Testing, Lovington 66 Site
424 S. Main St., Lovington, New Mexico

Sampling Event	Matrix	Target Analytes	Analytical Method	Sample Container	Preservative
Well DPE-1 Install	Soil	VOCs	EPA 8260B	1 x glass jar	Cool to 4°C
		TPH GRO	EPA 8015B	1 x glass jar	Cool to 4°C
		Total Lead	EPA 6010B	2 x 40 ml VOA vials	MeOH; Cool to 4°C
DPE-1 Pilot Test	Water	VOCs	EPA 8260B	6 x 40 ml VOA vials	HCl; Cool to 4°C
		TPH GRO	EPA 8015B		
		Total Lead	EPA 6010B	1 x plastic bottle	HNO_3; Cool to 4°C
	Vapor	VOCs	EPA 8260B	1 x tedlar bag	N/A

Notes: VOC = Volatile Organic Compound
TPH = Total Petroleum Hydrocarbons
GRO = Gasoline Range Organics
EPA = Environmental Protection Agency

Table 2: Summary of Soil Sample Results for DPE-1, Lovington 66 Site
424 S. Main St., Lovington, New Mexico

Well ID	Date Sampled	Sample Depth (ft)	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total BTEX	MTBE	Total Naphthalenes	TPH Gasoline Range	Total Lead
NMED Soil Screening Levels (DAF-20)			0.038	12.1	0.262	5.95	--	0.553	224	--	*40
DPE-1	6/14/2015	55-60	1.3	57	93	330	481.3	0.82	217	3,000	0.93

Notes: All concentrations in milligrams per kilogram (mg/kg)
BTEX = Benzene, Toluene, Ethyl Benzene, and Xylenes
MTBE = methyl tertiary butyl ether
TPH = Total Petroleum Hydrocarbon
Volatile Organic Compound data are by EPA Method 8260B.
TPH by EPA Method 8015.
Total Lead by EPA Method 6010B
*NMED Soil Screening Level for lead as for Residential risk

Golder Associates

Table 3: Summary of Water Sample Results for DPE-1, Lovington 66 Site
424 S. Main St., Lovington, New Mexico

Well ID	Date Sampled	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total BTEX	MTBE	Total Naphthalenes	TPH Gasoline Range (mg/L)	Total Lead (mg/L)
NMWQCC Standards		**10**	**750**	**750**	**620**	**--**	**100**	**30**	**--**	**0.05**
DPE-1	7/12/2015	28,000	60,000	7,500	24,000	119,500	39,000	22,900	260	1.3

Notes: All concentrations in micrograms per Liter (µg/L) unless otherwise noted
BTEX = Benzene, Toluene, Ethyl Benzene, and Xylenes
MTBE = methyl tertiary butyl ether
TPH = Total Petroleum Hydrocarbon
Volatile Organic Compound data are by EPA Method 8260B.
TPH by EPA Method 8015.
Total Lead by EPA Method 6010B

Table 4: Summary of Vapor Sample Results for DPE-1, Lovington 66 Site 424 S. Main St., Lovington, New Mexico

Well ID	Date Sampled	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Total BTEX	MTBE
DPE-1	7/12/2015	1,500	3,600	420	950	6,470	620

Notes: All concentrations in milligrams per cubic meter (mg/m^3)
BTEX = Benzene, Toluene, Ethyl Benzene, and Xylenes
MTBE = methyl tertiary butyl ether
Volatile Organic Compound data are by EPA Method 8260B.

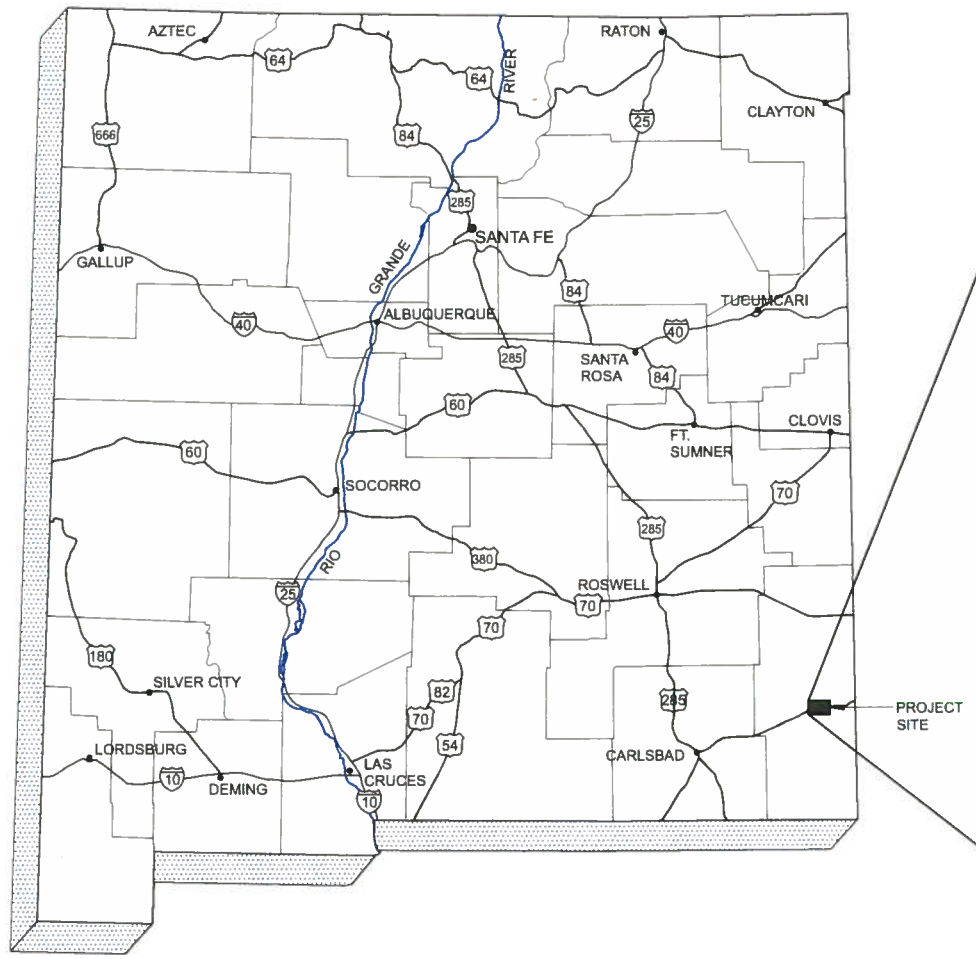
Table 5: Summary of NAPL Bail-Down Test Results, Lovington 66 Site
424 S. Main St., Lovington, New Mexico

Well	Date	Pre Bail Test Depth to Water (ft)	Pre Bail Test Depth to NAPL (ft)	Apparent NAPL Thickness, Pre Bailing Static (ft)	[1]NAPL Thickness at Peak Recovery Water Level (ft)	[2]Bouwer and Rice Method	[2]Cooper-Jacob Method	[2]Cooper, Bredehoeft, Papadopulos Method	Average of Analytical Methods	Cooper-Jacob Method	Cooper, Bredehoeft and Papadopulos Method
						Transmissivity (T_n), ft^2/day				Storage Coefficient (S_n), dimensionless	
W-1	6/2/2015	58.11	64.89	6.78	0.06	0.58	0.7	0.7	0.66	7.40E-02	4.00E-01
W-2	6/2/2015	57.07	64.26	7.19	0.22	0.28	0.58	0.3	0.39	4.60E-05	3.90E-01
W-3	6/2/2015	57.17	64.1	6.93	0.44	0.19	0.3	0.23	0.24	1.00E-03	5.30E-01

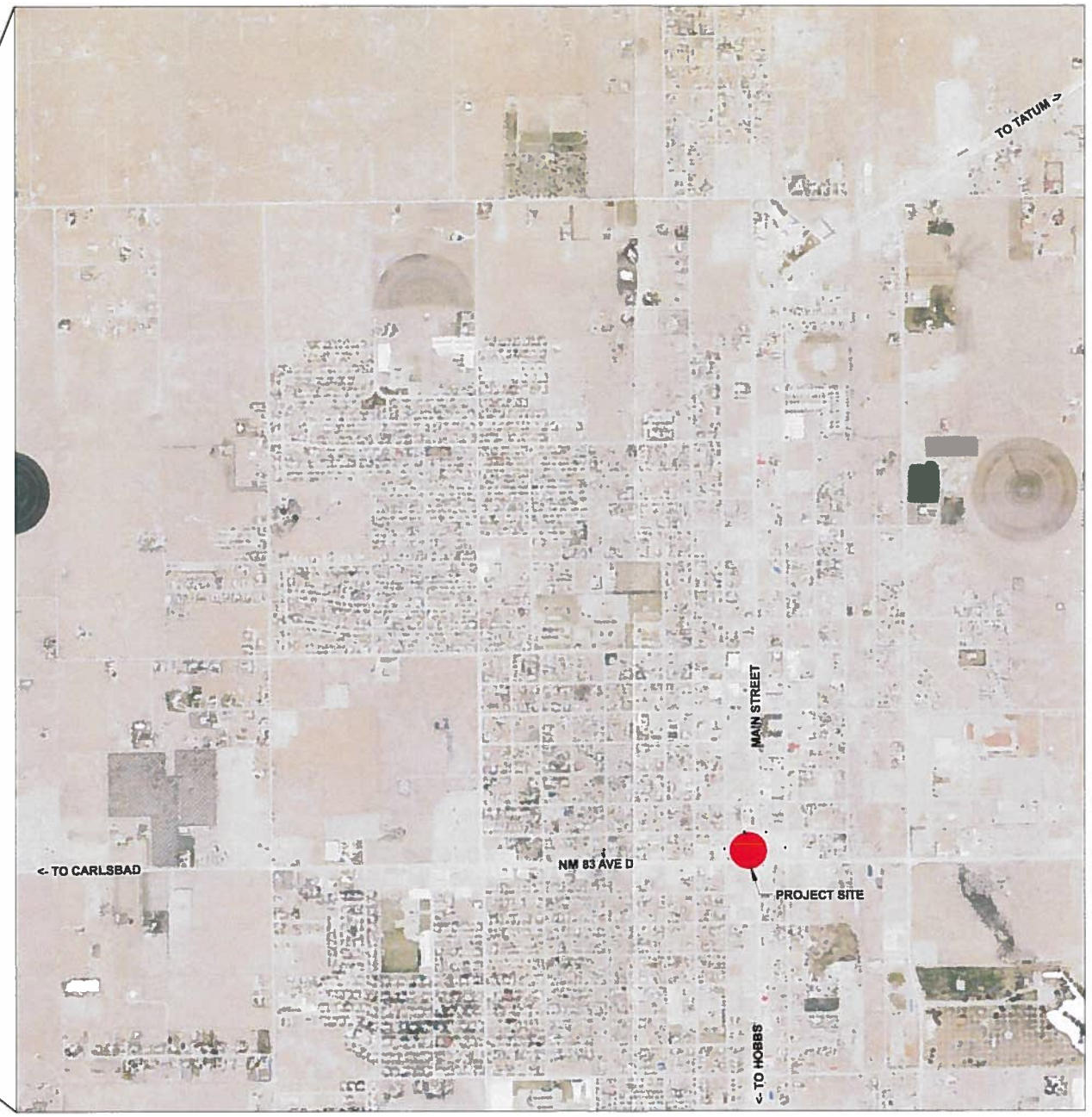
Notes:

[1] *Formation NAPL thickness estimated by Gruszenski method*

[2] *Hydraulic properties estimated using the ASTM Designation ES2856-13 method (API LNAPL Transmissivity Workbook)*



NEW MEXICO STATE MAP
N.T.S.



LOVINGTON, NEW MEXICO

0 1000 2000
1" = 2000' FEET

REFERENCE(S)
AERIAL PHOTOGRAPH TAKEN FROM RGIS. TITLED *LOVINGTON, NW NAIP DOQQ (3210306)* DATED 2014. DOWNLOADED ON 2015-07-22.

CLIENT
NEW MEXICO ENVIRONMENT DEPARTMENT
PETROLEUM STORAGE TANK BUREAU
SANTA FE, NEW MEXICO

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-07-22
DESIGNED	PDC
PREPARED	PDC
REVIEWED	CLK
APPROVED	BN

PROJECT
WALSTAD OIL COMPANY
LOVINGTON 66
LOVINGTON, NEW MEXICO

TITLE
PROJECT LOCATION MAP

PROJECT NO.	TASK	REV.	FIGURE
140-4221	4	0	1

Path: \\albuquerque\Acad\2014 Projects\140\4221\PRODUCTION\ | File Name: 140-4221D001.dwg

0 1in IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

LEGEND

W-2 Location of existing groundwater monitoring well showing well designation

CLIENT	NEW MEXICO ENVIRONMENT DEPARTMENT PETROLEUM STORAGE TANK BUREAU SANTA FE, NEW MEXICO
CONSULTANT	Golder Associates
YYYY-MM-DD	2015-09-29
DESIGNED	PDC
PREPARED	PDC
REVIEWED	CLK
APPROVED	BN
PROJECT	WALSTAD OIL COMPANY LOVINGTON 66 LOVINGTON, NEW MEXICO
TITLE	**SITE LAYOUT**
PROJECT NO.	140-4221
TASK	4
REV.	0
FIGURE	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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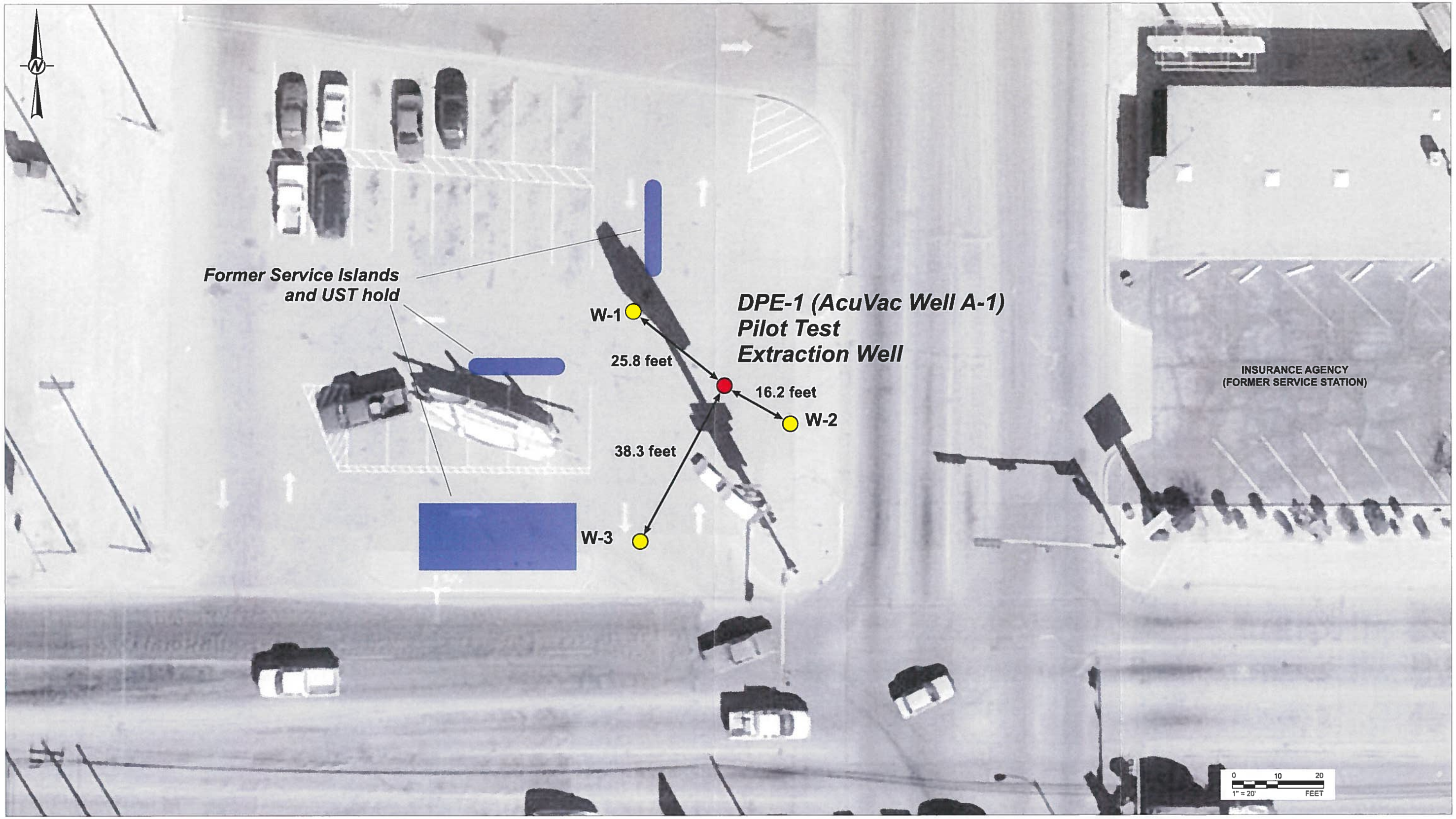


LEGEND

DPE-1	Location of dual phase extraction pilot test extraction well showing well designation
W-1	Location and designation of monitoring well used as observation well for dual phase extraction pilot test

CLIENT
NEW MEXICO ENVIRONMENT DEPARTMENT
PETROLEUM STORAGE TANK BUREAU
SANTA FE, NEW MEXICO

CONSULTANT
Golder Associates

YYYY.MM.DD	2015-07-22
DESIGNED	PDC
PREPARED	PDC
REVIEWED	CLK
APPROVED	BN

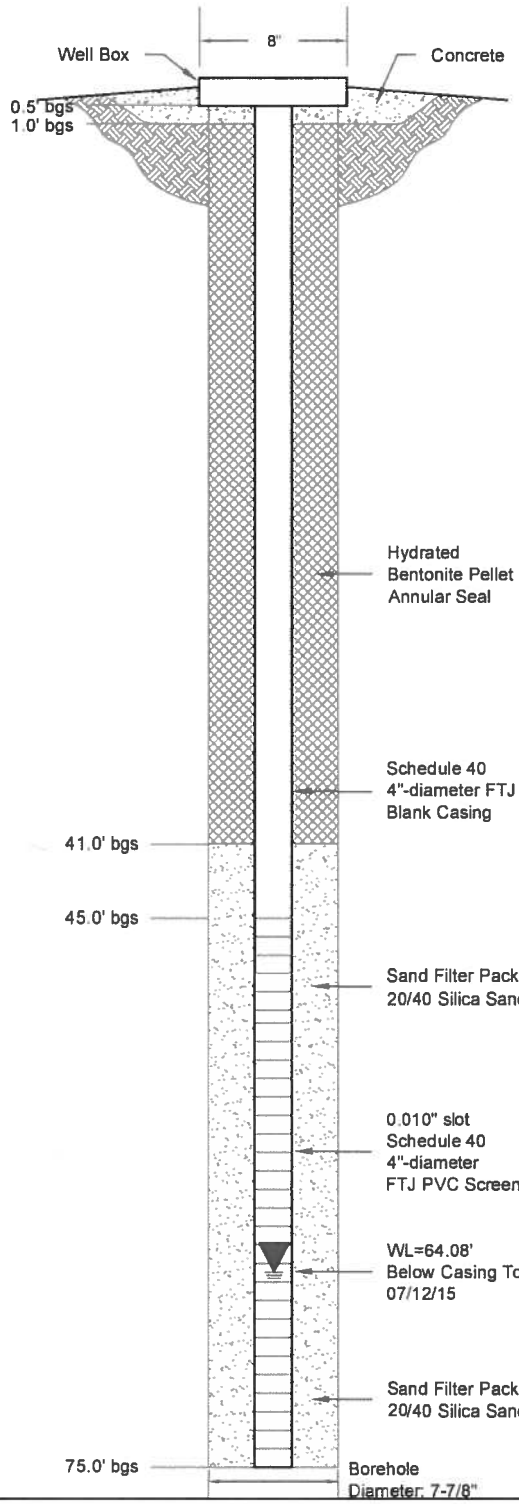
PROJECT
WALSTAD OIL COMPANY
LOVINGTON 66
LOVINGTON, NEW MEXICO

TITLE
DUAL PHASE EXTRACTION PILOT TEST WELL LOCATIONS

PROJECT NO.	TASK	REV.	FIGURE
140-4221	4	0	3

Path: \\afs\vancouver\Cad\2014 Projects\140221\PRODUCTION\ | File Name: 140421D001.dwg

FLUSH WELL DIAGRAM



SAMPLER TYPE	BLOW COUNTS	PID READING	USCS SOIL TYPE	DEPTH (FEET BGS)	SOIL DESCRIPTION
GRAB - CUTTINGS	NA	153.8	SL	0	ASPHALT SILTY SAND, SLIGHTLY MOIST, DARK BROWN (7YR, 7/2)
		2.7		5	CALICHE, WHITE TO PINK, SLIGHTLY MOIST, NO ODOR (7.5YR 7/2)
		0.0		10	
		25.7		15	CALICHE, SOME SILT, LIGHT BROWN WITH WHITE AND PINK, SLIGHTLY MOIST, NO ODOR (2.5YR, 6/3)
		15.4		20	CALICHE, LIGHT BROWN TO WHITE, SOME PINK, SLIGHTLY MOIST, NO ODOR (7.5YR, 7/2)
		7.8	CALICHE	25	
		7.6		30	
		9.7		35	CALICHE WITH GRAVEL (1/2" DIA.), WHITE TO PINK, SLIGHTLY MOIST, NO ODOR (7.5YR, 8/2)
		4.6		40	CALICHE SAND WITH GRAVEL (1/2" DIA.), WHITE TO PINK, SOME PINK, SLIGHTLY MOIST, NO ODOR (7.5YR, 7/2)
		18.4		45	SAME AS ABOVE WITH SOME SANDSTONE
		780.3		50	CALICHE WITH SAND AND SOME GRAVEL (1/4"-1/2"), LIGHT BROWN TO PINK, SOME ODOR, SLIGHTLY MOIST (7.5YR, 8/3)
		2709	CALICHE	55	
		2091		60	CALICHE SAND, STRONG ODOR, WHITE TO PINK, LIGHT BROWN, SLIGHTLY MOIST (7.5YR, 7/3)
		379.8		65	
		81.4	SL	70	CUTTINGS RETURNING, WET, SATURATED
				75	SAND WITH SILT, BROWN, WET, SLIGHT ODOR (7.5YR, 6/3)

Project:	Lovington 66
Drilling Company:	Harrison and Cooper
Drilling Rig/Bit:	Air Rotary Ingersol Rand OD - 7-7/8"
Driller:	Kenny Cooper
Start Date:	6/14/15
Completion Date:	6/14/15
Boring Depth:	75.0 feet below ground surface
Logged by:	Phillip Carrillo

LOVINGTON 66, 424 SOUTH MAIN
LOVINGTON, NEW MEXICO

BORING LOG/ WELL CONSTRUCTION DETAIL DPE-1
FIGURE 4

Golder Associates

\2014 Projects\1404221\PRODUCTION\Livington66-Log.dwg

APPENDIX A
PHOTOGRAPHIC LOG

Appendix A: Photographic Log

PHOTO 1 Drill rig setting up on DPE-1 location for drilling. 2015-06-14	
PHOTO 2 Cutting through the asphalt in the parking lot. Nominal diameter was 7-7/8". 2015-06-14	

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PHOTO 3 The first return on cuttings. Drill depth is approximately 5-ft BGS. 2015-06-14	
PHOTO 4 Cuttings were collected and transferred to 55-gal steel drums for off-site disposal. 2015-06-14	

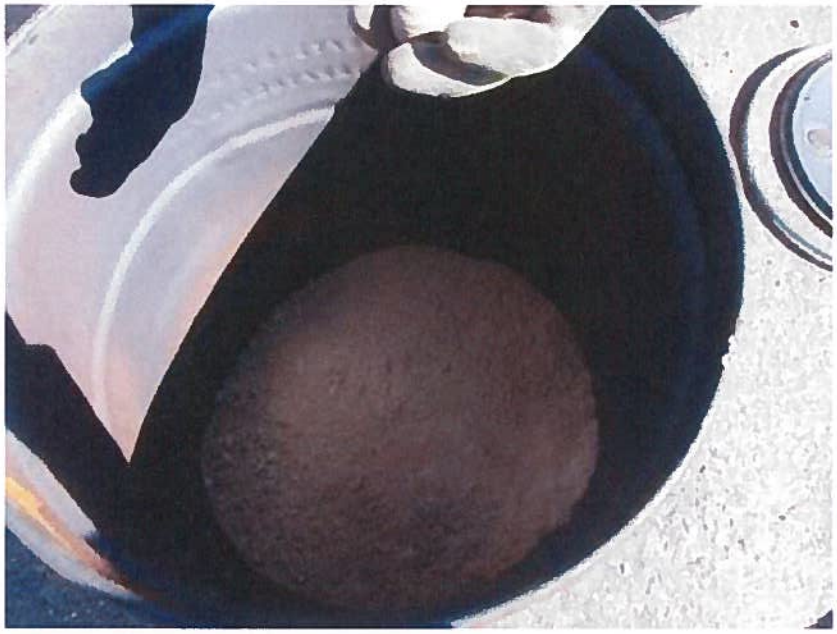
PHOTO 5 Some of the cuttings collected for off-site disposal. Composition was mostly Caliche with varying particle sizes. 2015-06-14	
PHOTO 6 Small amounts of cuttings were collected every 5-ft of drill depth for PID screening. Additionally a soil sample was collected from the interval producing the highest PID reading. 2015-06-14	

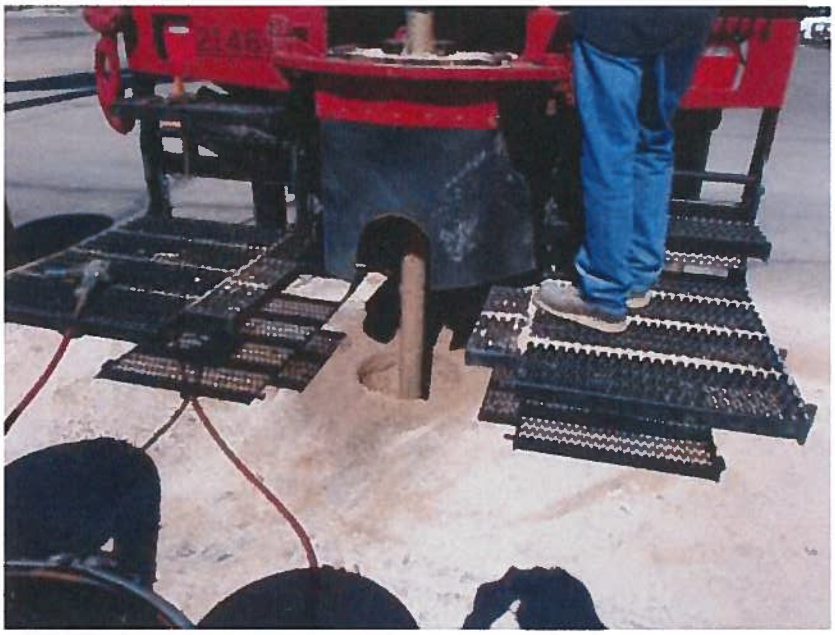
PHOTO 7 Drill encountered saturation at approximately 60-ft BGS. Cuttings return wet. 2015-06-14	
PHOTO 8 Lower section of 4-inch well being rigged for insertion into borehole. 2015-06-14	

PHOTO 9 Silica sand was packed around the well screen to approximately 3-ft above the top of the screen. 2015-06-14	
PHOTO 10 The well vault was flush mounted with concrete. The casing was cut approximately 6-inche BGS. 2015-06-14	

PHOTO 11 The final surface condition of DPE-1 2015-06-14	
PHOTO 12 Gandy was present onsite for developing well. Gandy was responsible for collecting and disposing of water from well development. 2015-06-14	

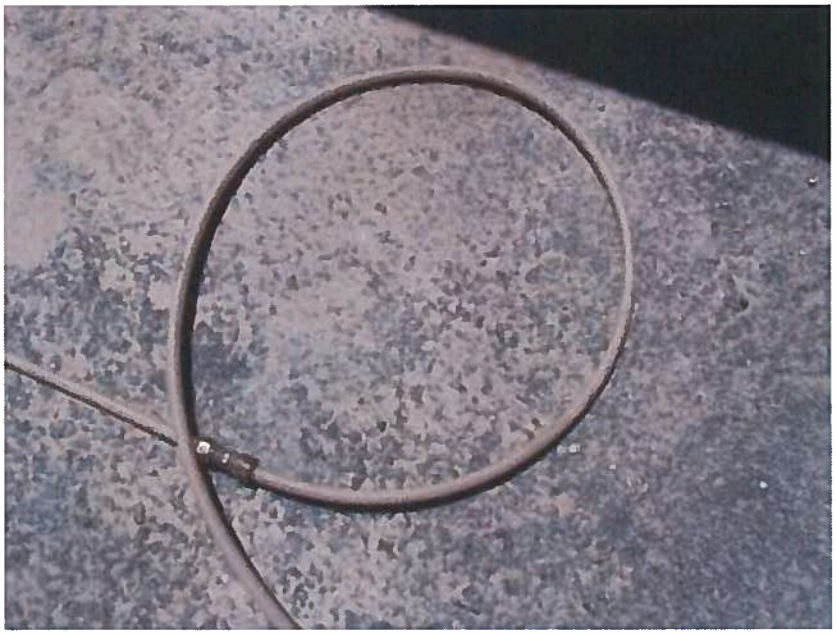
PHOTO 13 The water content of DPE-1 contained sediment and suspended solids. 2015-06-14	
PHOTO 14 DPE-1 was pumped until the water was clear and free of suspended solids. A total of approximately 150 gallons was pumped. 2015-06-14	

PHOTO 15 Five steel 55-gal drums were used for collecting cuttings and stored on-site. Gandy Marley retrieved the 55-gal drums for proper soil disposal. 2015-06-14	
PHOTO 16 AcuVac Inc. arrives on set with their rig setup for Pilot Testing. 2015-07-12	

PHOTO 17

The rig from AcuVac for producing the vacuum and oxidizing vapor contamination during the test.

2015-07-12

PHOTO 18

The pilot test was focused on DPE-1.

2015-07-13

PHOTO 19 W-1, W-2, & W-3 were used for monitoring during the test. Pictured is W-1. 2015-07-12	
PHOTO 20 W-2 is shown. 2015-07-12	

PHOTO 21 W-3 is shown. 2015-07-12	
PHOTO 22 AcuVac Inc. installing the apparatus for testing. 2015-07-12	

PHOTO 23 The testing setup is shown with the vacuum hose and flowmeter attached to DPE-1. 2015-07-12	
PHOTO 24 The rig was used to create the vacuum for the test and oxidize vapor contamination. 2015-07-12	

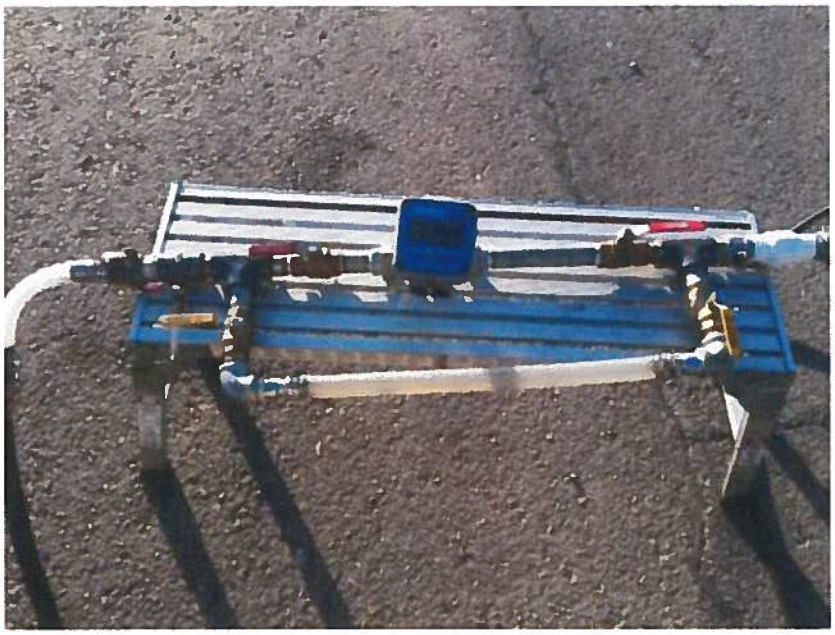
PHOTO 25 The pump test apparatus provided sight on water quality and a sampling port for collecting lab specimens. 2015-07-13	
PHOTO 26 The flow meter read flow rate and total gallons pumped. 2015-07-13	

PHOTO 27 A clear portion of the outlet hose shows the condition of water being pumped. 2015-07-13	
PHOTO 28 AcuVac periodically collected water samples to gauge NAPL content. 2015-07-13	

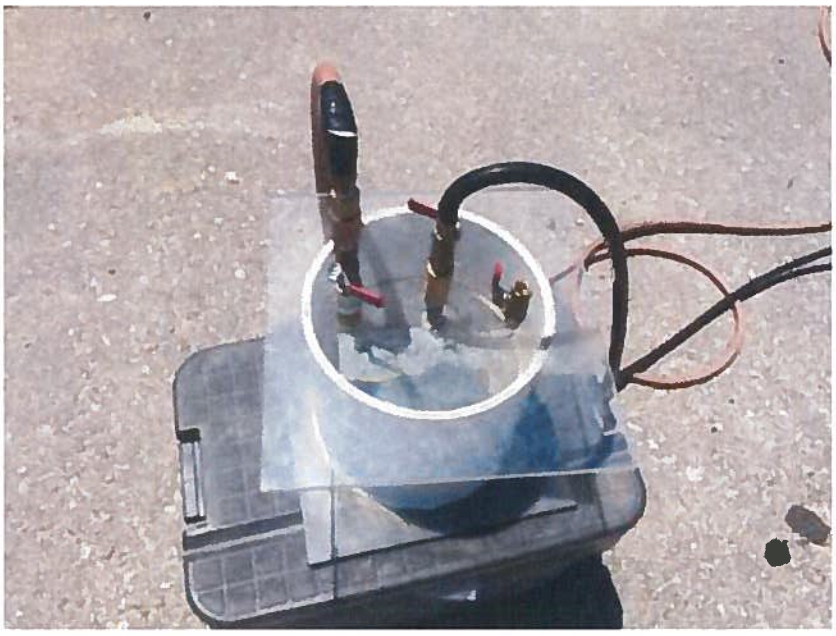
PHOTO 29 Bio-fouling material was observed during the pilot test on day two. 2015-07-13	
PHOTO 30 The testing apparatus for collecting air monitoring samples as well as the sample submitted for lab testing. 2015-07-12	

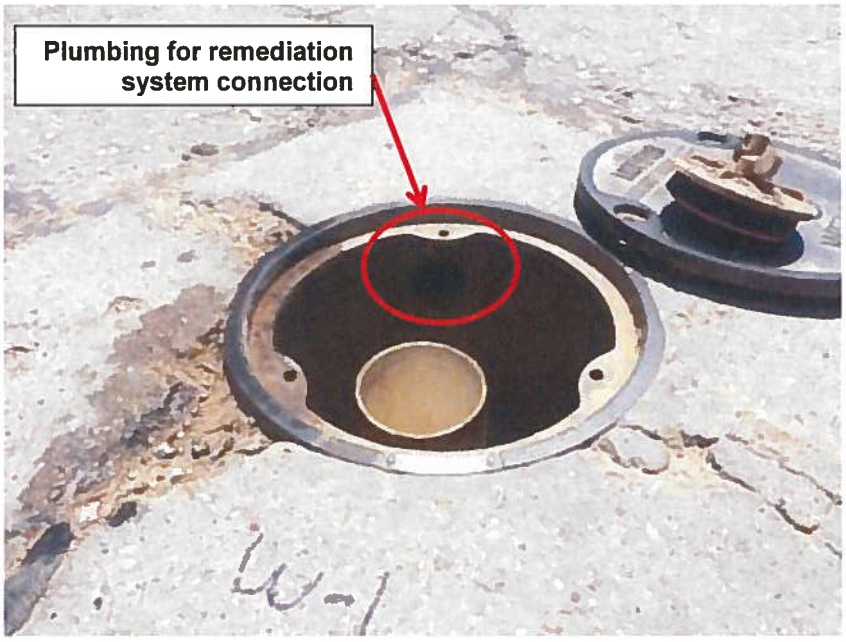
PHOTO 31 AcuVac checked the vacuum induced in the surrounding wells with a digital manometer. W-1 shown. 2015-07-12	
PHOTO 32 AcuVac checked the vacuum induced in the surrounding wells with a digital manometer. W-2 shown. 2015-07-12	

PHOTO 33 All produced water was containerized by Gandy in a tanker truck and sent off-site for proper disposal. 2015-07-12	
PHOTO 34 During testing, plumbing connections for a remediation system was noted. W-2 is shown. 2015-07-13	

PHOTO 35

During testing, plumbing connections for a remediation system was noted. W-1 is shown.

2015-07-13



APPENDIX B
ACCESS AGREEMENTS

THIS DOCUMENT MAY NOT BE RECORDED

City, State: Lovington, NM
Address: 410 S. Main
L/C: 030-0087
RE File # 14922

LICENSE TO INSTALL MONITORING WELLS

This License to Install Monitoring Wells ("**License**") is dated March 10, ~~2014~~ 2015, between **McDONALD'S CORPORATION,** a Delaware corporation of One McDonald's Plaza, Oak Brook, IL 60523 ("**McDonald's**"), Golder Associates, Inc., a New Mexico corporation, of 5200 Pasadena N.E., Suite C, Albuquerque, NM 87113 ("**Consultant**"), and Mr. Robert Murrell, Designated Representative of Walstad Oil Company, ("**Licensee**").

RECITALS

A. McDonald's leases the real property located at 410 S. Main, Lovington, NM legally described on Exhibit A (the "**Property**") from Pearson Oil Company, which has already granted to Consultant and a Right of Entry dated June 2, 2014, which is attached hereto as Exhibit D;

B. McDonald's leases the Property to Kenneth Fadke ("**Operator**"), who operates a McDonald's restaurant on the Property;

C. Licensee and Consultant desire to enter onto the Property to install up to three groundwater monitoring wells and to perform environmental investigations in connection with Licensee's investigation of the Property; and

D. McDonald's is willing to grant Licensee and Consultant a license for these purposes pursuant to the terms below.

AGREEMENT

Now, therefore, in consideration of the terms below and other good and valuable consideration, the receipt and sufficiency of which are acknowledged by the parties, the parties agree as follows:

1. License Grant. Subject to the terms of this License, McDonald's grants to Licensee and Consultant (collectively referred to as "**Licensee Parties**"), a revocable, non-exclusive license to enter upon a portion of the Property as necessary for the purposes of: install up to three groundwater monitoring wells and vacuum extraction wells in the locations shown on the attached Figure 1 ("**Wells**"); conduct a utility mark out in the vicinity of the proposed well locations; conduct a pilot vacuum extraction test; periodically gauge, monitor, survey or sample the Wells; after completion of the work as determined by governmental authorities, plug and abandon the Wells in compliance with all applicable laws; dispose of all samples off-site in accordance with applicable law; and after the completion of the work as determined by governmental authorities, remove any equipment brought onto the Property in connection with

the work, and restore any portion of the Property damaged by the work to as close to its condition existing at the time the work began as is reasonably possible; and access to and from the Property as necessary for purposes of conducting the foregoing activities (collectively the **"Authorized Activities"**), as further described in the Work Plan attached as Exhibit B. Figure 1 and Exhibit B are incorporated into and made a part of this License. The Authorized Activities include only pilot testing for the vacuum extraction contemplated for future remediation of the Property, and specifically does not include any future vacuum extraction activities, which will require a separate agreement.

2. Licensee Parties' Work Under This License. Licensee Parties, at their sole expense, jointly and severally agree as follows:

a) Licensee Parties will perform the Authorized Activities on the Property in a good and workmanlike manner. Licensee Parties will exercise their rights and perform the Authorized Activities under this License in compliance with all applicable laws, rules, regulations, ordinances, and guidance documents of any governmental agency with authority over the Authorized Activities, including the applicable environmental agency (**"Environmental Agency"**).

b) Licensee Parties will give written notice to McDonald's and verbal notice to the Regional McDonald's Property Manager for the Property Samantha Metzger Jupe (2140 460 9823 at least 10 days prior to each entry onto the Property for the purpose of conducting the Authorized Activities, which notice will specify the work to be performed, the date(s) when the work will be initiated, and an estimated date of completion. McDonald's will have the right, at its expense, to split samples during any sampling event by Licensee Parties.

c) Immediately upon completion of any Authorized Activities on the Property, Licensee Parties will restore the surface of the areas that were disturbed to the same condition as existed before the work commenced and to a safe condition, and will remove all of their equipment, tools, debris, and investigation-derived waste. Licensee Parties, in the name of Licensee or Consultant, will execute all manifests and other documentation associated with removal of waste residuals generated and removed from the Property and will select the disposal facility for such wastes.

d) Licensee Parties will contact the appropriate authorities in accordance with relevant law prior to commencing any subsurface activity as part of the Authorized Activities under this License. McDonald's makes no representation or warranty regarding the presence or absence of utilities in any given location on the Property, notwithstanding Licensee Parties' selection and identification of the locations for the Wells on Figure 1.

e) The Wells will be installed, maintained, and repaired in a workmanlike condition and in a manner that is reasonably secure from vandalism and any unauthorized use, including, without limitation, the installation of secure locking caps.

f) In connection with installation of the Wells, Licensee Parties will employ such boring and plugging techniques as necessary to protect aquifers from any contamination

and to prevent movement of any contamination from one stratum to another. The Wells will be flush-mounted and installed in conformance with the specifications contained on Figure 2.

g) Licensee Parties will not move, remove or demolish any of McDonald's signs, access drives, curbing or other improvements on the Property. If McDonald's future operational or construction needs require the relocation of one or more of the Wells, Licensee Parties will properly abandon and/or relocate the Wells at a time specified by McDonald's at no expense to McDonald's.

h) Licensee Parties will separate, by use of cones or other construction safety barriers, the areas surrounding the location where Licensee Parties perform any Authorized Activities. Licensee Parties will not park on or store any construction vehicles, equipment or materials on the Property when activity related to the Authorized Activities is not actively in progress.

i) Licensee Parties will not unduly disrupt the operation of the McDonald's restaurant on the Property. While the restaurant is open for business, Licensee Parties will not (1) block more than five parking stalls at any one time; (2) block in any manner more than the drive aisles shown on the drawings attached on Figure 1, which permit closure only of the two curb-cuts in the southeast corner of the Property at any time; or (3) perform any work in or obstruct any drive-thru lane. Licensee Parties will complete all Authorized Activities on three different Sundays, and the location of the areas permitted to be blocked off on each day of work are shown on Figure 1. If possible, Consultant will install the Wells with a hand auger. If that is not possible, then the drilling equipment will be positioned in the locations identified on Figure 1 and will be removed from the Property upon completion of the installation of the Wells and within the time period specified above. Licensee Parties will perform all aspects of the Authorized Activities other than installation of the Wells (such as sample collection) on any days and at any time other than during the following time periods: 7:00 am through 10:00 am; 11:30 am through 1:30 pm; and 5:00 pm through 7:00 pm.

j) Licensee Parties will perform all of the Authorized Activities under this License and any other activity related to this License at their own expense and will not allow any mechanics' or other lien to be placed on the Property with respect to the Authorized Activities. Should any such lien arise due to the acts or omissions of Licensee Parties or subcontractors working on behalf of Licensee Parties, Licensee Parties will, no later than 30 days from the claim of such lien, fully discharge the lien at their expense. McDonald's is not required to perform any activity or incur any expense for any purpose under this License, except as otherwise expressly stated in this License.

3. Sampling. Licensee Parties will permit the samples collected as part of the Authorized Activities to be analyzed only for the Volatile Organic Compounds by EPA Method 8260B, as listed on Exhibit C, and no other analytes without the written consent of McDonald's provided in advance of collecting the sample(s). Licensee Parties will provide McDonald's with a copy of all sampling results from samples taken from the Property promptly upon Licensee Parties' receipt of the sampling data. Simultaneously with submittal to the Environmental Agency, Licensee Parties will also provide McDonald's with copies of all correspondence, reports, and submittals

made to the Environmental Agency which include any sample results from the Property or any other data or information generated as part of any of the Authorized Activities. Upon request by McDonald's, Licensee Parties will also provide to McDonald's copies of field notes, boring logs, and other information generated or gathered in the course of executing any of the Authorized Activities.

4. Term. The term of this License will be for three days of work (each, a "Site Visit") over the course of the term of the License, which will commence on the date of this License aand terminate on the date that is the earlier of (a) the day after the third Site Visit on which Consultant conducts the Authorized Activities, and (b) December 31, 2014. Licensee Parties will properly abandon the Wells in accordance with all applicable laws, rules and protocol established by the Environmental Agency upon the expiration or earlier termination of this License, unless otherwise agreed in writing by the parties.

5. Indemnity. Licensee Parties, jointly and severally, will indemnify, defend, release and hold harmless McDonald's, Operator, and their subsidiaries and affiliates, from and against any and all claims, losses, causes of action, judgments, settlements, fines, penalties, damages including economic, direct, indirect and consequential damages, injury to persons and damages to property, costs and expenses, including reasonable attorneys' fees and costs (collectively "**Claims**") arising out of, in connection with, resulting from, or incidental to, directly or indirectly: (a) the performance of the Authorized Activities; (b) any acts, errors or omissions by the Consultant and/or its employees, agents, representatives, sub-consultants, or any other person acting directly or indirectly through or under the Consultant, or for subrogation actions initiated by the Consultant or the Consultant's workers' compensation insurance carrier, or for any other matter based on the Consultant's workers' compensation insurance; (c) any actual or alleged violation of any applicable federal, state or local laws, regulations, ordinances, administrative orders or rules; and/or (d) any actual or alleged breach by the Consultant or Licensee of any of their respective representations, warranties and/or obligations in this License. Licensee Parties' obligations under this License will not be negated or reduced by virtue of an insurance carrier's denial of coverage for the occurrence or event which is the subject matter of the claim or refusal to defend. This indemnification will survive the expiration or earlier termination of this License and will apply whether or not arising out of any claim by a third party.

6. Insurance.

a) The Consultant will procure and maintain in effect during the term of this License the insurance coverages described below, which insurance will be placed with insurance companies authorized to do business in the state in which the Property is located, rated A – VIII or better by the current edition of Best's Key Rating Guide and approved in advance in writing by McDonald's.

(1) Professional Liability Errors and Omissions Insurance, which will include contractual liability coverage on a per claim and aggregate limits of not less than $1,000,000.00 covering the Consultant and the Consultant's employees and anyone, including consultants (who may provide such coverage under their own policy) for whom the Consultant is liable or contracts with to perform any of the Authorized Activities. Consultant will maintain this coverage in effect during the term of the License and for 3 years after the expiration or earlier termination of this License.

Consultant will give prompt written notice to McDonald's of any and all claims made against this policy during the period in which this policy is required to be maintained pursuant to this License.

(2) Commercial General Liability Insurance, which will have coverage and terms comparable to an ISO CG-0001 form including personal injury, products and completed operations liability, with Bodily Injury and Property Damage limits of $5,000,000.00 per occurrence, and Advertising and Personal Injury limits of $5,000,000.00 per person or organization. This insurance will include coverage of the tort liability assumed by the Consultant in this License. The completed operations liability coverage will be maintained for 4 years after expiration or earlier termination of this License.

(3) Workers' Compensation Insurance, which will have statutory benefits and limits compliant with applicable state law, and Employer's Liability Insurance with limits of $1,000,000.00 per accident covering the Consultant and the Consultant's employees.

(4) Business Automobile Liability Insurance, including owned, non-owned, and hired vehicles, which will have coverage of not less than $1,000,000.00 for bodily injury and property damage for each accident.

(5) Any insurance coverage required by law and/or governmental agency with respect to the performance of Authorized Activities.

b) As to the policies identified in Sections 7(a)(2), 7(a)(4) and 7(a)(5) above, McDonald's and the Operator, will be named as additional insureds. These policies will be primary insurance for all additional insureds. All policies, with the exceptions of Professional Liability Errors and Ommissions Insurance will be endorsed to provide a waiver of rights of subrogation in favor of the additional insureds. The Consultant will be required to furnish evidence to McDonald's of insurance in form of certificates of insurance before commencing the Authorized Activities.

c) The Consultant will not make changes in nor allow the required insurance coverages to lapse without McDonald's prior written approval.

d) Consultant will give McDonald's 30 days prior notice of any cancellation of that policy or material change in coverage.

7. Waiver of Claims. Consultant acknowledges that it enters onto the Property and performs the Authorized Activities at its own risk. Licensee, and Consultant, for themselves and their officers, directors, shareholders, members, affiliates, agents, employees and subcontractors, waive any and all Claims arising out of, in connection with, resulting from, or incidental to, directly or indirectly, the conditions of the Property and any improvements on the Property.

8. Default. Any failure of Licensee, Consultant or Licensee Parties to perform any of their respective obligations set forth in this License will constitute a default. In the event of a default,

McDonald's may submit written notice of the default to the defaulting party and, if the default continues for 10 business days after receipt of notice from McDonald's, then McDonald's may terminate the Licensee Parties' right of access to the Property, cure the default and pursue any remedies available under applicable laws. If McDonald's cures the default, then Licensee Parties will reimburse McDonald's for the costs incurred within 30 days after receipt of McDonald's written demand for reimbursement. If Licensee Parties fail to pay any such sum when due, Licensee Parties will pay interest on the amount due at a rate which is the greater of: (1) 15% per year; or (2) the maximum rate allowed by law, from the date due to the date of payment in full. A default by Licensee or Consultant individually of any obligation imposed under this License will be deemed a default by Licensee Parties.

9. Survival of Obligations. Licensee Parties' obligations under this License that do not expressly survive the expiration of the term of this License will not cease until Licensee Parties have (a) removed all of their equipment from the Property in accordance with all applicable laws, regulations and orders of the Environmental Agency, (b) closed and sealed the Wells in such a manner so that they do not present a hazard or nuisance on the Property in the sole opinion of McDonald's, and (c) restored the Property to a state and appearance similar to the balance of the Property.

10. Notices. All notices under this License will be in writing and delivered by U.S. certified mail or overnight courier with proof of receipt, to the Designated Representative of the Licensee at 2317 Tuttington Circle, Oklahoma City, OK 7317, and to Consultant at 5200 Pasadena N.E., Suite C, Albuquerque, NM 87113 and to McDonald's at One McDonald's Plaza, Oak Brook, Illinois 60523, Attn: Director, U.S. Legal Dept. #091, L/C: 030-0087. Any party may lodge a change of address by sending notice of such change under this Section. Each notice will be deemed to have been given at the time it is deposited in the United States Mail, or upon receipt if sent by overnight courier.

12. No Liability. The granting of this License by McDonald's is not an admission of liability on the part of either McDonald's or any of its affiliates, successors or assigns, for any contamination discovered on or from the Property.

13. Assignability. This License may not be transferred or assigned by Licensee without the prior written consent of McDonald's.

14. Governing Law. This License and every term and provision in this License will be construed in accordance with the laws of the State in which the Property is located without giving effect to the principles of conflicts of laws.

15. Miscellaneous. This License is binding upon and inures to the benefit of the successors and assigns of each of the parties. This License contains a complete expression of the agreement between the parties, and there are no other promises, representations or inducements between them concerning the subject matter in this License. Each provision in this License is severable. If any provision of this License is held to be invalid, illegal or unenforceable in any respect, that provision will not affect any other provision or the validity of the remainder of this License. This License may only be modified by the written agreement of the parties to this License.

[SIGNATURE PAGE TO FOLLOW]

In witness whereof, the parties have executed this License on the first date written above.

LICENSEE:

By: _____

Its: Designated Representative of Walstad Oil Company

STATE OF OKLAHOMA)
) SS.
COUNTY OF CLEVELAND)

Acknowledged before me in OKLAHOMA County, OKLAHOMA on FEB 11, 2015, by [illegible] the D.R. of WALSTAD OIL, a N.M. CORP. on behalf of the CORP.

_____
JOSHUA NEUMANN, Notary Public

My commission expires 06/11/2018

JOSH NEUMANN NOTARY # 14005249 EXP. 06/11/18 PUBLIC STATE OF OKLAHOMA

Document #: 1387579-v1

CONSULTANT:

By: Robert Newcomer
Its: Associate

STATE OF New Mexico)
) SS.
COUNTY OF Bernalillo)

Acknowledged before me in Bernalillo County, NM, on August 11, 2014, by Robert Newcomer the Associate of Golder Assoc. a Georgia Corporation on behalf of the _____.

Marie Sanchez, Notary Public

My commission expires 3/1/2018

OFFICIAL SEAL
Marie Sanchez
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: _____

McDONALD'S:

McDONALD'S CORPORATION, a Delaware corporation

By: _____
Its: Corporate Assistant Secretary

CW

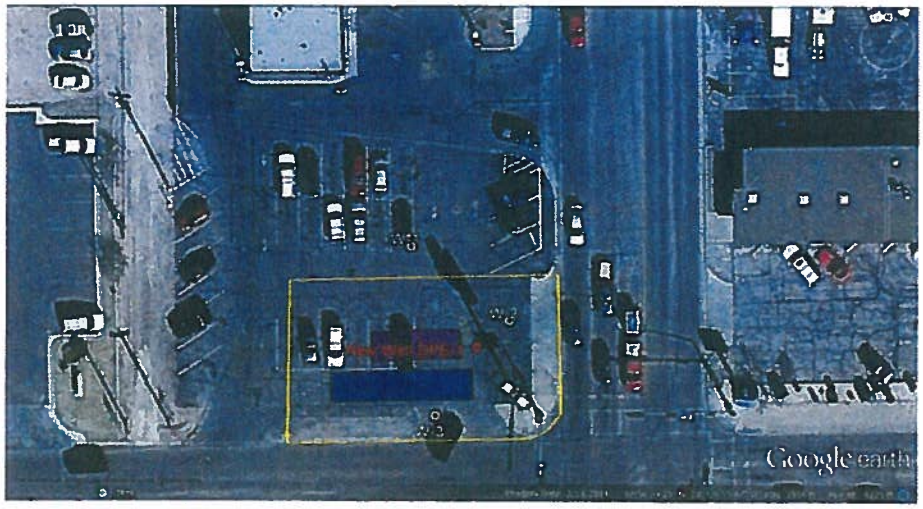
Document #: 1387579-v1

FIGURE 1

[***Depict location of wells, as applicable***]

Site work period 1.--working footprints for pre-pilot tests on existing wells.

Site work period 2.--working footprints for pilot test well installation.



Site work period 3.--working footprint for multiphase extraction pilot test.

Figure 1.--Attachment to McDonald's Lovington NM Site Access Agreement.

FIGURE 2

[*Well installation specifications, as applicable*]

Figure 2.--Well installation specifications

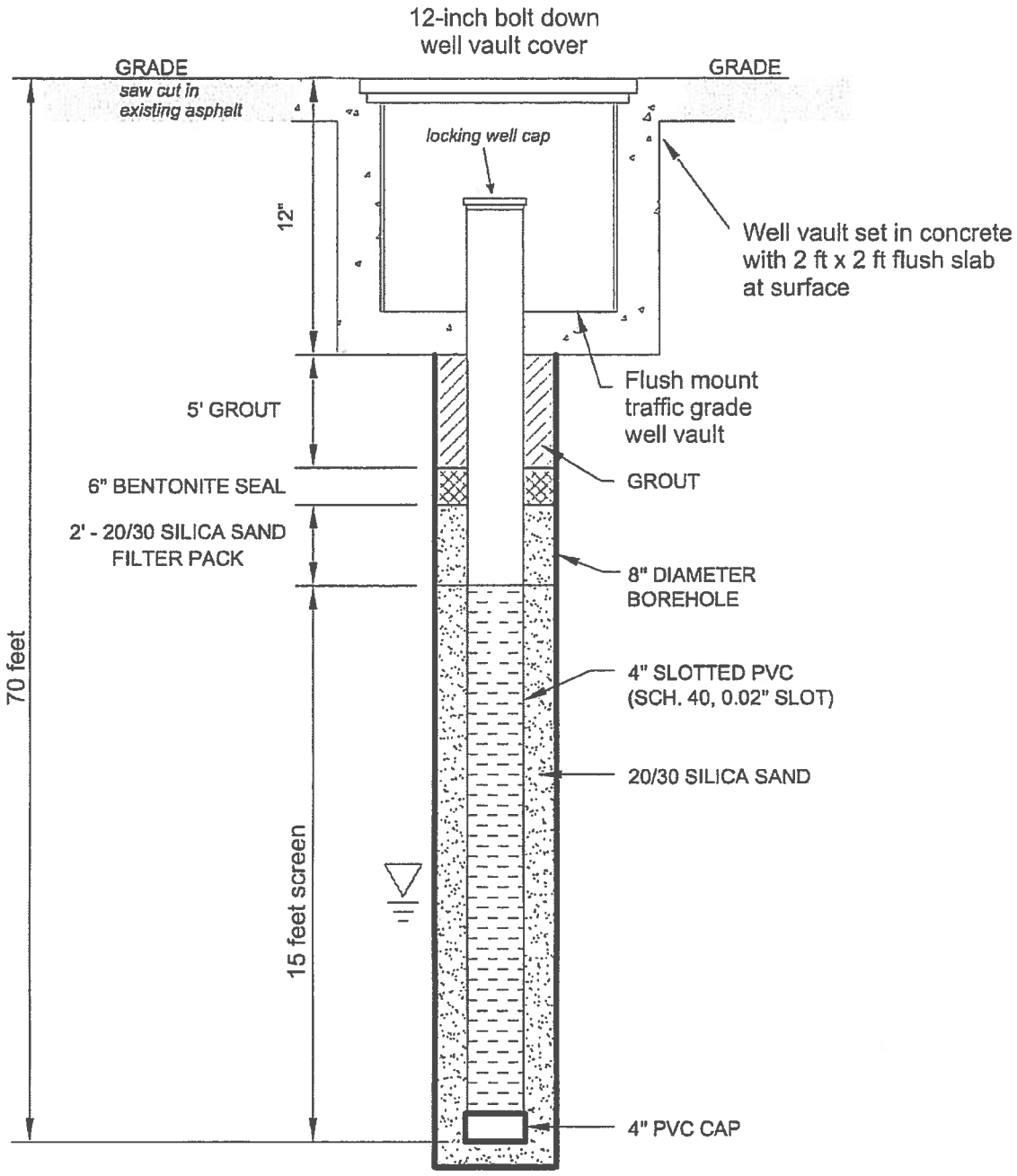
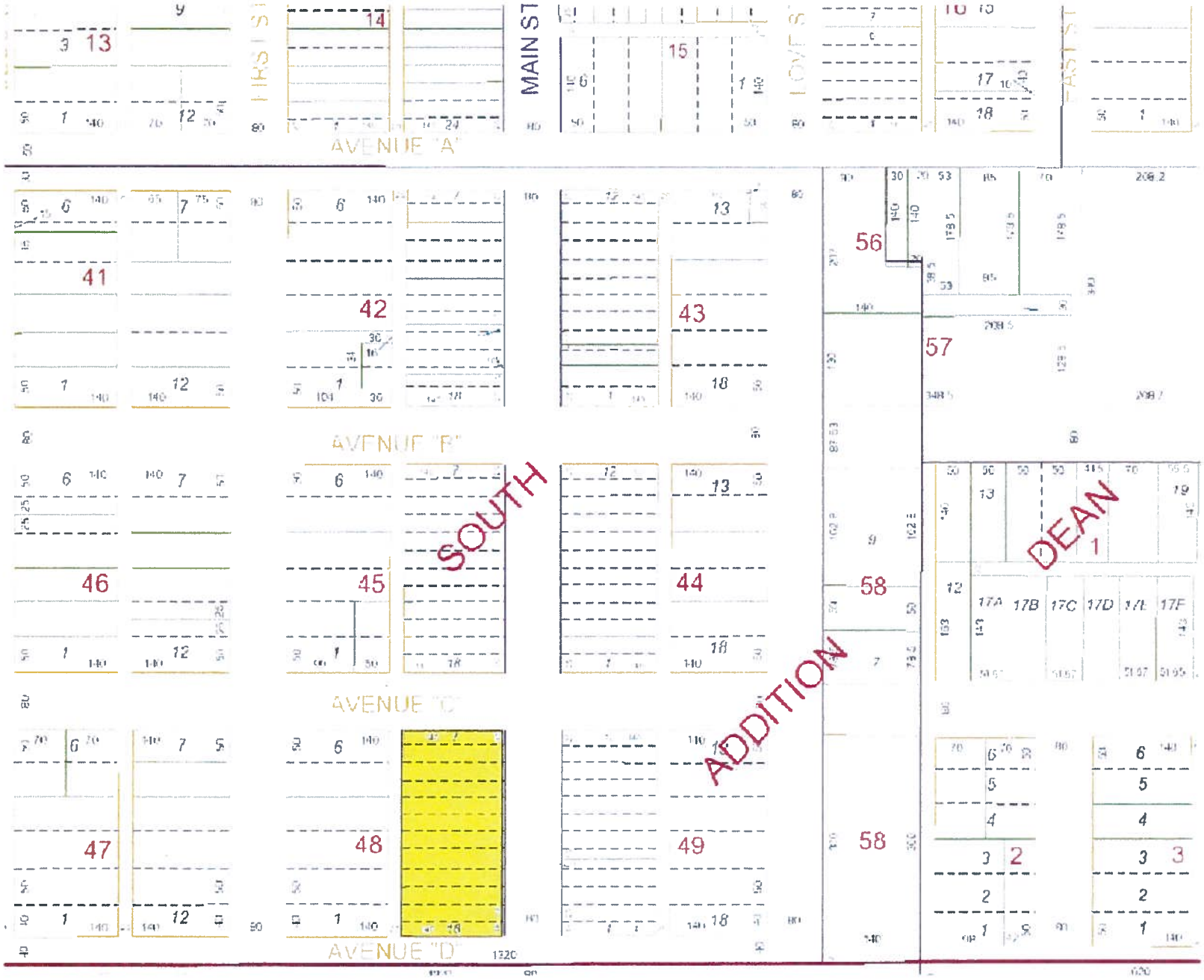
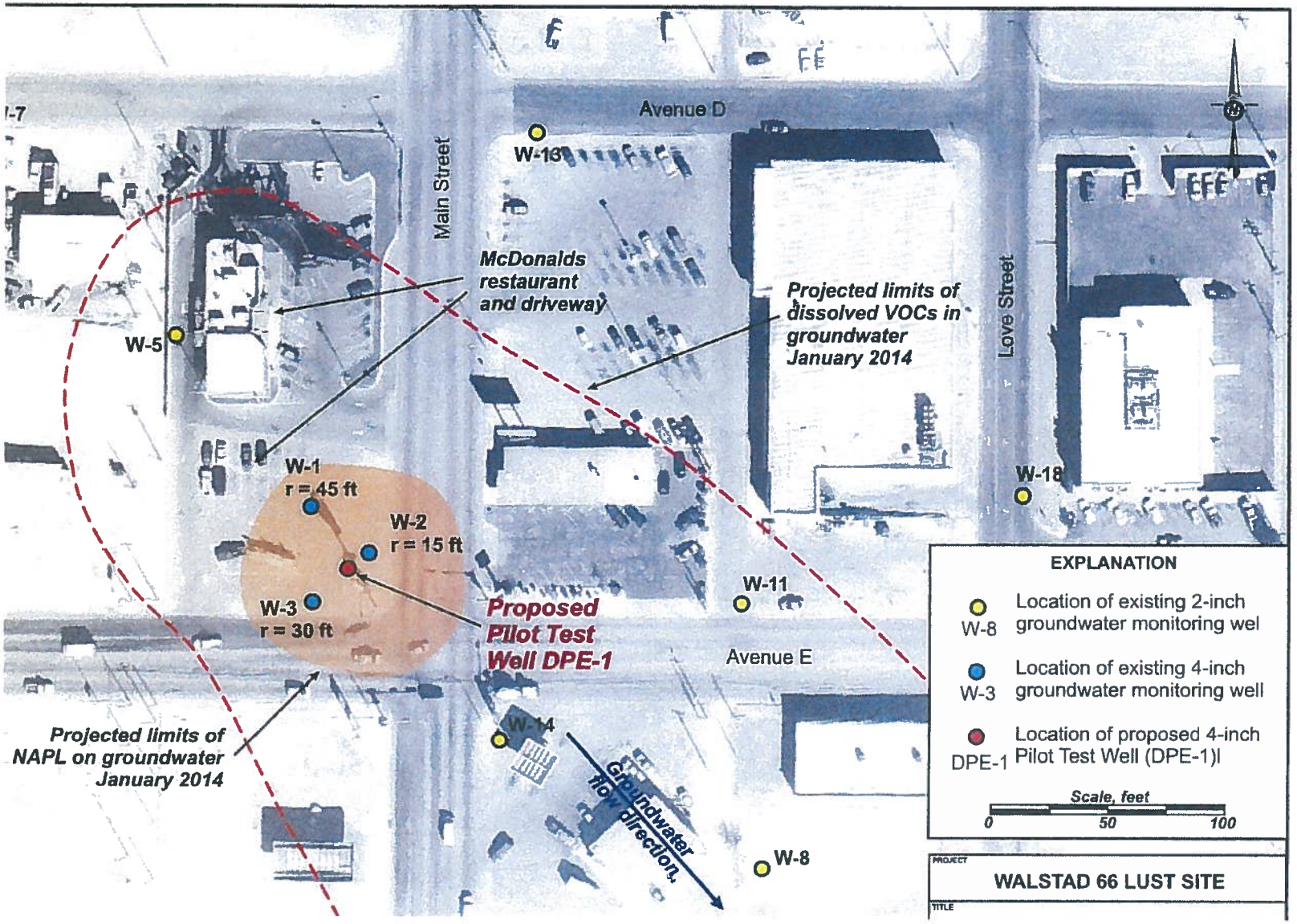


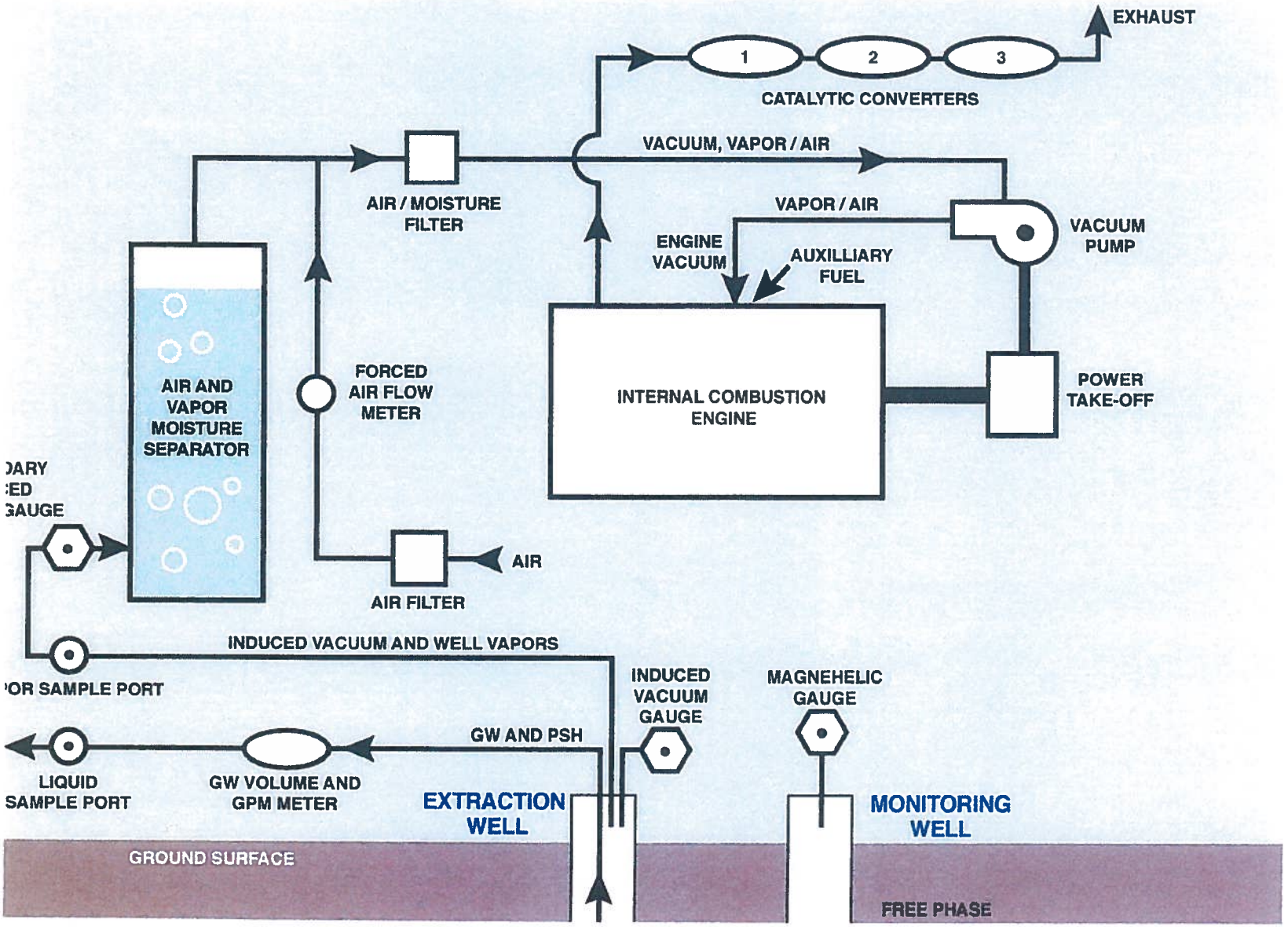
EXHIBIT A

PROPERTY LEGAL DESCRIPTION



Property described as: Lots 7-18 of Tract 48, South Addition, Lovington New Mexico


Avenue D
Main Street
Love Street
Avenue E
W-16
W-5
W-18
W-11
W-14
W-8
W-1
r = 45 ft
W-2
r = 15 ft
W-3
r = 30 ft
McDonalds restaurant and driveway
Projected limits of dissolved VOCs in groundwater January 2014
Proposed Pilot Test Well DPE-1
Projected limits of NAPL on groundwater January 2014
Groundwater flow direction
EXPLANATION
W-8 Location of existing 2-inch groundwater monitoring wel
W-3 Location of existing 4-inch groundwater monitoring well
DPE-1 Location of proposed 4-inch Pilot Test Well (DPE-1)l
Scale, feet
0
50
100
PROJECT
WALSTAD 66 LUST SITE
TITLE


EXHAUST
1
2
3
CATALYTIC CONVERTERS
VACUUM, VAPOR / AIR
AIR / MOISTURE FILTER
VAPOR / AIR
VACUUM PUMP
ENGINE VACUUM
AUXILLIARY FUEL
AIR AND VAPOR MOISTURE SEPARATOR
FORCED AIR FLOW METER
INTERNAL COMBUSTION ENGINE
POWER TAKE-OFF
DARY ED GAUGE
AIR
AIR FILTER
INDUCED VACUUM AND WELL VAPORS
OR SAMPLE PORT
INDUCED VACUUM GAUGE
MAGNEHELIC GAUGE
GW AND PSH
LIQUID SAMPLE PORT
GW VOLUME AND GPM METER
EXTRACTION WELL
MONITORING WELL
GROUND SURFACE
FREE PHASE

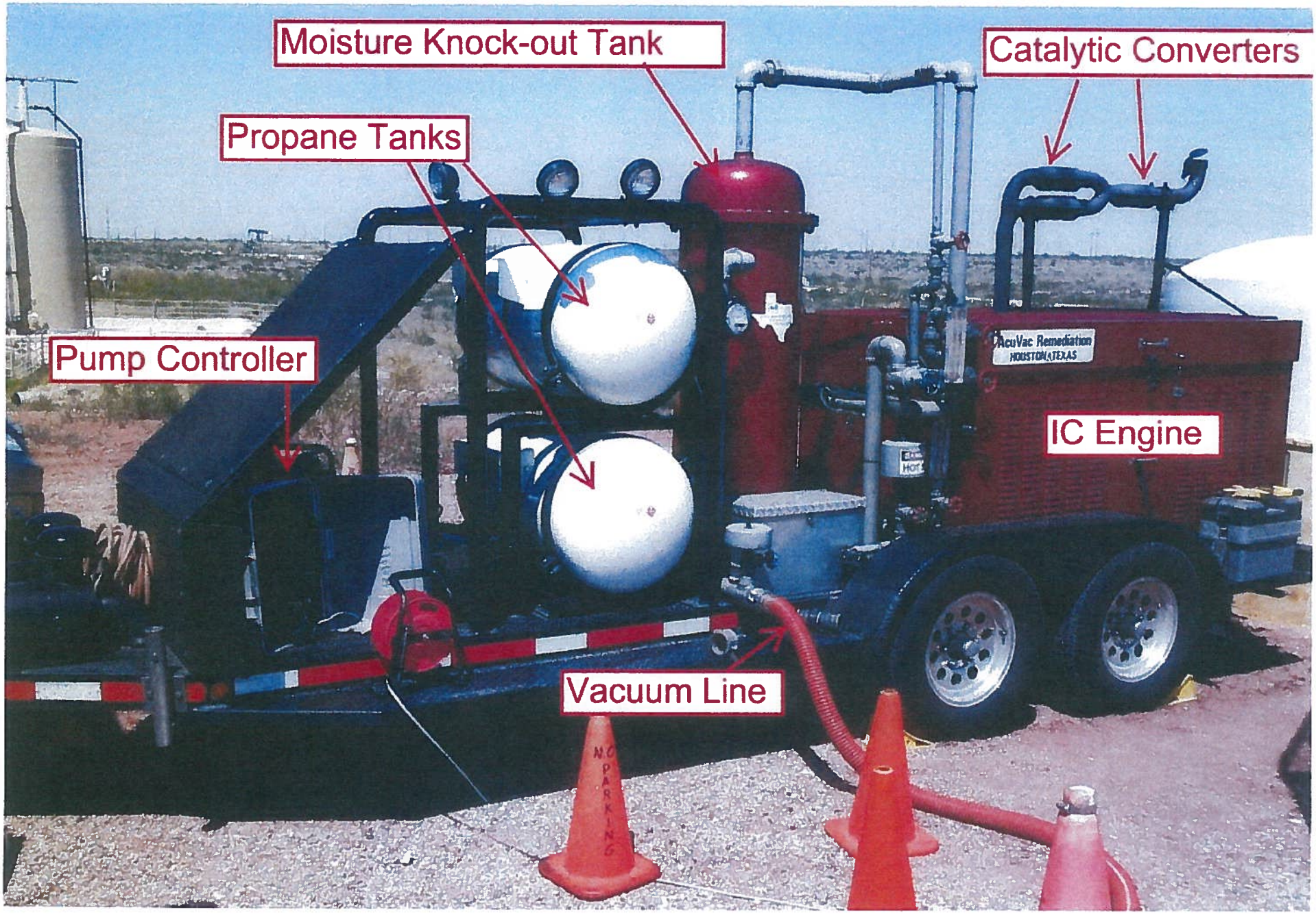

Moisture Knock-out Tank
Catalytic Converters
Propane Tanks
Pump Controller
AcuVac Remediation
HOUSTON,TEXAS
IC Engine
Vacuum Line
NO PARKING

EXHIBIT C

LABORATORY TESTING ANALYTES

Table 1B. Target Compound List, CAS Numbers, and Contract Required Quantitation Limits for Volatile Organic Compounds by Method 8260

Analyte	CAS Number	CROL •g/L[a]	CROL •g/Kg[b]
Benzene	71-43-2	1	5
Bromobenzene	108-86-1	1	5
Bromochloromethane	74-97-5	1	5
Bromodichloromethane	75-27-4	1	5
Bromoform	75-25-2	1	5
Bromomethane	74-83-9	1	5
n-Butylbenzene	104-51-8	1	5
sec-Butylbenzene	135-98-8	1	5
tert-Butylbenzene	98-06-6	1	5
Carbon tetrachloride	56-23-5	1	5
Chlorobenzene	108-90-7	1	5
Chlorodibromomethane	124-48-1	1	5
Chloroethane	75-00-3	1	5
Chloroform	67-66-3	1	5
Chloromethane	74-87-3	1	5
2-Chlorotoluene	95-49-8	1	5
4-Chlorotoluene	106-43-4	1	5
1,2-Dibromo-3-chloropropane	96-12-8	1	5
1,2-Dibromoethane	106-93-4	1	5
Dibromomethane	74-95-3	1	5
1,2-Dichlorobenzene	95-50-1	1	5
1,3-Dichlorobenzene	541-73-1	1	5
1,4-Dichlorobenzene	106-46-7	1	5
Dichlorodifluoromethane	75-71-8	1	5
1,1-Dichloroethane	75-34-3	1	5
1,2-Dichloroethane	107-06-2	1	5
1,1-Dichloroethene	75-35-4	1	5
cis-1,2-Dichloroethene	156-59-2	1	5
trans-1,2-Dichloroethene	156-60-5	1	5

1,2-Dichloropropane	78-87-5	1	5
2,2-Dichloropropane	594-20-7	1	5
1,3-Dichloropropane	142-28-9	1	5
1,1-Dichloropropene	563-58-6	1	5
Ethylbenzene	100-41-4	1	5
Hexachlorobutadiene	87-68-3	1	5
Isopropylbenzene	98-82-8	1	5
p-Isopropyltoluene	99-87-8	1	5
Methylene chloride	75-09-2	1	5
Naphthalene	91-20-3	1	5
n-Propylbenzene	103-65-1	1	5
Styrene	100-42-5	1	5
1,1,1,2-Tetrachloroethane	630-20-6	1	5
1,1,2,2-Tetrachloroethane	79-34-5	1	5
Tetrachloroethene	127-18-4	1	5
Toluene	108-88-3	1	5
1,2,4-Trichlorobenzene	120-82-1	1	5
1,2,3-Trichlorobenzene	87-61-6	1	5
1,1,1-Trichloroethane	71-55-6	1	5
1,1,2-Trichloroethane	79-00-5	1	5
Trichloroethene	79-01-6	1	5
Trichlorofluoromethane	75-69-4	1	5
1,2,3-Trichloropropane	96-18-4	1	5
1,2,4-Trimethylbenzene	95-63-6	1	5
1,3,5-Trimethylbenzene	108-67-8	1	5
Vinyl chloride	75-01-4	1	5
o-Xylene	95-47-6	1	5
m-Xylene	108-38-3	1	5
p-Xylene	106-42-3	1	5
Methyl-t-butyl ether	163-40-44	1	5
Dichlorofluoromethane	75-43-4	1	5

[a] Based on 25 mL water purge. [b] Based on wet weight

Golder Associates Inc.
5200 Pasadena Blvd NE, Suite C
Albuquerque, NM USA 87113
Telephone: (505) 821 3043
Fax: (505) 821-5273

May 30, 2014

Our Ref.: 140-1221

Mr. Keith Pearson
KW Fuels – Pearson Oil Company
717 Sanger Street
Hobbs, NM 88240

RE: ACCESS AGREEMENT FOR ENVIRONMENTAL MONITORING WELL INSTALLATION AND TESTING, FORMER LOVINGTON 66 LUST SITE, 424 SOUTH MAIN ST, LOVINGTON, NM

Dear Mr. Pearson:

Per our discussion, attached is the right of entry form allowing Golder Associates Inc. access to the above referenced Pearson Oil Company property in the southeast corner of the McDonald's restaurant parking area as indicated on Figure 1. We request authorization to enter the property to install up to two monitor wells, as well as to perform vacuum extraction pilot testing on the site wells. If you consent, please sign and fax or email the agreement to me at your earliest convenience.

Please call me at 505/821-3043 if you need additional information or have any questions regarding the access agreement. Thank you for your consideration and effort in this matter.

Sincerely,
GOLDER ASSOCIATES INC.

Clay Kilmer
Sr. Hydrogeologist

Attachments: Right of Entry Form
Figure 1 – Site Map and Proposed Pilot Test Well Locations

LCK/lck

Golder Associates Inc.
5200 Pasadena N.E., Suite C
Albuquerque, NM USA 87113
Telephone (505) 821-3043
Fax (505) 821-5273
www.golder.com

Golder Associates

RIGHT OF ENTRY FORM
GOLDER ASSOCIATES INC.

The undersigned, who is (are) the fee owner(s) of record (hereinafter referred to as Owner) with the sole right to the property in question, does hereby consent and grant Golder Associates Inc., its agents, employees, and assignees the right to enter the property stated below to install monitor wells and perform testing as required by the New Mexico Environment Department, and to conduct other activities as may be required in connection therewith. This Right of Entry is effective upon completion of this document.

Property Owner:	Keith Pearson, Pearson Oil Company
Property Street Address:	424 South Main Street McDonald's Restaurant (See attached Figure)
City, State:	Lovington, New Mexico

This Right of Entry is granted in consideration of the following Golder Associates Inc. commitments:

1. Golder Associates, Inc. agrees that in consideration of Owners(s) granting this Right of Entry, the affected property will be restored as much as reasonably possible to its condition proceeding our entry. If monitoring wells are developed, these wells will be plugged and abandoned upon project termination in accordance with New Mexico's applicable rules and regulations.

2. Golder Associates Inc. agrees to coordinate with Mr. Ken Fadke (McDonald's franchise owner) to plan and execute the site work to minimize impact to the restaurant business.

3. Golder Associates, Inc. agrees to protect Owner from any and all liability which might arise as a result of the foregoing activities on the described property.

4. Owner(s) retain the discretion to terminate this agreement at any time, after 30 days written notice, if it is in his or his successor's interests.

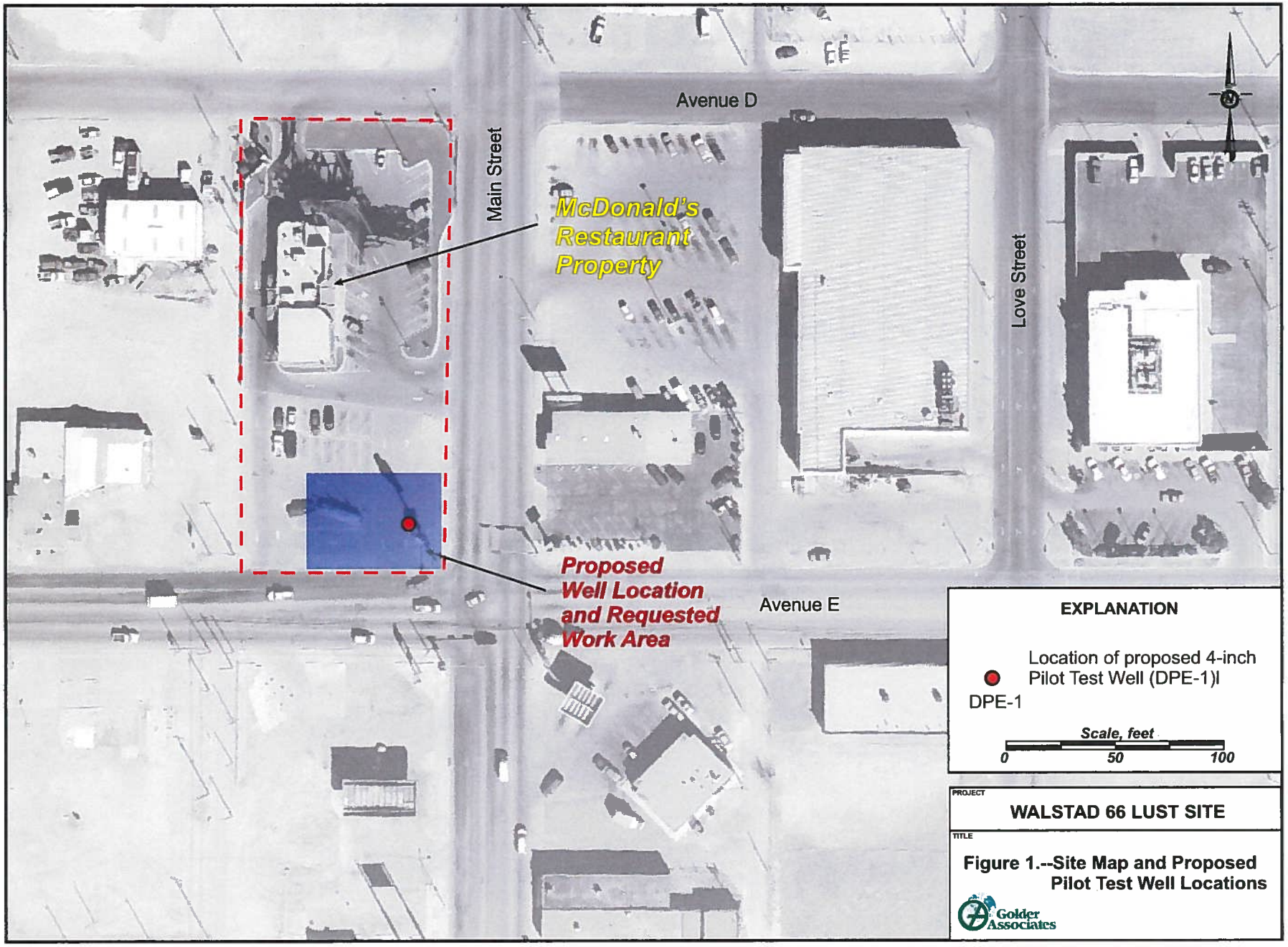
5. Golder Associates Inc. will provide owner(s) with all analytical results and final investigation reports upon request. Golder Associates, Inc. agrees to provide owner with all future laboratory results and keep the owner informed of all future developments concerning subject property as it pertains to this investigation as requested by owner.

Owner(s) Agent
M. K. Pearson

6-2-14
Date

Golder Associates Inc.
Clay Kilmer
Project Manager

May 30, 2014
Date


Avenue D
Main Street
McDonald's Restaurant Property
Love Street
Proposed Well Location and Requested Work Area
Avenue E
EXPLANATION
Location of proposed 4-inch Pilot Test Well (DPE-1)I
DPE-1
Scale, feet
0
50
100
PROJECT
WALSTAD 66 LUST SITE
TITLE
Figure 1.--Site Map and Proposed Pilot Test Well Locations
Golder Associates

LEGEND

W-1	LOCATION OF WALSTAD MONITORING WELL
SB-1/MW-1	ALLSUPS SOIL BORING/MONITORING WELL LOCATION
SB-4	ALLSUPS SOIL BORING

0 60 120 180
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT

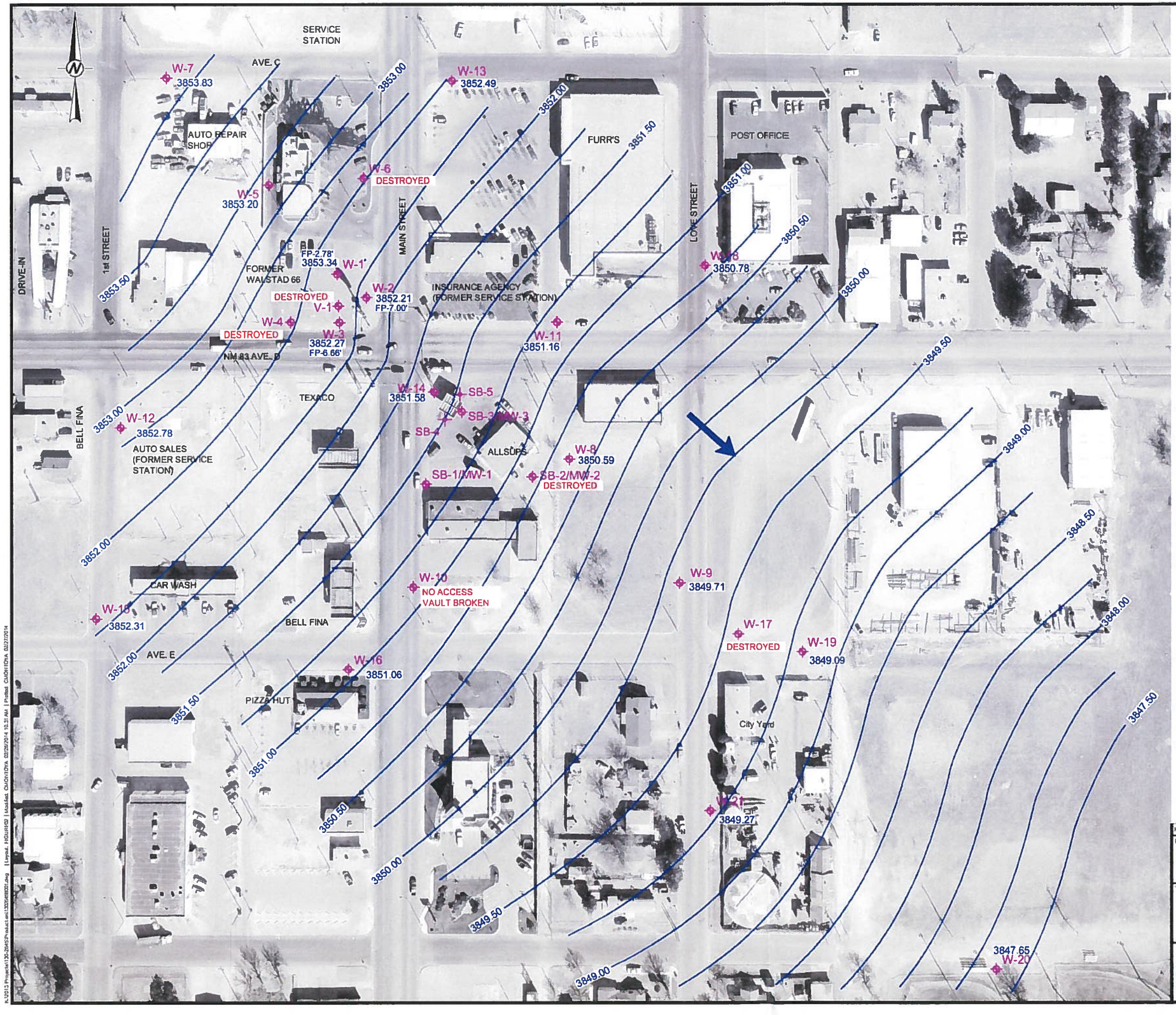
WALSTADD 66
LOVINGTON, NEW MEXICO

TITLE

SITE MAP

Golder Associates

PROJECT No.		130-2645	FILE No.	1302645B001
DESIGN	CK	02/20/2014	SCALE	AS SHOWN
CADD	CM	02/24/2014	DRAWING	
CHECK	CK	02/24/2014		**FIGURE 1**
REVIEW	CK	02/24/2014		



LEGEND

W-1 3853.34	LOCATION OF WALSTAD MONITORING WELL SHOWING DESIGNATION AND WATER LEVEL ELEVATION, IN FEET ABOVE MEAN SEA LEVEL 1/21/2014
SB-1/MW-1	ALLSUPS SOIL BORING/ MONITORING WELL LOCATION WITH GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
SB-4	ALLSUPS SOIL BORING
3851.00	ISOPLETH ON LINE OF PROJECTED EQUAL SHOLLOW GROUNDWATER ELEVATION FROM DATA COLLECTED ON 1/21/2017
	GROUNDWATER FLOW DIRECTION

NOTES

* DATA NOT USED FOR CONTOURING

0 60 120 180
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT

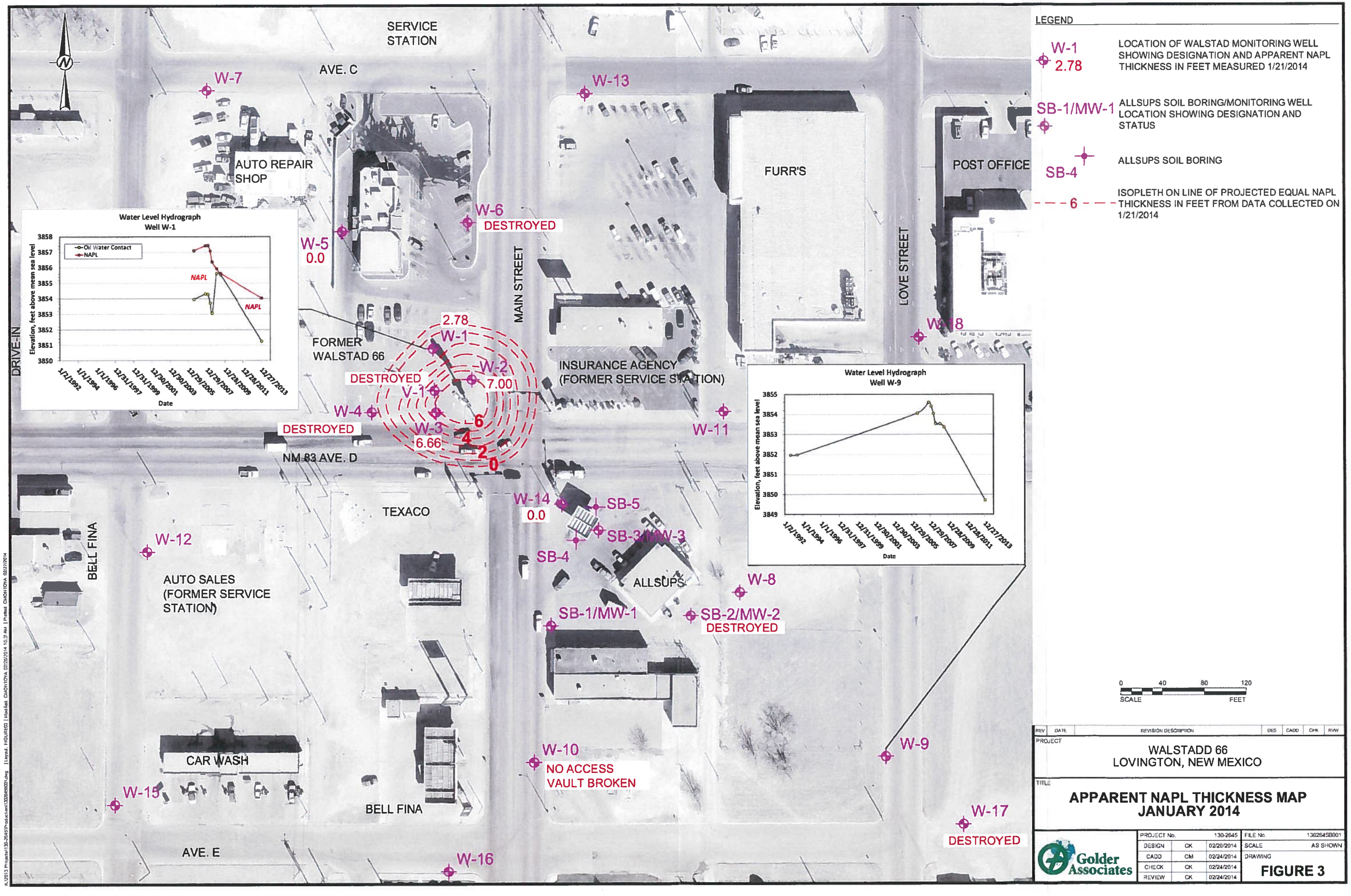
WALSTADD 66
LOVINGTON, NEW MEXICO

TITLE

WATER TABLE MAP JANUARY 2014

Golder Associates

PROJECT No.		130-2645	FILE No.		1302645B001
DESIGN	CK	02/20/2014	SCALE		AS SHOWN
CADD	CM	02/24/2014	DRAWING		
CHECK	CK	02/24/2014	**FIGURE 2**		
REVIEW	CK	02/24/2014			



LEGEND

- W-1 / 2.78 — LOCATION OF WALSTAD MONITORING WELL SHOWING DESIGNATION AND APPARENT NAPL THICKNESS IN FEET MEASURED 1/21/2014
- SB-1/MW-1 — ALLSUPS SOIL BORING/MONITORING WELL LOCATION SHOWING DESIGNATION AND STATUS
- SB-4 — ALLSUPS SOIL BORING
- 6 — ISOPLETH ON LINE OF PROJECTED EQUAL NAPL THICKNESS IN FEET FROM DATA COLLECTED ON 1/21/2014

0 40 80 120
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

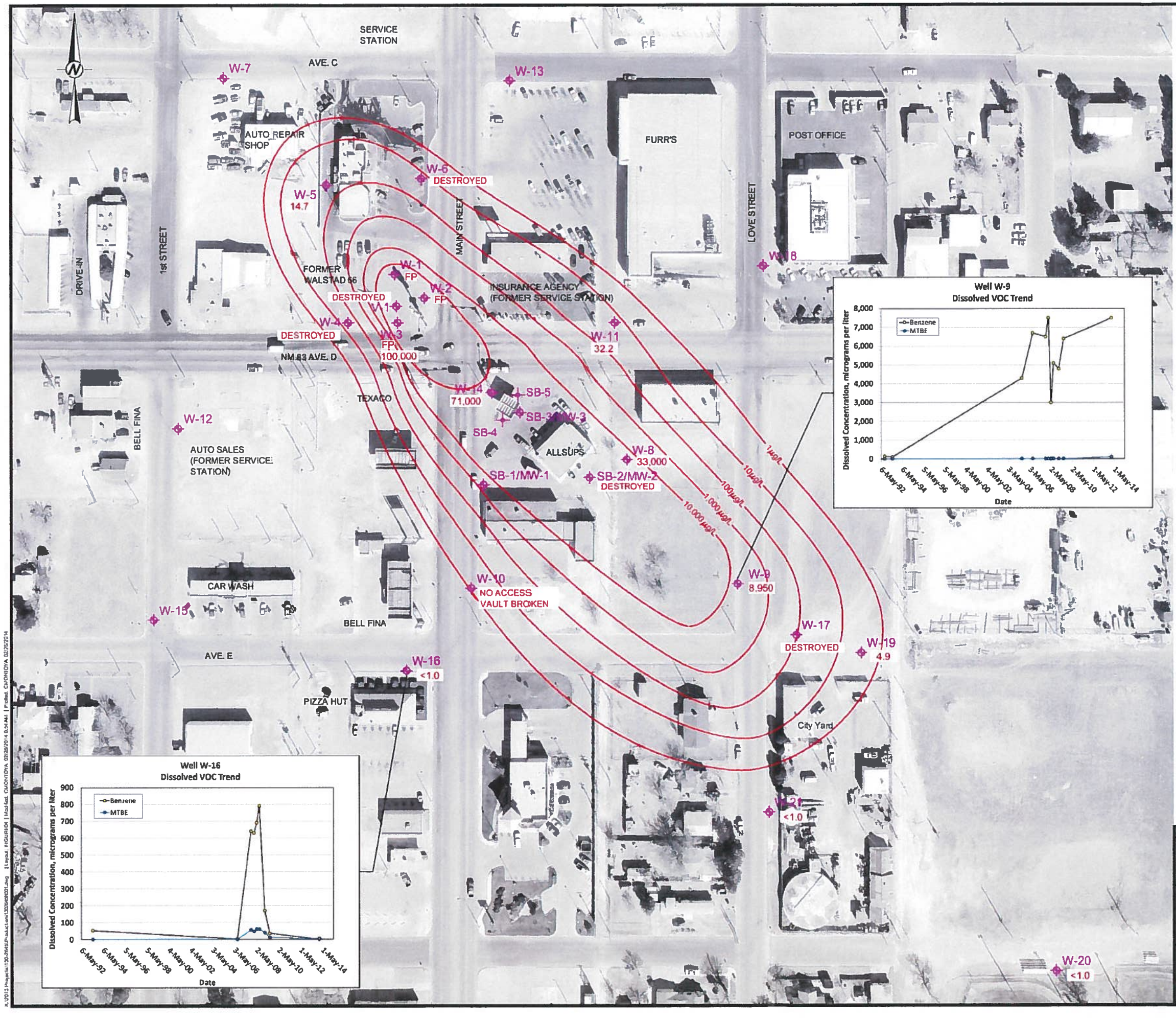
PROJECT
WALSTADD 66
LOVINGTON, NEW MEXICO

TITLE
APPARENT NAPL THICKNESS MAP JANUARY 2014

Golder Associates

PROJECT No.		130-2645	FILE No.	1302645B001
DESIGN	CK	02/20/2014	SCALE	AS SHOWN
CADD	CM	02/24/2014	DRAWING	
CHECK	CK	02/24/2014	**FIGURE 3**	
REVIEW	CK	02/24/2014		

K:\2013 Projects\130-2645\Production\1302645B001.dwg | Layout: FIGURE3 | Modified: CMOHTOYA 02/25/2014 10:37 AM | Plotted: CMOHTOYA 02/27/2014



LEGEND

W-8 33,000 — LOCATION OF WALSTAD MONITORING WELL SHOWING DESIGNATION AND TOTAL BTEX CONCENTRATION IN MICROGRAMS PER LITER IN GROUNDWATER SAMPLE COLLECTED 1/21/2014

SB-1/MW-1 — ALLSUPS SOIL BORING/MONITORING WELL LOCATION SHOWING DESIGNATION

SB-4 — ALLSUPS SOIL BORING

10 µg/L — ISOPLETH ON LINE OF PROJECTED EQUAL TOTAL BTEX CONCENTRATION IN GROUNDWATER IN MICROGRAMS PER LITER FROM SAMPLE DATA COLLECTED 1/21/2014

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW

PROJECT

WALSTADD 66
LOVINGTON, NEW MEXICO

TITLE

DISSOLVED VOC'S IN GROUNDWATER JANUARY 2014

Golder Associates

PROJECT No.		130-2645	FILE No.		1302645B001
DESIGN	CK	02/20/2014	SCALE		AS SHOWN
CADD	CM	02/24/2014	DRAWING		
CHECK	CK	02/24/2014	**FIGURE 4**		
REVIEW	CK	02/24/2014			

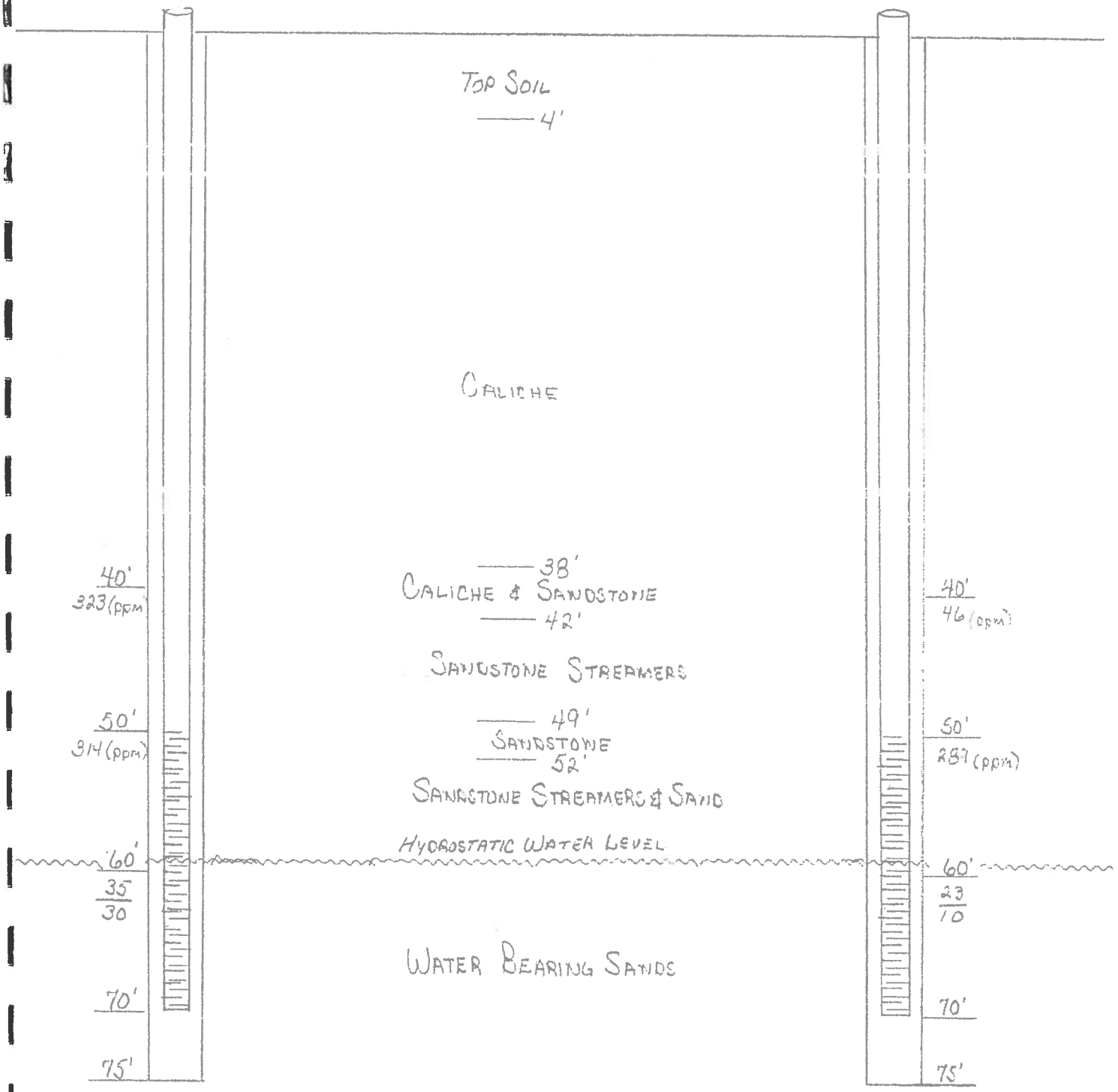
AE1

BORING LOG MONITORING WELLS
MARCH 13, 1992

MINIMUM SITE ASSESSMENT
DEC. 1991

MONITOR WELL #2 (W-2)

MONITOR WELL #3 (W-3)



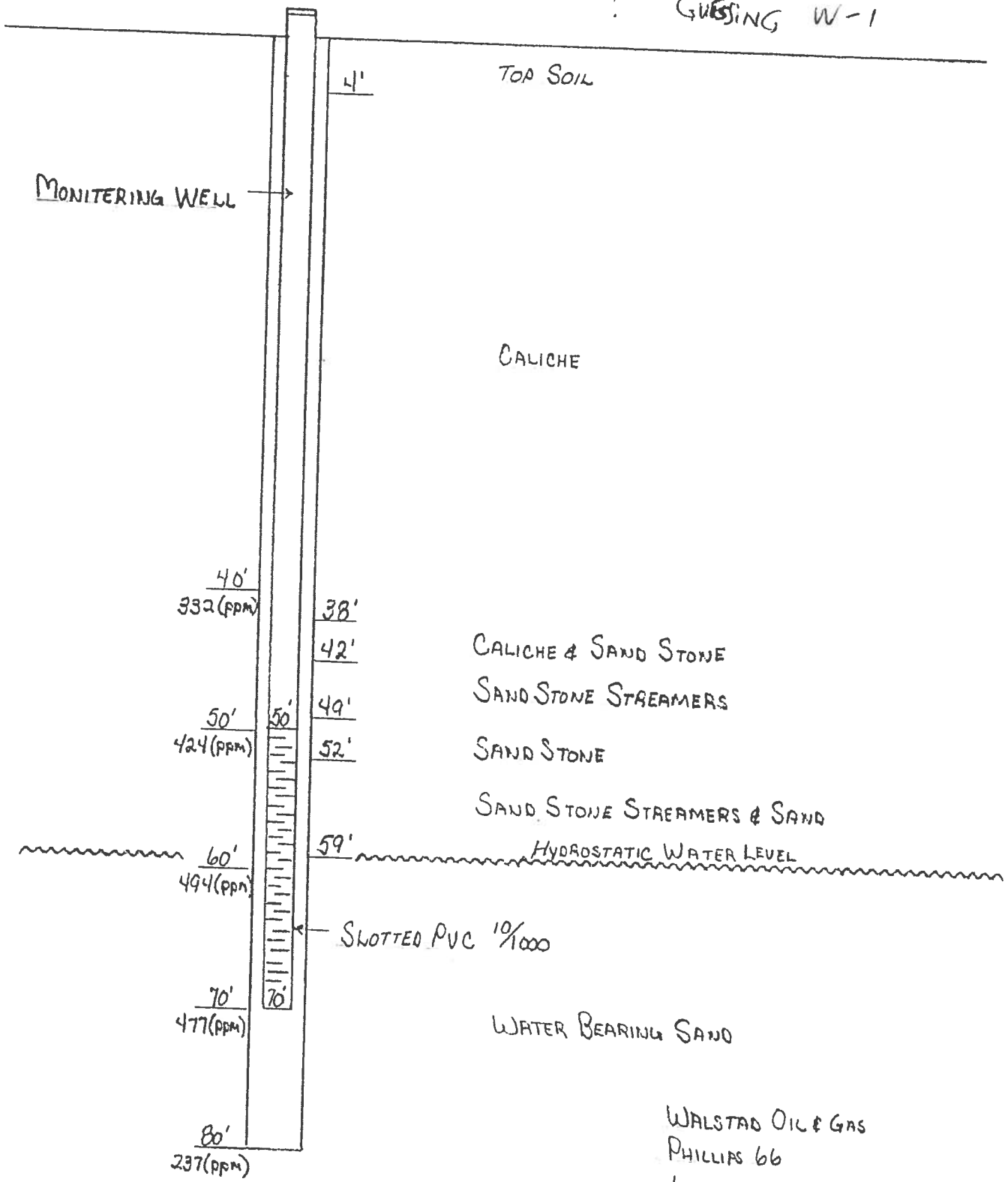
WALSTAD OIL & GAS
PHILLIPS 66
LOVINGTON, NEW MEXICO

AE1

Boring Log - Monitoring Well
February 12, 1992

Minimum Site Assessment
Dec. 1991

? Guessing W-1



Walstad Oil & Gas
Phillips 66
Lovington, N. M.

Well W-1 Test
Date: 3/29/2015
Data by: C. Kilmer
Well Screen Interval (ft): 50-70
Depth to NAPL (ft): 57 92
Depth to Water (ft): 64 40

Time	Elapsed Time	Well W-1	Well W-2	Well W-3	Rotameter Flow Rate (SCFM)	[1]Flow Rate Correction Factor	[1]Corrected Flow Rate (SCFM)	PID (ppm)	Temp F	Comments
		Radius to Production Well (ft)								
		R = 0	R = 30	R = 36						
		Induced Vacuum, (Inches H_2O)								
12:29 PM		0.5	0.05	0.010						Pre-test Gauge Reading
12:30 PM	0:00	32	0.05	0.010	2	1.048	2.10	3460	75.2	Start STEP 1
12:35 PM	0:05	35	0.05	0.010	2					
12:39 PM	0:09	35	0.06	0.020	2					
12:40 PM	0:10	45	0.07	0.022	4	1.067	4.27	6620	76.4	Start STEP 2
12:45 PM	0:15	45	0.07	0.022	4					
12:49 PM	0:19	45	0.07	0.022	4					
12:50 PM	0:20	55	0.09	0.030	5	1.082	5.41	8040	76.4	Start STEP 3
12:55 PM	0:25	55	0.08	0.030	5					
12:59 PM	0:29	55	0.08	0.030	5					
1:00 PM	0:30	65	0.09	0.035	5.5	1.101	6.06	8530	79.3	Start STEP 4
1:05 PM	0:35	65	0.09	0.035	6					
1:09 PM	0:39	65	0.09	0.035	6					
1:10 PM	0:40	75	0.08	0.032	7	1.115	7.81	7020	77.3	Start STEP 5
1:15 PM	0:45	75	0.07	0.030	7					
1:19 PM	0:49	75	0.07	0.030	7					
1:20 PM	0:50	86	0.08	0.038	8	1.134	9.07	5020	77.1	Start STEP 6
1:25 PM	0:55	86	0.07	0.037	8.5					
1:29 PM	0:59	86	0.07	0.037	8.5					
1:30 PM	1:00	100	0.07	0.037	10	1.160	11.60	4442	77.7	Start STEP 6
1:35 PM	1:05	100	0.07	0.037	10					
1:39 PM	1:09	100	0.07	0.037	10					
1:40 PM	1:10	Max Vac (>100)	0.08	0.020	33			4250	78.4	Start STEP 7
1:41 PM	1:11	Max Vac (>100)	0.07	0.030	26					
1:45 PM	1:15	Max Vac (>100)	0.08	0.035	23					
1:50 PM	1:20	Max Vac (>100)	0.07	0.030	22					End STEP 7
1:54 PM	1:24	1.1								Residual Vacuum
1:56 PM	1:26	0.75								Residual Vacuum
1:58 PM	1:28	0.45								Residual Vacuum
1:59 PM	1:29	0.3								Residual Vacuum
2:00 PM	1:30	0.25								Residual Vacuum
2:03 PM	1:33	0.15								Residual Vacuum

[1] *Flow rate correction factor calculated in accordance with attached document*

Well W-2 Test
Date: 3/29/2015
Data by: C. Kilmer
Well Screen Interval (ft): 50-70
Depth to NAPL (ft): 56 88
Depth to Water (ft): 63 65

Time	Elapsed Time	Well W-2	Well W-1	Well W-3	Flow Rate (SCFM)	[1]Flow Rate Correction Factor	[1]Corrected Flow Rate (SCFM)	PID (ppm)	Temp F	Comments
		Radius to Production Well (ft)								
		R = 0	R = 30	R = 43						
		Induced Vacuum, (Inches H_2O)								
2:06 PM		0	0.050	0.000						Pre-test Gauge Reading
2:10 PM	0:00	34	0.050	0.005	5.5	1.038	5.71	4943	62.9	Start STEP 1
2:15 PM	0:05	34	0.070	0.010	5.5					
2:19 PM	0:09	34	0.080	0.015	5.5					
2:20 PM	0:10	44	0.090	0.020	7.5	1.061	7.96	4690	71.2	Start STEP 2
2:25 PM	0:15	44	0.110	0.030	7					
2:29 PM	0:19	44	0.110	0.030	7					
2:30 PM	0:20	55	0.110	0.030	9	1.079	9.72	4328	73.4	Start STEP 3
2:35 PM	0:25	55	0.120	0.033	8.5					
2:39 PM	0:29	55	0.125	0.040	8.5					
2:40 PM	0:30	65	0.120	0.038	10.5	1.095	11.50	3770	73.7	Start STEP 4
2:45 PM	0:35	65	0.125	0.045	10					
2:50 PM	0:40	65	0.130	0.055	10					
2:54 PM	0:44	65	0.125	0.052	10					
2:55 PM	0:45	75	0.130	0.045	11.5	1.113	12.80	3971	74.6	Start STEP 5
3:00 PM	0:50	75	0.130	0.052	11					
3:04 PM	0:54	75	0.125	0.045	10.5					
3:05 PM	0:55	88	0.130	0.048	13	1.134	14.74	3665	73.5	Start STEP 6
3:10 PM	1:00	90	0.130	0.055	12					
3:14 PM	1:04	90	0.120	0.040	12					
3:15 PM	1:05	102	0.110	0.040	15	1.160	17.40	3322	73.7	Start STEP 7
3:20 PM	1:10	102	0.120	0.055	14					
3:24 PM	1:14	102	0.110	0.035	14					
3:25 PM	1:15	Max Vac (>100)	0.100	0.020	35			303	72.8	Start STEP 8
3:30 PM	1:20	Max Vac (>100)	0.090	0.030	25					
3:35 PM	1:25	Max Vac (>100)	0.100	0.040	22					End STEP 8

[1] *Flow rate correction factor calculated in accordance with attached document*

Well W-3 Test
Date: 3/29/2015
Data by: C. Kilmer
Well Screen Interval (ft): 50-70
Depth to NAPL (ft): 57 01
Depth to Water (ft): 63 60

Time	Elapsed Time	Well W-3	Well W-1	Well W-2	Flow Rate (SCFM)	[1]Flow Rate Correction Factor	[1]Corrected Flow Rate (SCFM)	PID (ppm)	Temp F	Comments
		Radius to Production Well (ft)								
		R = 0	R = 36	R = 43						
		Induced Vacuum, (Inches H_2O)								
10:36 AM		0	0.02	0.07						Pre-test Gauge Reading
10:41 AM	0:00	34	0.00	0.15	4	1.035	4.14	2037	59.7	Start STEP 1
10:44 AM	0:03	34	0.00	0.15	4					
10:50 AM	0:09	34	0.00	0.10	4					
10:55 AM	0:14	34	0.00	0.10	4					
11:00 AM	0:19	45	0.01	0.12	6	1.055	6.33	6100	64.2	Start STEP 2
11:05 AM	0:24	45	0.01	0.12	6					
11:09 AM	0:28	45	0.01	0.12	6					
11:10 AM	0:29	55	0.01	0.12	8	1.074	8.59	7287	68.3	Start STEP 3
11:15 AM	0:34	55	0.01	0.12	8					
11:19 AM	0:38	55	0.01	0.12	8					
11:20 AM	0:39	68	0.01	0.13	10	1.093	10.93	4720	66.5	Start STEP 4
11:25 AM	0:44	67	0.01	0.12	9					
11:29 AM	0:48	67	0.00	0.10	8					
11:30 AM	0:49	80	0.00	0.10	11				73.2	Start STEP 5
11:35 AM	0:54	80	0.00	0.10	10.5					
11:39 AM	0:58	80	0.00	0.10	10					
11:40 AM	0:59	100	0.00	0.10	14	1.157	16.19	4350	74.3	Start STEP 6
11:45 AM	1:04	100	0.00	0.10	13					
11:49 AM	1:08	100	0.00	0.10	12					
11:50 AM	1:09	Max Vac (>100)	0.00	0.10	34			3430	74.8	Start STEP 7
11:51 AM	1:10	Max Vac (>100)	0.00	0.10	30					
11:55 AM	1:14	Max Vac (>100)	0.00	0.10	23					
12:00 PM	1:19	Max Vac (>100)	0.00	0.10	21.5					
12:05 PM	1:24	Max Vac (>100)	0.00	0.10	20					
12:10 PM	1:29	Max Vac (>100)	0.00	0.10	20					End Step 7

[1] *Flow rate correction factor calculated in accordance with attached document*

Flowmeter Sizing

Gas Flowmeter Sizing ***Click Here To Download A Printable Version***
Variable area flowmeters suitable for liquid service have a capacity rating based on water at 70° Fahrenheit. Flowmeters suitable for gas service have a capacity rating based on air at STP (70°F, 14.7 PSIA) conditions. The correction factors listed below are used to calculate the flow capacity when using a liquid other than water or a gas other than air at STP conditions.

GAS CORRECTION FORMULA

Air Equivalent Flow Rate = Customer Gas Flow Rate X Gas Correction Factor

Step 1: Convert *Customer Gas Flow Rate* unit of measure to a standard unit of measure for air flow (SCFM or SCCM).

Step 2: Calculate *Gas Correction Factor* from given values.

Step 3: Calculate the product of the *Air Equivalent Flow Rate* from the *Customer Gas Flow Rate* and the *Gas Correction Factor*.

Step 4: Calculate the maximum or minimum flow rate for the customer's conditions.

Step 1: Convert *Customer Gas Flow Rate* unit of measure to a standardunit of measure for air flow

Customer Gas Flow Rate _____
Converted Gas Flow Rate _____ SCFM / SCCM

Gas Flow Rate Conversions

From	To SCFM	From	To SCCM
SCFH	Divide by 60	SCFM	Multiply by 28.317
SCIM	Divide by 1,728	SCFH	Multiply by 472
SLPM	Divide by 28.317	SCIM	Multiply by 16.39
SM³/MIN	Multiply by 35.31	SLPM	Multiply by 1,000
SM³/HR	Multiply by 0.5885	SLPH	Multiply by 16.67
NM³/MIN	Multiply by 37.99	SM³/MIN	Multiply by 1,000,000
NM³/HR	Multiply by 0.6331	SM³/HR	Multiply by 16,667
SCCM	Divide by 28,317	NM³/MIN	Multiply by 1,075,785
KG/MIN	Multiply by (29.39 ÷ SpGr)	NM³/HR	Multiply by 17,929
KG/HR	Multiply by (0.49 ÷ SpGr)	KG/MIN	Multiply by (832,000 ÷ SpGr)
LBS/MIN	Multiply by (13.33 ÷ SpGr)	KG/HR	Multiply by (13,876 ÷ SpGr)
LBS/HR	Multiply by(0.2222 ÷ SpGr)	LBS/MIN	Multiply by (377,500 ÷ SpGr)
LBS/DAY	Multiply by (0.00926 ÷ SpGr)	LBS/HR	Multiply by (6,292 ÷ SpGr)
ACFM	Multiply by [[(Operating PSIG+14.7)(530)] ÷ [(14.7)(Operating °F+460)]]		

Step 2: Calculate *Gas Correction Factor* from given values

This information is required to size for conditions other than air at STP:
- Operating Temperature: _____°F
- Operating Back Pressure: _____ PSIG
- Specific Gravity of Gas: _____ @STP

Temperature Conversions

From	To °Fahrenheit
°Centigrade	(°C X 1.8) + 32
°Kelvin	(°K – 273.15)1.8 + 32
°Rankine	°R – 459.67

Gas Density Conversions

From	To Specific Gravity
LBS/FT³	Divide by 0.075
KG/M³	Divide by 1.2
MolWt	Divide by 29.0
g/cm³	Divide by 0.0012

Pressure Conversions

From	To PSIG	From	To PSIG
foot Water	Divide by 2.308	Pa	(Pa÷101,300) X 14.7
Inch Water	Divide by 27.73	PSIA	Minus 14.7
mm Water	Divide by 704	ATM	(ATM X 14.7) – 14.7
inch Hg	Divide by 2.036	Torr	((Torr÷760) X14.7) – 14.7
mm Hg	Divide by 51.7	Bars	((Bars÷1.013) X14.7) – 14.7
kg/cm²	Multiply by 14.228	Millibar	((Millibars÷1013) X 14.7) –14.7
kPa	(kPa÷101.3) X 14.7		

Gas Correction Factor (GCF) formula:

$$GCF = \sqrt{\frac{[(\text{Gas Specific Gravity}) \times (\text{Operating Temperature} + 460)]}{[(36) \times (\text{Operating Backpressure} + 14.7)]}}$$

GCF = _____

Step 3: Determine the Air Equivalent Flow Rate.

Air Equivalent Flow Rate = Customer Gas Flow Rate x Gas Correction Factor
Air Equivalent Flow Rate = _____

Step 4: Calculate the maximum or minimum flow rate for the customer's conditions (Customer Gas Flow Rate Scale)

Customer Gas Flow Rate Scale = Catalog Flow Rate ÷ Gas Correction Factor
Customer Gas Flow Rate Scale = _____

Liquid Flowmeter Sizing ***Click Here To Download A Printable Version***
Variable area flowmeters suitable for liquid service have a capacity rating based on water at 70°Fahrenheit. Flowmeters suitable for gas service have a capacity rating based on air at STP (70°F, 14.7 PSIA) conditions. The correction factors listed below are used to calculate the flow capacity when using a liquid other than water or a gas other than air at STP conditions.

LIQUID CORRECTION FORMULA

Water Equivalent Flow Rate = Customer Liquid Flow Rate X Liquid Correction Factor

Step 1: Convert *Customer Liquid Flow Rate* unit of measure to a standard unit of measure for water flow (GPM or CC/MIN).

Step 2: Calculate *Liquid Specific GravityCorrection Factor* from given values.

Step 3: Determine the *Water Equivalent Flow Rate* from the product of the *Customer Liquid Flow Rate* and the *Liquid Correction Factor*.

Step 4: Calculate the maximum or minimum flow rate for the customer's conditions.

Step 1: Convert *Customer Liquid Flow Rate* unit of measure to a standard unit of measure for water flow.

Step 2: Calculate *Liquid Correction Factor* from given values

This information is required to size for liquids other than water:
- Specific Gravity of Liquid: _____ @ Operating Conditions
- Liquid Temperature: _____°F @ Operating Conditions
- Liquid Viscosity: _____cps @Operating Conditions
- Specific Gravity of the Float to be used: _____

Float Specific Gravity

Teflon	2.20	316 SS	8.04
Glass	2.53	Hastelloy C	8.94
Sapphire	3.99	Carboloy	15.00
Titanium	4.50	Tantalum	16.60
316L SS	8.03		

Liquid Density Conversions

From	To Specific Gravity
LBS/FT³	Divide by 62.4
KG/M³	Divide by 1,000
API	[141.5 ÷ (131.5+API)]
g/cm³	= SpGr

Customer Liquid Flow Rate _____
Converted Gas Flow Rate _____GPM / CC/MIN

Liquid Flow Rate Conversions

From	To GPM	From	To CC/MIN
GPH	Divide by 60	GPM	Multiply by 3,785
CC/MIN	Divide by 3,785	GPH	Multiply by 63.08
CC/HR	Divide by 227,100	CC/HR	Divide by 60
LPM	Multiply by 3.785	LPM	Multiply by 1,000
LPH	Multiply by 227.1	LPH	Multiply by 16.67
M^3/MIN	Multiply by 264.2	M^3/MIN	Multiply by 1,000,000
M^3/HR	Multiply by 4.402	M^3/HR	Multiply by 16,667
PINTS/MIN	Divide by 8	PINTS/MIN	Multiply by 473.1
FT^3/MIN	Multiply by 7.48	FT^3/MIN	Multiply by 28.320
FT^3/HR	Divide by 8.021	FT^3/HR	Multiply by 472
KG/MIN	Multiply by (0.264 ÷ SpGr)	KG/MIN	Multiply by (1,000 ÷ SpGr)
KG/HR	Divide by (227 X SpGr)	KG/HR	Multiply by (16.67 ÷ SpGr)
LBS/MIN	Divide by (8.347 X SpGr)	LBS/MIN	Multiply by (453.6 ÷ SpGr)
LBS/HR	Divide by (500.8 X SpGr)	LBS/HR	Multiply by (7.56 ÷ Spgr)
GMS/MIN	Divide by (3,785 X SpGr)	GMS/MIN	Divide by SpGr
GMS/HR	Divide by (227,000 X SpGr)	GMS/HR Multiply by 3.785	Divide by (60 X SpGr)

Liquid Specific Gravity Correction Factor (LSGCF) formula:

$$LSGCF = \sqrt{\frac{\text{(Float Specific Gravity – Specific Gravity of the Metered Liquid)}}{\text{[(Float Specific Gravity – 1.0) X (Specific Gravity of the Metered Fluid)]}}}$$

3. Determine the Water Equivalent Flow Rate

Water Equivalent Flow Rate = Customer's Liquid Flow Rate + LSGCF Water Equivalent Flow Rate = _____

4. Calculate the maximum or minimum flow rate for the customer's conditions. (Customer Liquid Flow Rate Scale)

Customer Liquid Flow Rate Scale = Catalog Flow Rate + LSGCF @ 70° F
Customer Liquid Flow Rate Scale = _____

The Company Mission
"To produce the finest group of rotameters ever sold"

We are committed to:
Clearly understanding and fulfilling our Customers' needs and expectations of timely delivery, product performance and value.
Fostering productive, long-term relationships with Suppliers by aligning their goals with the needs of our Customers.
Methodically improving our production systems to create true quality and productivity enhancements that directly benefit our Customers.
A culture that values continuous improvement in our products, services, and personal relationships.

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APPENDIX E

NAPL BAILDOWN
AND
RECOVERY TEST DATA AND INTERPRETATION

BARNHILL NAPL BAILING AND RECOVERY DATA

Baildown/Slug Test Data
Site: Walstad 66 Lovington
Well: W-1
Date: 6/2/15 - 6/4/15

Project #:	1404221	Site Name:	Walstad Oil Co.
Well:	W-1	Samplers:	Barnhill/Beagles
Evacuation Method:	Bailing	Weather:	Warm Sunny

Borehole Diam: 8 inches
Filter Pack Specific Yield (LNAPL)
0.175
Effective Well Radius (ft)
LNAPL Well Volume
6.78 x 0.668
4.40 g. psh

Well Information		LNAPL Information	
Casing Diameter (Inches):	4"	Fluid Type:	Gasolline
Total Depth (Ft):	70.03'	Volume Removed:	16 gallons
Static Depth to Product (Ft)	58.11	Evacuation Method:	bailing
Static Depth to Water (Ft)	64.89	LNAPL Removed:	5.75 gallons removed

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	NAPL Thickness (feet)	Comments
Bailed	06/02/15	9:39:00					4 gals NAPL
Bailed	06/02/15	9:44:00					1 gal NAPL, 3 gal water
Bailed	06/02/15	9:50:00					0.75 gal NAPL, 3.25 gal water
Bailed	06/02/15	9:55:00					trace NAPL, 4 gal water
0 - 5	06/02/15	9:57:00	start recovery	0	60.51		
0 - 5	06/02/15	9:57:30	0.5	60.41	60.51	0.10	
0 - 5	06/02/15	9:58:00	1.0	60.26	60.27	0.01	
0 - 5	06/02/15	9:58:30	1.5	60.16	60.17	0.01	
0 - 5	06/02/15	9:59:00	2.0	60.06	60.07	0.01	
0 - 5	06/02/15	9:59:30	2.5	59.91	59.94	0.03	
0 - 5	06/02/15	10:00:00	3.0	59.88	59.90	0.02	
0 - 5	06/02/15	10:00:30	3.5	59.85	59.87	0.02	
0 - 5	06/02/15	10:01:00	4.0	59.84	59.86	0.02	
0 - 5	06/02/15	10:01:30	4.5	59.81	59.83	0.02	
0 - 5	06/02/15	10:02:00	5.0	59.79	59.81	0.02	
0 - 5	06/02/15	10:02:30	5.5	59.77	59.79	0.02	
5 - 10	06/02/15	10:03:00	6.0	59.74	59.78	0.04	
5 - 10	06/02/15	10:04:00	7.0	59.71	59.77	0.06	Water level peak vaule
5 - 10	06/02/15	10:05:00	8.0	59.68	59.79	0.11	
5 - 10	06/02/15	10:06:00	9.0	59.67	59.81	0.14	
5 - 10	06/02/15	10:07:00	10.0	59.65	59.84	0.19	
5 - 10	06/02/15	10:08:00	11.0	59.64	59.86	0.22	
10 - 30	06/02/15	10:10:00	13.0	59.62	59.9	0.28	
10 - 30	06/02/15	10:12:00	15.0	59.60	59.94	0.34	
10 - 30	06/02/15	10:14:00	17.0	59.59	59.98	0.39	
10 - 30	06/02/15	10:16:00	19.0	59.58	60.00	0.42	
10 - 30	06/02/15	10:18:00	21.0	59.57	60.02	0.45	
10 - 30	06/02/15	10:20:00	23.0	59.57	60.04	0.47	
10 - 30	06/02/15	10:22:00	25.0	59.56	60.06	0.50	
10 - 30	06/02/15	10:24:00	27.0	59.55	60.08	0.53	
10 - 30	06/02/15	10:26:00	29.0	59.54	60.09	0.55	
10 - 30	06/02/15	10:28:00	31.0	59.53	60.11	0.58	
10 - 30	06/02/15	10:30:00	33.0	59.53	60.12	0.59	
10 - 30	06/02/15	10:32:00	35.0	59.52	60.14	0.62	
10 - 30	06/02/15	10:34:00	37.0	59.52	60.16	0.64	
10 - 30	06/02/15	10:36:00	39.0	59.51	60.17	0.66	
10 - 30	06/02/15	10:38:00	41.0	59.50	60.19	0.69	
10 - 30	06/02/15	10:40:00	43.0	59.49	60.21	0.72	
30 - 60	06/02/15	10:45:00	48.0	59.48	60.24	0.76	
30 - 60	06/02/15	10:50:00	53.0	59.47	60.29	0.82	
30 - 60	06/02/15	10:55:00	58.0	59.45	60.33	0.88	
30 - 60	06/02/15	11:00:00	63.0	59.44	60.36	0.92	
30 - 60	06/02/15	11:05:00	68.0	59.43	60.39	0.96	
30 - 60	06/02/15	11:10:00	73.0	59.42	60.43	1.01	
60-180	06/02/15	11:20:00	83.0	59.40	60.51	1.11	
60-180	06/02/15	11:30:00	93.0	59.37	60.57	1.2	
60-180	06/02/15	11:40:00	103.0	59.36	60.65	1.29	
60-180	06/02/15	11:50:00	113.0	59.34	60.73	1.39	
60-180	06/02/15	12:00:00	123.0	59.31	60.80	1.49	

Well: W-1 **Baildown/Slug Test Field Form** Site: Walstad Oil Co., Lovington, NM

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	NAPL Thickness (feet)	Comments
60-180	06/02/15	12:10:00	133.0	59.27	60.88	1.61	
60-180	06/02/15	12:20:00	143.0	59.26	60.92	1.66	
60-180	06/02/15	12:30:00	153.0	59.24	60.98	1.74	
60-180	06/02/15	12:40:00	163.0	59.21	61.04	1.83	
60-180	06/02/15	12:50:00	173.0	59.19	61.11	1.92	
60-180	06/02/15	13:00:00	183.0	59.17	61.16	1.99	
60-180	06/02/15	13:10:00	193.0	59.15	61.23	2.08	
60-180	06/02/15	13:20:00	203.0	59.12	61.29	2.17	
180+	06/02/15	13:30:00	213.0	59.10	61.35	2.25	
180+	06/02/15	14:00:00	243.0	59.04	61.54	2.50	
180+	06/02/15	14:30:00	273.0	58.98	61.71	2.73	
180+	06/02/15	15:00:00	303.0	58.93	61.87	2.94	
180+	06/02/15	16:00:00	363.0	58.84	61.57	2.73	
180+	06/02/15	17:00:00	423.0	58.73	62.49	3.76	
180+	06/02/15	18:00:00	483.0	58.65	62.77	4.12	
180+	06/02/15	19:00:00	543.0	58.58	63.02	4.44	
180+	06/02/15	20:00:00	603.0	58.52	63.22	4.70	
180+	06/02/15	21:00:00	663.0	58.47	63.40	4.93	
180+	06/03/15	6:30:00	1233.0	58.22	64.27	6.05	
180+	06/03/15	7:30:00	1293.0	58.20	64.30	6.10	
180+	06/03/15	8:30:00	1353.0	58.19	64.32	6.13	
180+	06/03/15	9:30:00	1413.0	58.18	64.36	6.18	
180+	06/03/15	10:30:00	1473.0	58.16	64.38	6.22	
180+	06/03/15	11:30:00	1533.0	58.16	64.40	6.24	
180+	06/03/15	12:30:00	1593.0	58.15	64.42	6.27	
180+	06/03/15	13:30:00	1653.0	58.14	64.43	6.29	
180+	06/03/15	14:30:00	1713.0	58.13	64.44	6.31	
180+	06/03/15	15:30:00	1773.0	58.12	64.45	6.33	
180+	06/04/15	11:30:00	2973.0	58.14	64.61	6.47	
180+	06/04/15	16:30:00	3273.0	58.11	64.58	6.47	

Baildown/Slug Test Data
Site: Walstad 66 Lovington
Well: W-2
Date: 6/2/15 - 6/4/15

Project #:	1404221	Site Name:	Walstad Oil Co.
Well:	W-2	Samplers:	Barnhill/Beagles
Evacuation Method:	Bailing	Weather:	Warm Sunny

Borehole Diam: 8 inches
Filter Pack Specific Yield (LNAPL)
0.175
Effective Well Radius (ft)
LNAPL Well Volume
7.19 x 0.668 = 4.80 gallons
4.8 gal psh

Well Information		LNAPL Information	
Casing Diameter (Inches):	4"	Fluid Type:	Gasolline
Total Depth (Ft):	69.55	Volume Removed:	16 gallons
Static Depth to Product (Ft)	57.07	Evacuation Method:	bailing
Static Depth to Water (Ft)	64.26	LNAPL Removed:	7.2 gallons removed

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	Total thickness (feet)	Comments
Bailed	06/02/15	11:36:00					4 gal NAPL
Bailed	06/02/15	11:44:00					2 gal NAPL, 2 gal water
Bailed	06/02/15	11:53:00					1.2 gal NAPL, 2.8 gal water
Bailed	06/02/15	12:02:00					trace NAPL, 4 gal water
0 - 5	06/02/15	12:04:00	start recovery	59.30	59.32	0.02	
0 - 5	06/02/15	12:04:30	0.5	59.14	59.17	0.03	
0 - 5	06/02/15	12:05:00	1.0	59.01	59.06	0.05	
0 - 5	06/02/15	12:05:30	1.5	58.94	59.02	0.08	
0 - 5	06/02/15	12:06:00	2.0	58.87	58.95	0.08	
0 - 5	06/02/15	12:06:30	2.5	58.82	58.95	0.13	
0 - 5	06/02/15	12:07:00	3.0	58.79	58.91	0.12	
0 - 5	06/02/15	12:07:30	3.5	58.75	58.88	0.13	
0 - 5	06/02/15	12:08:00	4.0	58.73	58.86	0.13	
0 - 5	06/02/15	12:08:30	4.5	58.71	58.86	0.15	
0 - 5	06/02/15	12:09:00	5.0	58.70	58.86	0.16	
5 - 10	06/02/15	12:10:00	6.0	58.69	58.85	0.16	
5 - 10	06/02/15	12:11:00	7.0	58.66	58.85	0.19	
5 - 10	06/02/15	12:12:00	8.0	58.65	58.85	0.20	
5 - 10	06/02/15	12:13:00	9.0	58.64	58.85	0.21	
5 - 10	06/02/15	12:14:00	10.0	58.64	58.85	0.21	
10 - 30	06/02/15	12:16:00	12.0	58.63	58.85	0.22	Water level peak vaule
10 - 30	06/02/15	12:18:00	14.0	58.62	58.86	0.24	
10 - 30	06/02/15	12:20:00	16.0	58.61	58.88	0.27	
10 - 30	06/02/15	12:22:00	18.0	58.61	58.89	0.28	
10 - 30	06/02/15	12:24:00	20.0	58.61	58.89	0.28	
10 - 30	06/02/15	12:26:00	22.0	58.60	58.90	0.30	
10 - 30	06/02/15	12:28:00	24.0	58.60	58.91	0.31	
10 - 30	06/02/15	12:30:00	26.0	58.60	58.92	0.32	
10 - 30	06/02/15	12:32:00	28.0	58.59	58.93	0.34	
10 - 30	06/02/15	12:34:00	30.0	58.59	58.94	0.35	
30 - 60	06/02/15	12:39:00	35.0	58.58	58.96	0.38	
30 - 60	06/02/15	12:44:00	40.0	58.58	58.98	0.40	
30 - 60	06/02/15	12:49:00	45.0	58.57	58.99	0.42	
30 - 60	06/02/15	12:54:00	50.0	58.56	59.01	0.45	
30 - 60	06/02/15	12:59:00	55.0	58.55	59.03	0.48	
30 - 60	06/02/15	13:04:00	60.0	58.54	59.04	0.50	
60 - 180	06/02/15	13:14:00	70.0	58.53	59.08	0.55	
60 - 180	06/02/15	13:24:00	80.0	58.51	59.11	0.60	
60 - 180	06/02/15	13:34:00	90.0	58.50	59.14	0.64	
60 - 180	06/02/15	13:44:00	100.0	58.49	59.17	0.68	
60 - 180	06/02/15	13:54:00	110.0	58.48	59.20	0.72	
60 - 180	06/02/15	14:04:00	120.0	58.47	59.23	0.76	
60 - 180	06/02/15	14:14:00	130.0	58.46	59.27	0.81	
60 - 180	06/02/15	14:24:00	140.0	58.44	59.30	0.86	
60 - 180	06/02/15	14:34:00	150.0	58.43	59.33	0.90	
60 - 180	06/02/15	14:44:00	160.0	58.42	59.35	0.93	
180+	06/02/15	15:00:00	176.0	58.41	59.40	0.99	
180+	06/02/15	15:30:00	206.0	58.39	59.51	1.12	
180+	06/02/15	16:00:00	236.0	58.32	59.62	1.30	

Well: W-2 **Baildown/Slug Test Field Form** Site: Walstad Oil Co., Lovington, NM

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	Total thickness (feet)	Comments
180+	06/02/15	17:00:00	296.0	58.30	59.74	1.44	
180+	06/02/15	18:00:00	356.0	58.25	59.90	1.65	
180+	06/02/15	19:00:00	416.0	58.21	60.05	1.84	
180+	06/02/15	20:00:00	476.0	58.16	60.22	2.06	
180+	06/02/15	21:00:00	536.0	58.11	60.37	2.26	
180+	06/03/15	6:30:00	1106.0	57.72	61.67	3.95	
180+	06/03/15	7:30:00	1166.0	57.68	61.78	4.10	
180+	06/03/15	8:30:00	1226.0	57.65	61.89	4.24	
180+	06/03/15	9:30:00	1286.0	57.61	61.97	4.36	7.19' PSH initial
180+	06/03/15	10:30:00	1346.0	57.57	62.07	4.50	
180+	06/03/15	11:30:00	1406.0	57.55	62.17	4.62	
180+	06/03/15	12:30:00	1466.0	57.51	62.25	4.74	
180+	06/03/15	13:30:00	1526.0	57.48	62.33	4.85	
180+	06/03/15	14:30:00	1586.0	57.46	62.42	4.96	
180+	06/03/15	15:30:00	1646.0	57.43	62.49	5.06	
180+	06/04/15	11:30:00	2846.0	57.22	63.47	6.25	
180+	06/04/15	16:30:00	3146.0	57.16	63.55	6.39	

Baildown/Slug Test Data
Site: Walstad 66 Lovington
Well: W-3
Date: 6/2/15 - 6/4/15

Project #:	1404221	Site Name:	Walstad Oil Co.
Well:	W-3	Samplers:	Barnhill/Beagles
Evacuation Method:	Bailing	Weather:	Hot 92°F

Borehole Diam: 8 inches
Filter Pack Specific Yield (LNAPL)
0.175
Effective Well Radius (ft)
LNAPL Well Volume
6.94 x 0.668 = 4.63 gallons
4.63 gal psh

Well Information		LNAPL Information	
Casing Diameter (Inches):	4"	Fluid Type:	Gasolline
Total Depth (Ft):	73.45	Volume Removed:	16 gallons
Static Depth to Product (Ft)	57.17	Evacuation Method:	bailing
Static Depth to Water (Ft)	64.1	LNAPL Removed:	7 gallons removed

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	Total thickness (feet)	Comments
Bailed	06/02/15	15:08:00					4 gals NAPL
Bailed	06/02/15	15:12:00					2 gal NAPL, 2 gal water
Bailed	06/02/15	15:17:00					0.8 gal NAPL, 3.2 gal water
Bailed	06/02/15	15:21:00					0.2 gal NAPL, 3.2 gal water
0 - 5	06/02/15	15:23:00	0	59.80	59.95	0.15	
0 - 5	06/02/15	15:23:30	0.5	59.55	59.80	0.25	
0 - 5	06/02/15	15:24:00	1.0	59.50	59.77	0.27	
0 - 5	06/02/15	15:24:30	1.5	59.30	59.65	0.35	
0 - 5	06/02/15	15:25:00	2.0	59.23	59.54	0.31	
0 - 5	06/02/15	15:25:30	2.5	59.16	59.47	0.31	
0 - 5	06/02/15	15:26:00	3.0	59.06	59.40	0.34	
0 - 5	06/02/15	15:26:30	3.5	58.99	59.34	0.35	
0 - 5	06/02/15	15:27:00	4.0	58.93	59.30	0.37	
0 - 5	06/02/15	15:27:30	4.5	58.99	59.26	0.27	
0 - 5	06/02/15	15:28:00	5.0	58.85	59.23	0.38	
5 - 10	06/02/15	15:29:00	6.0	58.80	59.20	0.40	
5 - 10	06/02/15	15:30:00	7.0	58.77	59.17	0.40	
5 - 10	06/02/15	15:31:00	8.0	58.74	59.15	0.41	
5 - 10	06/02/15	15:32:00	9.0	58.72	59.13	0.41	
5 - 10	06/02/15	15:33:00	10.0	58.70	59.13	0.43	
10 - 30	06/02/15	15:35:00	12.0	58.68	59.11	0.43	
10 - 30	06/02/15	15:37:00	14.0	58.66	59.10	0.44	Water level peak vaule
10 - 30	06/02/15	15:39:00	16.0	58.65	59.11	0.46	
10 - 30	06/02/15	15:41:00	18.0	58.64	59.11	0.47	
10 - 30	06/02/15	15:43:00	20.0	58.63	59.12	0.49	
10 - 30	06/02/15	15:45:00	22.0	58.63	59.13	0.50	
10 - 30	06/02/15	15:47:00	24.0	58.62	59.13	0.51	
10 - 30	06/02/15	15:49:00	26.0	58.62	59.14	0.52	
10 - 30	06/02/15	15:51:00	28.0	58.62	59.15	0.53	
10 - 30	06/02/15	15:53:00	30.0	58.62	59.15	0.53	
30 - 60	06/02/15	15:58:00	35.0	58.61	59.17	0.56	
30 - 60	06/02/15	16:03:00	40.0	58.60	59.18	0.58	
30 - 60	06/02/15	16:08:00	45.0	58.59	59.20	0.61	
30 - 60	06/02/15	16:13:00	50.0	58.59	59.21	0.62	
30 - 60	06/02/15	16:18:00	55.0	58.58	59.23	0.65	
30 - 60	06/02/15	16:23:00	60.0	58.57	59.25	0.68	
60 - 180	06/02/15	16:33:00	70.0	58.57	59.27	0.70	
60 - 180	06/02/15	16:43:00	80.0	58.56	59.30	0.74	
60 - 180	06/02/15	16:53:00	90.0	58.55	59.32	0.77	
60 - 180	06/02/15	17:03:00	100.0	58.53	59.34	0.81	
60 - 180	06/02/15	17:13:00	110.0	58.53	59.38	0.85	
60 - 180	06/02/15	17:23:00	120.0	58.53	59.40	0.87	
60 - 180	06/02/15	17:33:00	130.0	58.52	59.42	0.90	
60 - 180	06/02/15	17:43:00	140.0	58.51	59.45	0.94	
60 - 180	06/02/15	17:53:00	150.0	58.50	59.46	0.96	
60 - 180	06/02/15	18:03:00	160.0	58.50	59.49	0.99	
60 - 180	06/02/15	18:13:00	170.0	58.49	59.52	1.03	
60 - 180	06/02/15	18:23:00	180.0	58.48	59.53	1.05	
180+	06/02/15	19:00:00	217.0	58.47	59.62	1.15	

Well: W-3 **Baildown/Slug Test Field Form** Site: Walstad Oil Co., Lovington, NM

Period	Date	Time (HH:MM:SS)	Elapsed Time (Minutes)	DTP (feet)	DTW (feet)	Total thickness (feet)	Comments
180+	06/02/15	20:00:00	277.0	58.42	59.76	1.34	
180+	06/02/15	21:00:00	337.0	58.39	59.89	1.50	
180+	06/03/15	6:30:00	907.0	58.06	61.00	2.94	
180+	06/03/15	7:30:00	967.0	58.02	61.09	3.07	
180+	06/03/15	8:30:00	1027.0	58.00	61.18	3.18	
180+	06/03/15	9:30:00	1087.0	57.96	61.26	3.30	6.93' PSH initial
180+	06/03/15	10:30:00	1147.0	57.93	61.35	3.42	
180+	06/03/15	11:30:00	1207.0	57.90	61.44	3.54	
180+	06/03/15	12:30:00	1267.0	57.87	61.51	3.64	
180+	06/03/15	13:30:00	1327.0	57.84	61.59	3.75	
180+	06/03/15	14:30:00	1387.0	57.82	61.66	3.84	
180+	06/03/15	15:30:00	1447.0	57.79	61.72	3.93	
180+	06/04/15	11:30:00	2647.0	57.48	62.82	5.34	
180+	06/04/15	16:30:00	2947.0	57.42	62.96	5.54	

API LNAPL TRANSMISSIVITY WORKBOOK RESULTS

API LNAPL Transmissivity Workbook

Calculation of LNAPL Transmissivity from Baildown Test Data

STEP 1: RESET OUTPUT SUMMARY

STEP 2: ENTER DATA & VIEW FIGURES

STEP 3: CHOOSE WELL CONDITIONS

STEP 4: LNAPL TRANSMISSIVITY SUMMARY

Mean LNAPL Transmissivity (ft^2/d)

0.66

Standard Deviation (ft^2/d)

0.07

Coefficient of Variation

0.10

NAPL Bailing Test Data and Interpretation
Well W-1
Walstad Lovington 66 LUST Site
June 2-4, 2015

Well Designation:	W-1	Walstad LUST Site
Date:	date	2-Jun-15

Ground Surface Elev (ft msl)	0.0	Enter These Data
Top of Casing Elev (ft msl)	0.0	
Well Casing Radius, r_c (ft):	0.167	r_{e1}
Well Radius, r_w (ft):	0.333	
LNAPL Specific Yield, S_y:	0.175	
LNAPL Density Ratio, ρ_r:	0.780	
Top of Screen (ft bgs):	50.0	
Bottom of Screen (ft bgs):	70.0	
LNAPL Baildown Vol. (gal.):	6.0	
Effective Radius, r_{e3} (ft):	0.206	Calculated Parameters
Effective Radius, r_{e2} (ft):	0.197	
Initial Casing LNAPL Vol. (gal.):	4.44	
Initial Filter LNAPL Vol. (gal.):	2.31	

Drawdown Adjustment (ft)
0.004

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	58.11	64.89	58.11	64.89	59.60					6.78	
Enter Test Data:												
	0.5	60.41	60.51	60.41	60.51	60.43	2.30				0.10	
	1.0	60.26	60.27	60.26	60.27	60.26	2.15	0.8	-34.538	2.22	0.01	0.206
	1.5	60.17	60.17	60.17	60.17	60.17	2.06	1.3	-3.838	2.10	0.00	0.206
	2.0	60.06	60.07	60.06	60.07	60.06	1.95	1.8	3.838	2.00	0.01	0.206
	2.5	59.91	59.94	59.91	59.94	59.92	1.80	2.3	7.675	1.87	0.03	0.206
	3.0	59.88	59.90	59.88	59.90	59.88	1.77	2.8	-3.838	1.78	0.02	0.206
	3.5	59.85	59.87	59.85	59.87	59.85	1.74	3.3	0.000	1.75	0.02	0.206
	4.0	59.84	59.86	59.84	59.86	59.84	1.73	3.8	0.000	1.73	0.02	0.206
	4.5	59.81	59.83	59.81	59.83	59.81	1.70	4.3	0.000	1.71	0.02	0.206
	5.0	59.79	59.81	59.79	59.81	59.79	1.68	4.8	0.000	1.69	0.02	0.206
	6.0	59.74	59.78	59.74	59.78	59.75	1.63	5.5	3.838	1.65	0.04	0.206
	7.0	59.71	59.77	59.71	59.77	59.72	1.60	6.5	3.838	1.61	0.06	0.206
	8.0	59.68	59.79	59.68	59.79	59.70	1.57	7.5	9.594	1.58	0.11	0.206
	9.0	59.67	59.81	59.67	59.81	59.70	1.56	8.5	5.756	1.56	0.14	0.206
	10.0	59.65	59.84	59.65	59.84	59.69	1.54	9.5	9.594	1.55	0.19	0.206
	11.0	59.64	59.86	59.64	59.86	59.69	1.53	10.5	5.756	1.53	0.22	0.206
	13.0	59.62	59.90	59.62	59.90	59.68	1.51	12.0	5.756	1.52	0.28	0.206
	15.0	59.6	59.94	59.60	59.94	59.67	1.49	14.0	5.756	1.50	0.34	0.206
	17.0	59.59	59.98	59.59	59.98	59.68	1.48	16.0	4.797	1.48	0.39	0.206
	19.0	59.58	60.00	59.58	60.00	59.67	1.47	18.0	2.878	1.47	0.42	0.206
	21.0	59.57	60.02	59.57	60.02	59.67	1.46	20.0	2.878	1.46	0.45	0.206
	23.0	59.57	60.04	59.57	60.04	59.67	1.46	22.0	1.919	1.46	0.47	0.206
	25.0	59.56	60.06	59.56	60.06	59.67	1.45	24.0	2.878	1.45	0.50	0.206
	27.00	59.55	60.08	59.55	60.08	59.67	1.44	26.0	2.878	1.44	0.53	0.206
	29.00	59.54	60.09	59.54	60.09	59.66	1.43	28.0	1.919	1.43	0.55	0.206
	35.00	59.52	60.14	59.52	60.14	59.66	1.41	32.0	2.239	1.42	0.62	0.206
	41.00	59.5	60.19	59.50	60.19	59.65	1.39	38.0	2.239	1.40	0.69	0.206
	43.00	59.49	60.21	59.49	60.21	59.65	1.38	42.0	2.878	1.38	0.72	0.206
	48.00	59.48	60.24	59.48	60.24	59.65	1.37	45.5	1.535	1.37	0.76	0.206
	53.00	59.47	60.29	59.47	60.29	59.65	1.36	50.5	2.303	1.36	0.82	0.206
	58.00	59.45	60.33	59.45	60.33	59.64	1.34	55.5	2.303	1.35	0.88	0.206
	68.00	59.43	60.39	59.43	60.39	59.64	1.32	63.0	1.535	1.33	0.96	0.206
	73.00	59.42	60.43	59.42	60.43	59.64	1.31	70.5	1.919	1.31	1.01	0.206
	83.00	59.4	60.51	59.40	60.51	59.64	1.29	78.0	1.919	1.30	1.11	0.206
	93.00	59.37	60.57	59.37	60.57	59.63	1.26	88.0	1.727	1.27	1.20	0.206
	103.00	59.36	60.65	59.36	60.65	59.64	1.25	98.0	1.727	1.25	1.29	0.206
	123.00	59.31	60.80	59.31	60.80	59.64	1.20	113.0	1.919	1.22	1.49	0.206
	143.00	59.26	60.92	59.26	60.92	59.63	1.15	133.0	1.631	1.17	1.66	0.206
	163	59.21	61.04	59.21	61.04	59.61	1.10	153.0	1.631	1.12	1.83	0.206
	183	59.17	61.16	59.17	61.16	59.61	1.06	173.0	1.535	1.08	1.99	0.206
	213	59.12	61.29	59.12	61.29	59.60	1.01	198.0	1.151	1.03	2.17	0.206
	243	59.04	61.54	59.04	61.54	59.59	0.93	228.0	2.111	0.97	2.50	0.206
	273	58.98	61.71	58.98	61.71	59.58	0.87	258.0	1.471	0.90	2.73	0.206
	303	58.93	61.87	58.93	61.87	59.58	0.82	288.0	1.343	0.84	2.94	0.206
	363	58.84	61.57	58.84	61.57	59.44	0.73	333.0	-0.672	0.77	2.73	0.206
	423	58.73	62.49	58.73	62.49	59.56	0.62	393.0	3.294	0.67	3.76	0.206
	483	58.65	62.77	58.65	62.77	59.56	0.54	453.0	1.151	0.58	4.12	0.206
	543	58.58	63.02	58.58	63.02	59.56	0.47	513.0	1.023	0.50	4.44	0.206
	603	58.52	63.22	58.52	63.22	59.55	0.41	573.0	0.831	0.44	4.70	0.206
	663	58.47	63.40	58.47	63.40	59.55	0.36	633.0	0.736	0.38	4.93	0.206
	1233	58.22	64.27	58.22	64.27	59.55	0.11	948.0	0.377	0.23	6.05	0.206
	1293	58.20	64.30	58.20	64.30	59.54	0.09	1263.0	0.160	0.10	6.10	0.206
	1353	58.19	64.32	58.19	64.32	59.54	0.08	1323.0	0.096	0.08	6.13	0.206
	1413	58.18	64.36	58.18	64.36	59.54	0.07	1383.0	0.160	0.07	6.18	0.206
	1473	58.16	64.38	58.16	64.38	59.53	0.05	1443.0	0.128	0.06	6.22	0.206
	1533	58.16	64.40	58.16	64.40	59.53	0.05	1503.0	0.064	0.05	6.24	0.206
	1773	58.12	64.45	58.12	64.45	59.51	0.01	1653.0	0.072	0.03	6.33	0.206
	2973	58.14	64.61	58.14	64.61	59.56	0.03	2373.0	0.022	0.02	6.47	0.206
	3273	58.14	64.58	58.14	64.58	59.56	0.03	3123.0	-0.019	0.03	6.44	0.206

Figure 1

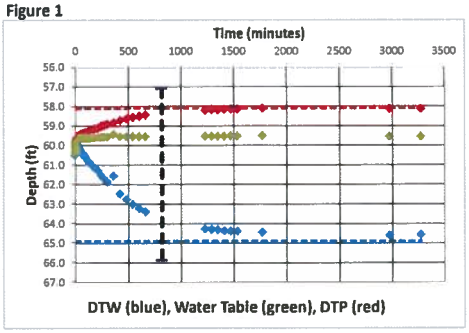
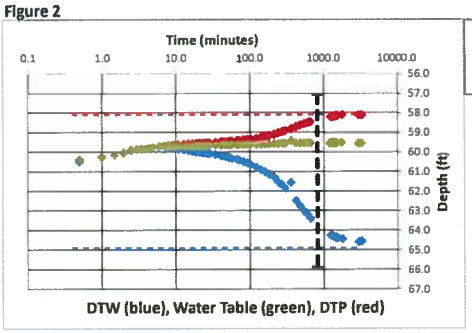


Figure 2



0.4	58.11
3273	58.11
0.4	64.89
3273	64.89
818.3	57.11
818.3	65.9

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
2	0.9

Drawdown Adjust.	
Δs_n (ft)	0.004

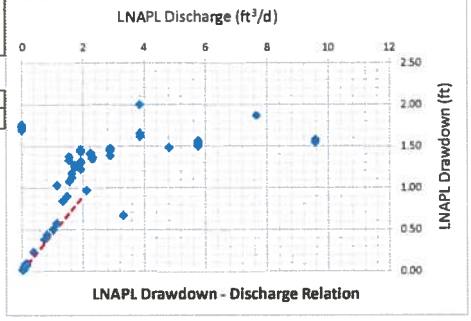


Figure 4

b_n	s_n
0	1.53
6.4	0

J-ratio	-0.239

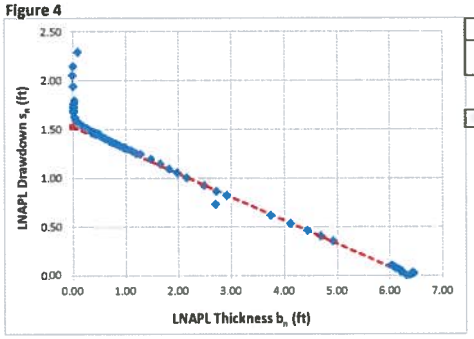


Figure 5

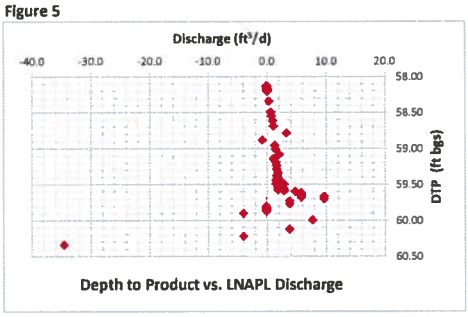


Figure 6

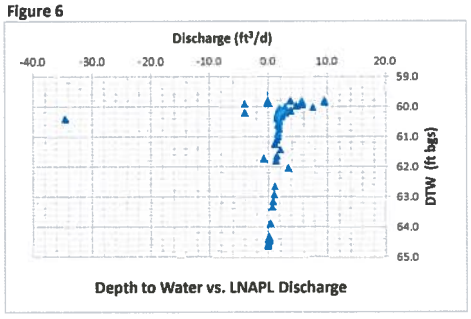


Figure 7

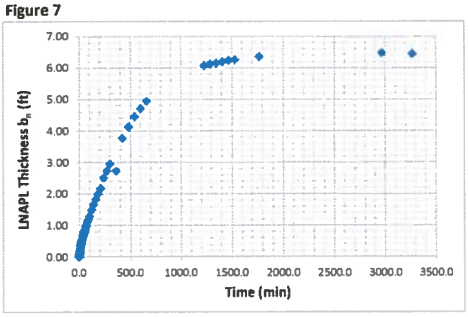


Figure 8

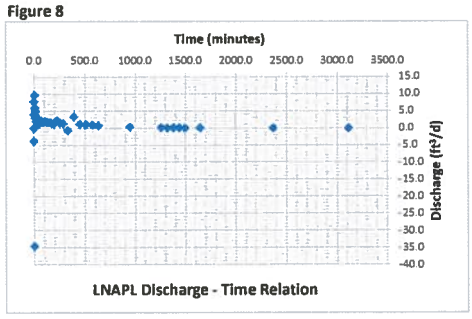


Figure 9

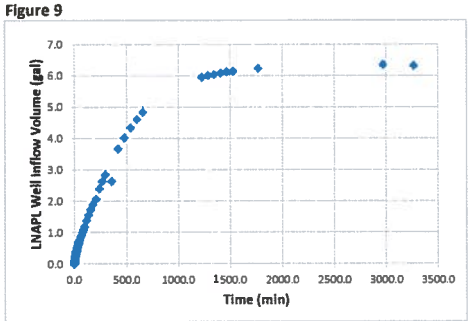
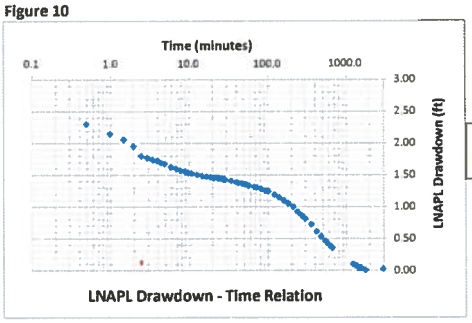


Figure 10



t (min)	s_n (ft)
2.5	0.115
2.5	0.145

Generalized Bouwer and Rice (1976)

Well Designation:	W-1
Date:	2-Jun-15

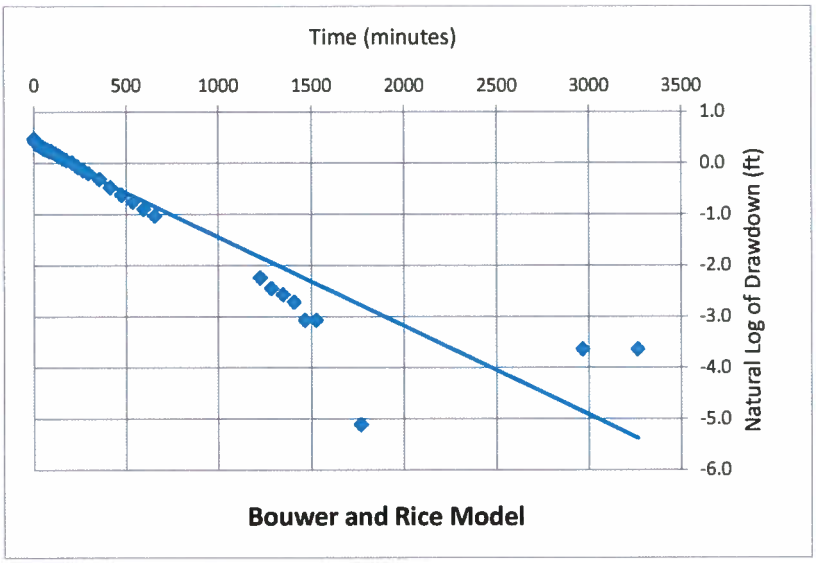
$$T_n = \frac{r_e^{\,2} \ln(R/r_e) \ln(s_n(t_1)/s_n(t))}{2(-J)(t - t_1)}$$

Enter early time cut-off for least-squares model fit

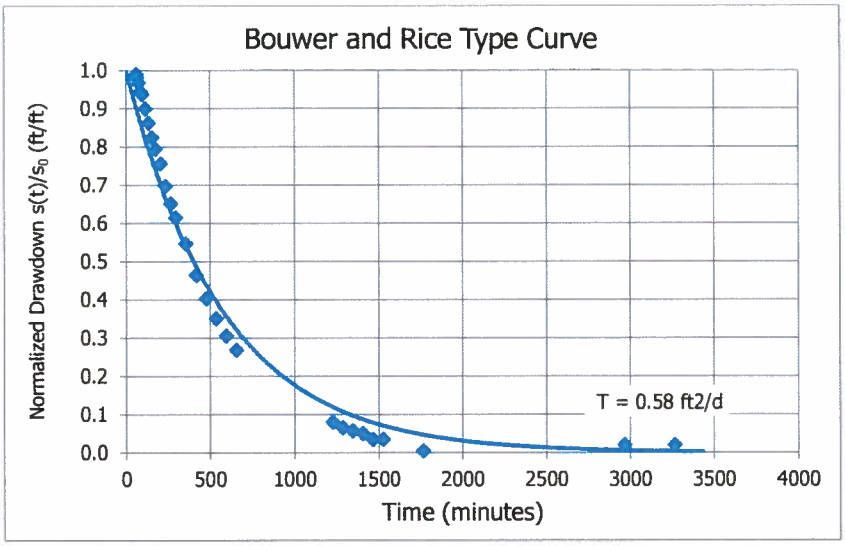
$Time_{cut}$	6	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.58 +/- 0.03 ft^2/d

L_e/r_e	32.9
C	2.11
R/r_e	14.01
J-Ratio	-0.239
Coef. Of Variation	0.06



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	W-1
Date:	date

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	200	<- Enter or change values here
Time Adjustment (min):	1.5	

Trial S_n: d <-- Enter d for default or enter S_n value

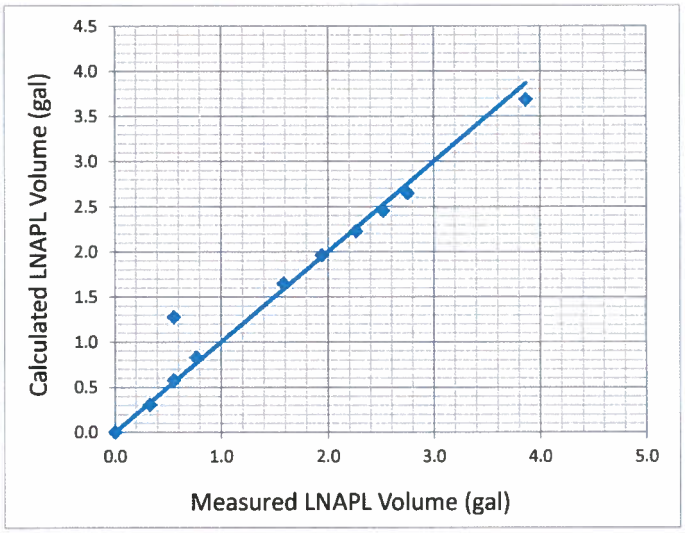
Root-Mean-Square Error: 0.756 <-- Minimize this using "Solver"

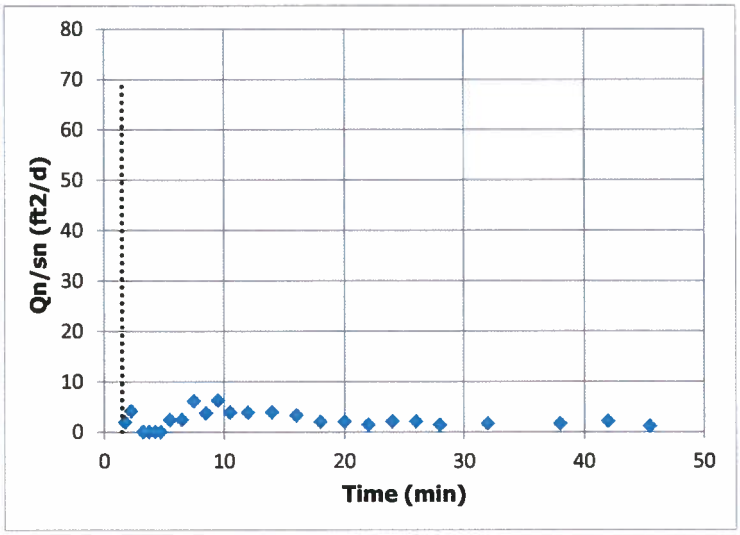
0.074 <-- Working S_n

Trial T_n (ft^2/d): 0.700 <-- By changing T_n through "Solver"

Add constraint $T_n > 0.00001$

Model Result: T_n (ft^2/d) = **0.70**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	W-1
Date:	date

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	5	<- Enter or change values here
Initial Drawdown s_n (ft):	2.6	

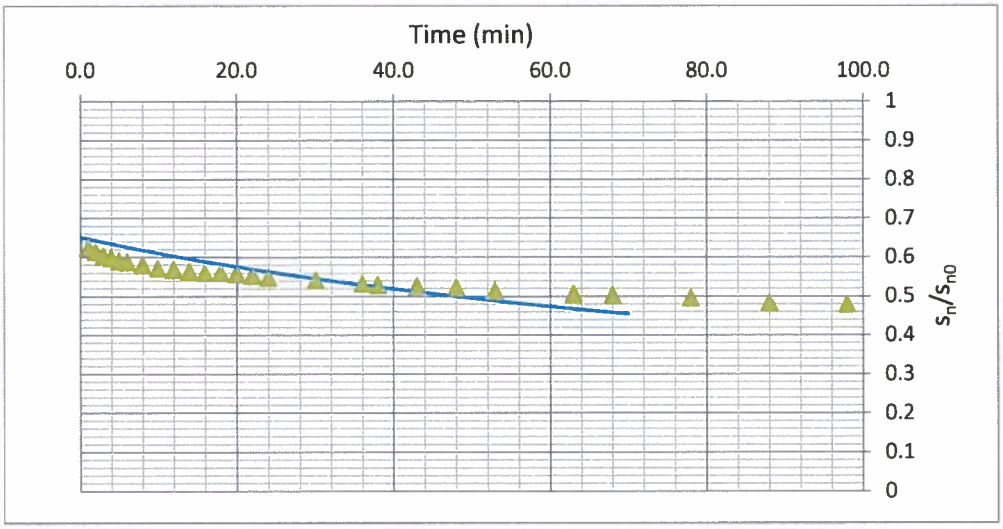
Trial S_n:	d	<-- Enter d for default
Root-Mean-Square Error:	0.259	<-- Minimize this using "Solver"
Trial T_n (ft^2/d):	0.700	<-- By changing T_n through "Solver"
	0.40000	<-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.2
T_{max}	70

Model Result:

T_n (ft^2/d) =	0.70



J-Ratio
-0.239

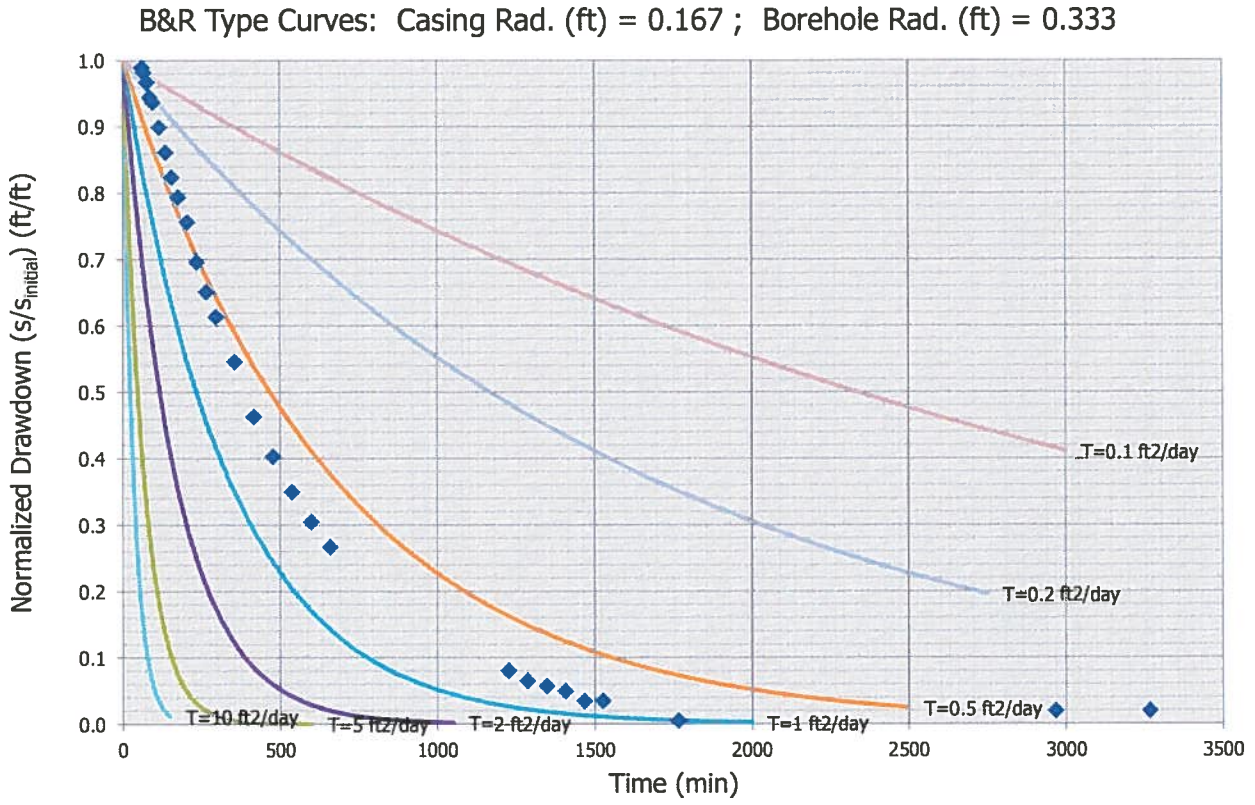
Bouwer and Rice Short Term LNAPL Mobility Test Type Curves

B&R Type Curves: Casing Rad. (ft) = 0.167 ; Borehole Rad. (ft) = 0.333

Enter these values

Type Curve ID	Type Curve Name	Notes	Max Time (min)	Transmissivity (ft^2/day)
1	T=10 ft2/day		150	10
2	T=5 ft2/day		600	5
3	T=2 ft2/day		1050	2
4	T=1 ft2/day		2000	1
5	T=0.5 ft2/day		2500	0.5
6	T=0.2 ft2/day		2750	0.2
7	T=0.1 ft2/day		3000	0.1

J-Ratio	
-0.239	<-- If uncertain u:
	-0.22



API LNAPL Transmissivity Workbook

Calculation of LNAPL Transmissivity from Baildown Test Data

STEP 1: RESET OUTPUT SUMMARY

STEP 2: ENTER DATA & VIEW FIGURES

STEP 3: CHOOSE WELL CONDITIONS

STEP 4: LNAPL TRANSMISSIVITY SUMMARY

Mean LNAPL Transmissivity (ft^2/d)

0.39

Standard Deviation (ft^2/d)

0.17

Coefficient of Variation

0.43

NAPL Bailing Test Data and Interpretation
Well W-2
Walstad Lovington 66 LUST Site
June 2-4, 2015

Well Designation:	W-2	Walstad LUST Site
Date:	date	2-Jun-15

Ground Surface Elev (ft msl)	0.0	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	0.0		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.004
Well Radius, r_w (ft):	0.333		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.780		
Top of Screen (ft bgs):	0.0		
Bottom of Screen (ft bgs):	0.0		
LNAPL Baildown Vol. (gal.):	7.2		
Effective Radius, r_{e3} (ft):	0.206	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.197		
Initial Casing LNAPL Vol. (gal.):	4.71		
Initial Filter LNAPL Vol. (gal.):	2.45		

	Enter Data Here					Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)							
Initial Fluid Levels:	0	57.07	64.26	57.07	64.26	58.65					7.19	
Enter Test Data:											0.18	
	0.5	59.14	59.32	59.14	59.32	59.18	2.07					
	1.0	59.01	59.06	59.01	59.06	59.02	1.94	0.8	-49.888	2.00	0.05	0.206
	1.5	58.94	59.02	58.94	59.02	58.96	1.87	1.3	11.513	1.90	0.08	0.206
	2.0	58.87	58.95	58.87	58.95	58.89	1.80	1.8	0.000	1.83	0.08	0.206
	2.5	58.82	58.95	58.82	58.95	58.85	1.75	2.3	19.188	1.77	0.13	0.206
	3.0	58.79	58.91	58.79	58.91	58.82	1.72	2.8	-3.838	1.73	0.12	0.206
	3.5	58.75	58.88	58.75	58.88	58.78	1.68	3.3	3.838	1.70	0.13	0.206
	4.0	58.73	58.86	58.73	58.86	58.76	1.66	3.8	0.000	1.67	0.13	0.206
	4.5	58.71	58.86	58.71	58.86	58.74	1.64	4.3	7.675	1.65	0.15	0.206
	5.0	58.70	58.86	58.70	58.86	58.74	1.63	4.8	3.838	1.63	0.16	0.206
	6.0	58.69	58.85	58.69	58.85	58.73	1.62	5.5	0.000	1.62	0.16	0.206
	7.0	58.66	58.85	58.66	58.85	58.70	1.59	6.5	5.756	1.60	0.19	0.206
	8.0	58.65	58.85	58.65	58.85	58.69	1.58	7.5	1.919	1.58	0.20	0.206
	9.0	58.64	58.85	58.64	58.85	58.69	1.57	8.5	1.919	1.57	0.21	0.206
	10.0	58.64	58.85	58.64	58.85	58.69	1.57	9.5	0.000	1.57	0.21	0.206
	12.0	58.63	58.85	58.63	58.85	58.68	1.56	11.0	0.959	1.56	0.22	0.206
	14.0	58.62	58.86	58.62	58.86	58.67	1.55	13.0	1.919	1.55	0.24	0.206
	16.0	58.61	58.88	58.61	58.88	58.67	1.54	15.0	2.878	1.54	0.27	0.206
	18.0	58.61	58.89	58.61	58.89	58.67	1.54	17.0	0.959	1.54	0.28	0.206
	20.0	58.61	58.89	58.61	58.89	58.67	1.54	19.0	0.000	1.54	0.28	0.206
	22.0	58.6	58.90	58.60	58.90	58.67	1.53	21.0	1.919	1.53	0.30	0.206
	24.0	58.6	58.91	58.60	58.91	58.67	1.53	23.0	0.959	1.53	0.31	0.206
	26.0	58.6	58.92	58.60	58.92	58.67	1.53	25.0	0.959	1.53	0.32	0.206
	28.00	58.59	58.93	58.59	58.93	58.66	1.52	27.0	1.919	1.52	0.34	0.206
	30.00	58.59	58.94	58.59	58.94	58.67	1.52	29.0	0.959	1.52	0.35	0.206
	35.00	58.58	58.96	58.58	58.96	58.66	1.51	32.5	1.151	1.51	0.38	0.206
	40.00	58.58	58.98	58.58	58.98	58.67	1.51	37.5	0.768	1.51	0.40	0.206
	45.00	58.57	58.99	58.57	58.99	58.66	1.50	42.5	0.768	1.50	0.42	0.206
	50.00	58.56	59.01	58.56	59.01	58.66	1.49	47.5	1.151	1.49	0.45	0.206
	55.00	58.55	59.03	58.55	59.03	58.66	1.48	52.5	1.151	1.48	0.48	0.206
	60.00	58.54	59.04	58.54	59.04	58.65	1.47	57.5	0.768	1.47	0.50	0.206
	70.00	58.53	59.08	58.53	59.08	58.65	1.46	65.0	0.959	1.46	0.55	0.206
	80.00	58.51	59.11	58.51	59.11	58.64	1.44	75.0	0.959	1.45	0.60	0.206
	90.00	58.5	59.14	58.50	59.14	58.64	1.43	85.0	0.768	1.43	0.64	0.206
	100.00	58.49	59.17	58.49	59.17	58.64	1.42	95.0	0.768	1.42	0.68	0.206
	110.00	58.48	59.20	58.48	59.20	58.64	1.41	105.0	0.768	1.41	0.72	0.206
	120.00	58.47	59.23	58.47	59.23	58.64	1.40	115.0	0.768	1.40	0.76	0.206
	130.00	58.46	59.27	58.46	59.27	58.64	1.39	125.0	0.959	1.39	0.81	0.206
	140	58.44	59.30	58.44	59.30	58.63	1.37	135.0	0.959	1.38	0.86	0.206
	160	58.42	59.35	58.42	59.35	58.62	1.35	150.0	0.672	1.36	0.93	0.206
	176	58.41	59.40	58.41	59.40	58.63	1.34	168.0	0.720	1.34	0.99	0.206
	206	58.39	59.51	58.39	59.51	58.64	1.32	191.0	0.831	1.33	1.12	0.206
	236	58.32	59.62	58.32	59.62	58.61	1.25	221.0	1.151	1.28	1.30	0.206
	296	58.30	59.74	58.30	59.74	58.62	1.23	266.0	0.448	1.24	1.44	0.206
	356	58.25	59.90	58.25	59.90	58.61	1.18	326.0	0.672	1.20	1.65	0.206
	416	58.21	60.05	58.21	60.05	58.61	1.14	386.0	0.608	1.16	1.84	0.206
	476	58.16	60.22	58.16	60.22	58.61	1.09	446.0	0.704	1.11	2.06	0.206
	536	58.11	60.37	58.11	60.37	58.61	1.04	506.0	0.640	1.06	2.26	0.206
	1114	57.72	61.67	57.72	61.67	58.59	0.65	825.0	0.561	0.84	3.95	0.206
	1174	57.68	61.78	57.68	61.78	58.58	0.61	1144.0	0.480	0.63	4.10	0.206
	1234	57.65	61.89	57.65	61.89	58.58	0.58	1204.0	0.448	0.59	4.24	0.206
	1294	57.61	61.97	57.61	61.97	58.57	0.54	1264.0	0.384	0.56	4.36	0.206
	1354	57.57	62.07	57.57	62.07	58.56	0.50	1324.0	0.448	0.52	4.50	0.206
	1414	57.55	62.17	57.55	62.17	58.57	0.48	1384.0	0.384	0.49	4.62	0.206
	1466	57.51	62.25	57.51	62.25	58.55	0.44	1440.0	0.443	0.46	4.74	0.206
	1526	57.48	62.33	57.48	62.33	58.55	0.41	1496.0	0.352	0.42	4.85	0.206
	1666	57.43	62.49	57.43	62.49	58.54	0.36	1596.0	0.288	0.38	5.06	0.206
	2866	57.22	63.47	57.22	63.47	58.60	0.15	2266.0	0.190	0.25	6.25	0.206
	3166	57.16	63.55	57.16	63.55	58.57	0.09	3016.0	0.090	0.12	6.39	0.206

Figure 1

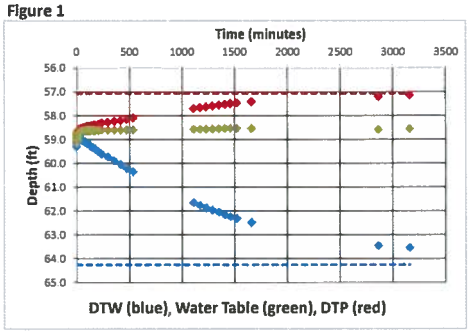
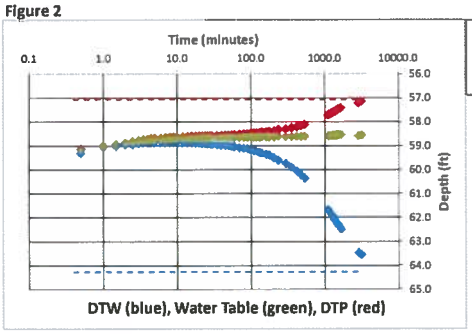


Figure 2



0.4	57.07
3166	57.07
0.4	64.26
3166	64.26

791.5	#N/A
791.5	#N/A

Figure 3

Q_n (ft^3/d)	s_n (ft)
0	0
1	1.6

Drawdown Adjust.	
Δs_n (ft)	0.004

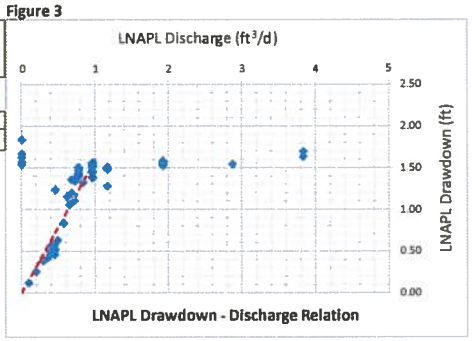


Figure 4

b_n	s_n
0	1.6
6.4	0

J-ratio	-0.250

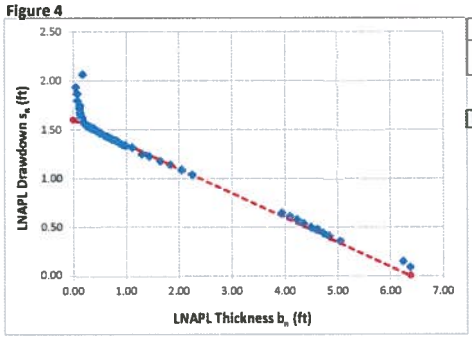


Figure 5

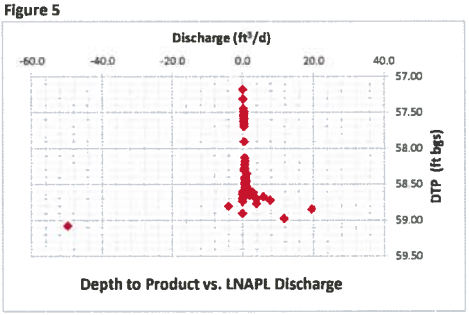


Figure 6

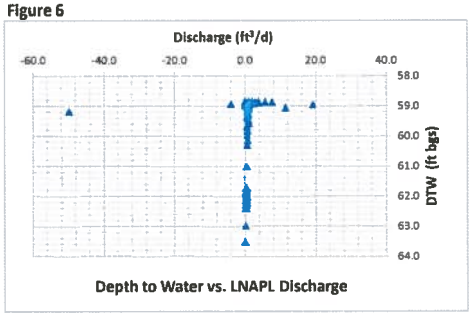


Figure 7

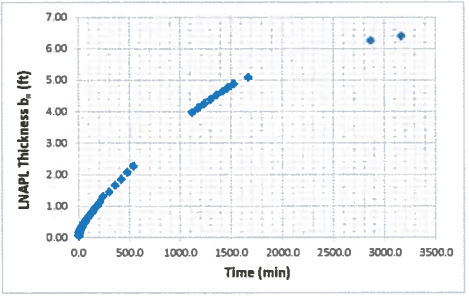


Figure 8

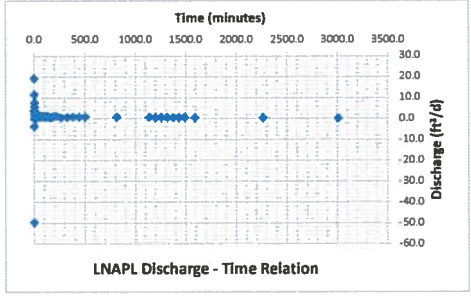


Figure 9

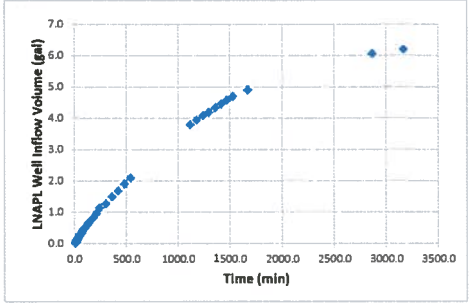
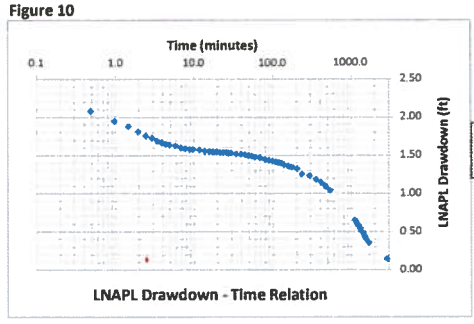


Figure 10



t (min)	s_n (ft)
2.5	0.115
2.5	0.145

Generalized Bouwer and Rice (1976)

Well Designation:	W-2
Date:	2-Jun-15

$$T_n = \frac{r_e^2 \ln(R/r_e) \ln(s_n(t_1)/s_n(t))}{2(-J)(t-t_1)}$$

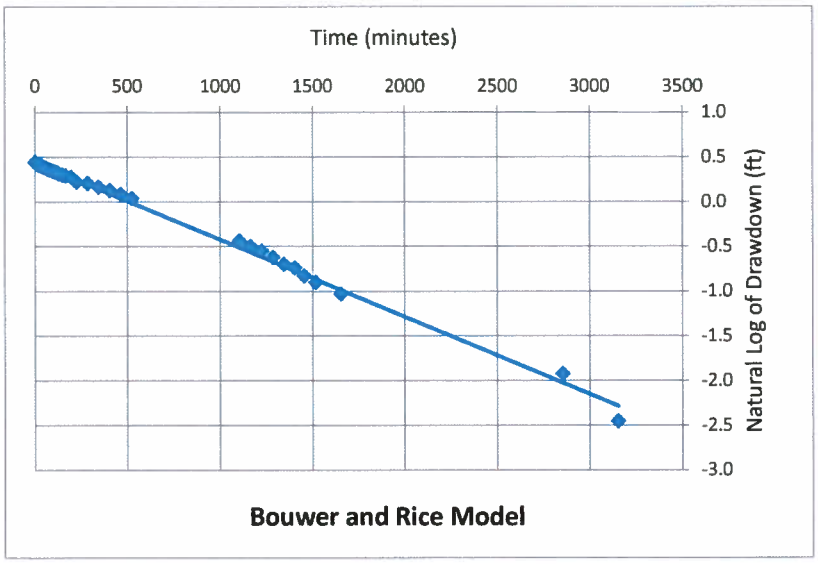
Enter early time cut-off for least-squares model fit

$Time_{cut}$	10	<- Enter or change value here

L_e/r_e
34.9
C
2.19
R/r_e
14.68

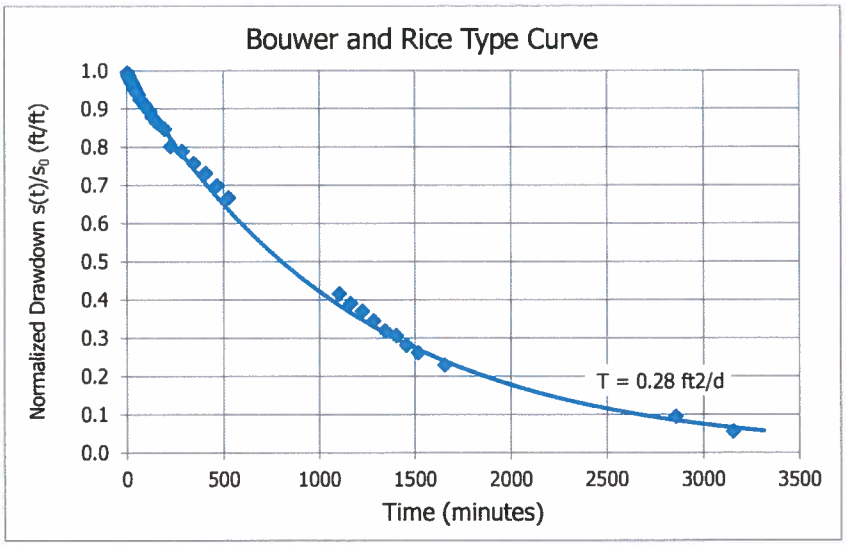
Model Results: T_n (ft^2/d) = 0.28 +/- 0.00 ft^2/d

J-Ratio
-0.250



Coef. Of Variation
0.01

C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	W-2
Date:	date

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	5	<- Enter or change values here
Time Adjustment (min):	2	

Trial S_n: d <-- Enter d for default or enter S_n value

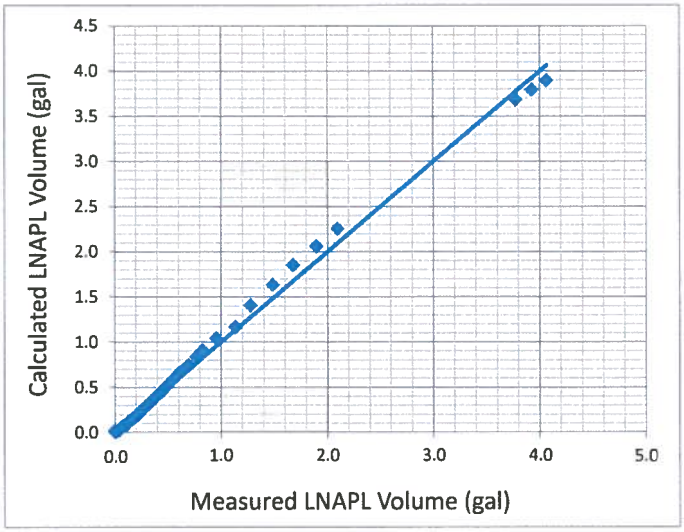
Root-Mean-Square Error: 0.460 <-- Minimize this using "Solver"

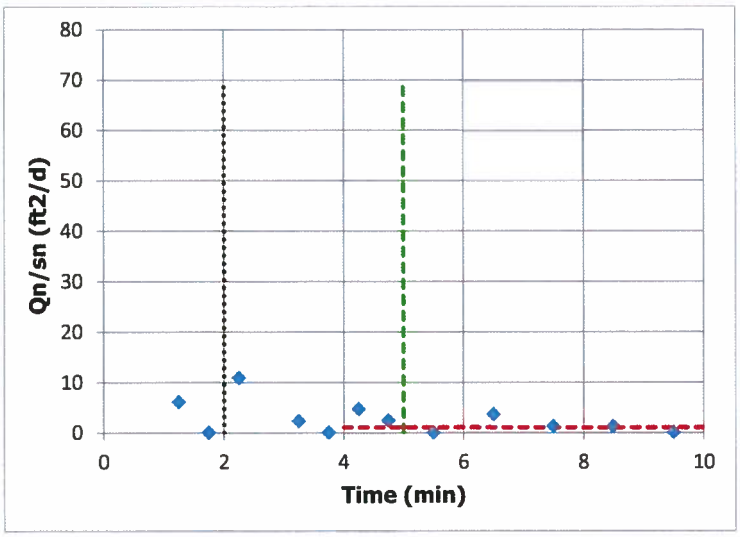
0.000046 <-- Working S_n

Trial T_n (ft^2/d): 0.58 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = 0.58





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	W-2
Date:	date

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	9	<- Enter or change values here
Initial Drawdown s_n (ft):	2.5	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.197 <-- Minimize this using "Solver"

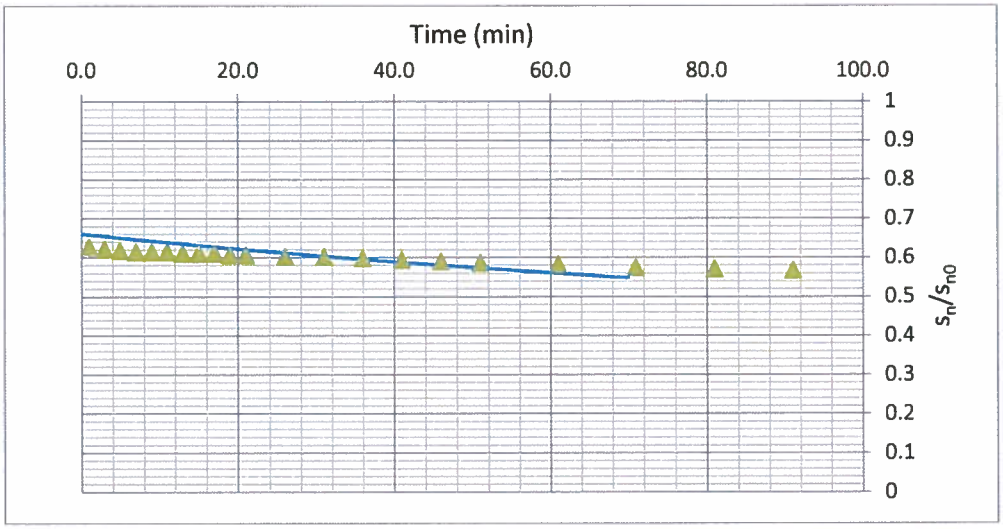
Trial T_n (ft^2/d): 0.300 <-- By changing T_n through "Solver"

0.3900 <-- Working S_n

Add constraint Tn > 0.00001

Model Result: T_n (ft^2/d) = **0.30**

T_{min}	0.2
T_{max}	70



J-Ratio
-0.250

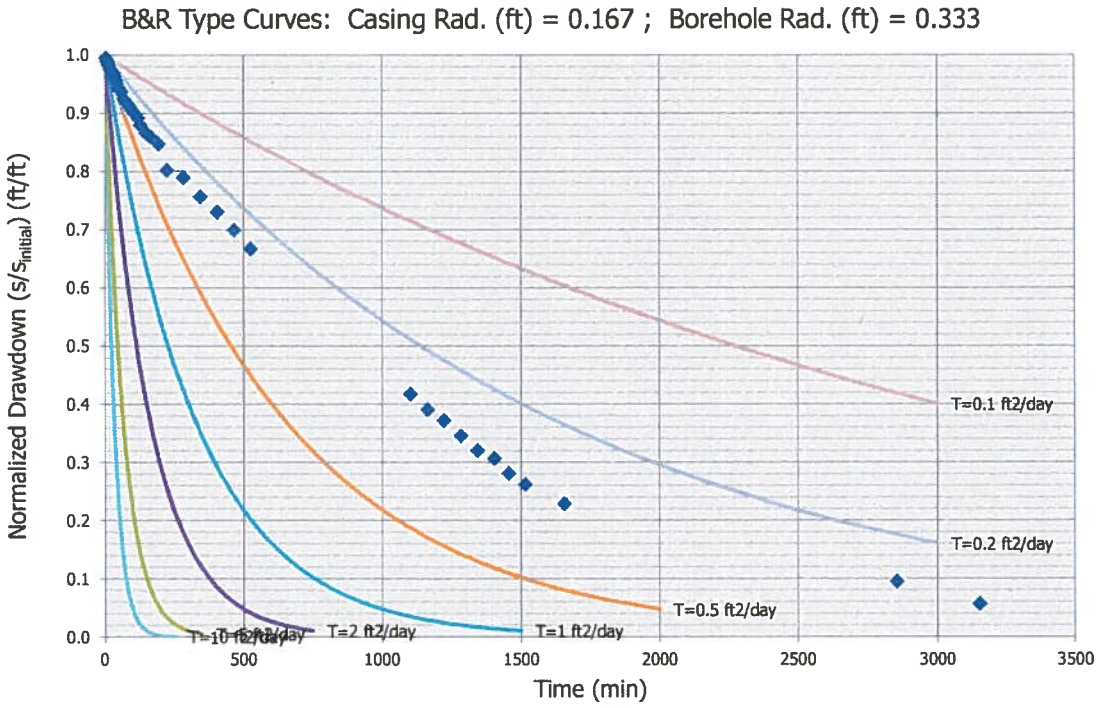
Bouwer and Rice Short Term LNAPL Mobility Test Type Curves

B&R Type Curves: Casing Rad. (ft) = 0.167 ; Borehole Rad. (ft) = 0.333

Enter these values

Type Curve ID	Type Curve Name	Notes	Max Time (min)	Transmissivity (ft^2/day)
1	T=10 ft2/day		250	10
2	T=5 ft2/day		350	5
3	T=2 ft2/day		750	2
4	T=1 ft2/day		1500	1
5	T=0.5 ft2/day		2000	0.5
6	T=0.2 ft2/day		3000	0.2
7	T=0.1 ft2/day		3000	0.1

J-Ratio	
-0.250	<-- If uncertain use
	-0.22



API LNAPL Transmissivity Workbook

Calculation of LNAPL Transmissivity from Baildown Test Data

STEP 1: RESET OUTPUT SUMMARY

STEP 2: ENTER DATA & VIEW FIGURES

STEP 3: CHOOSE WELL CONDITIONS

STEP 4: LNAPL TRANSMISSIVITY SUMMARY

Mean LNAPL Transmissivity (ft^2/d)

0.24

Standard Deviation (ft^2/d)

0.05

Coefficient of Variation

0.23

NAPL Bailing Test Data and Interpretation
Well W-3
Walstad Lovington 66 LUST Site
June 2-4, 2015

Well Designation:	W-3	Walstad LUST Site
Date:	2-Jun-15	

Ground Surface Elev (ft msl)	0.0	Enter These Data	**Drawdown Adjustment (ft)**
Top of Casing Elev (ft msl)	0.0		
Well Casing Radius, r_c (ft):	0.167	r_{e1}	0.004
Well Radius, r_w (ft):	0.333		
LNAPL Specific Yield, S_y:	0.175		
LNAPL Density Ratio, ρ_r:	0.780		
Top of Screen (ft bgs):	0.0		
Bottom of Screen (ft bgs):	0.0		
LNAPL Baildown Vol. (gal.):	7.0		
Effective Radius, r_{e3} (ft):	0.206	Calculated Parameters	
Effective Radius, r_{e2} (ft):	0.197		
Initial Casing LNAPL Vol. (gal.):	4.54		
Initial Filter LNAPL Vol. (gal.):	2.37		

Enter Data Here

	Time (min)	DTP (ft btoc)	DTW (ft btoc)	DTP (ft bgs)	DTW (ft bgs)	Water Table Depth (ft)	LNAPL Drawdown s_n (ft)	Average Time (min)	LNAPL Discharge Q_n (ft^3/d)	s_n (ft)	b_n (ft)	r_e (ft)
Initial Fluid Levels:	0	57.17	64.1	57.17	64.1	58.69					6.93	
Enter Test Data:	0.5	59.55	59.80	59.55	59.80	59.61	2.38				0.25	
	1.0	59.50	59.77	59.50	59.77	59.56	2.33	0.8	7.675	2.35	0.27	0.206
	1.5	59.30	59.65	59.30	59.65	59.38	2.13	1.3	30.700	2.23	0.35	0.206
	2.0	59.23	59.54	59.23	59.54	59.30	2.06	1.8	-15.350	2.09	0.31	0.206
	2.5	59.16	59.47	59.16	59.47	59.23	1.99	2.3	0.000	2.02	0.31	0.206
	3.0	59.06	59.40	59.06	59.40	59.13	1.89	2.8	11.513	1.94	0.34	0.206
	3.5	58.99	59.34	58.99	59.34	59.07	1.82	3.3	3.838	1.85	0.35	0.206
	4.0	58.93	59.30	58.93	59.30	59.01	1.76	3.8	7.675	1.79	0.37	0.206
	4.5	58.89	59.26	58.89	59.26	58.97	1.72	4.3	0.000	1.74	0.37	0.206
	5.0	58.85	59.23	58.85	59.23	58.93	1.68	4.8	3.838	1.70	0.38	0.206
	6.0	58.80	59.20	58.80	59.20	58.89	1.63	5.5	3.838	1.65	0.40	0.206
	7.0	58.77	59.17	58.77	59.17	58.86	1.60	6.5	0.000	1.61	0.40	0.206
	8.0	58.74	59.15	58.74	59.15	58.83	1.57	7.5	1.919	1.58	0.41	0.206
	9.0	58.72	59.13	58.72	59.13	58.81	1.55	8.5	0.000	1.56	0.41	0.206
	10.0	58.7	59.13	58.70	59.13	58.79	1.53	9.5	3.838	1.54	0.43	0.206
	12.0	58.68	59.11	58.68	59.11	58.77	1.51	11.0	0.000	1.52	0.43	0.206
	14.0	58.66	59.10	58.66	59.10	58.76	1.49	13.0	0.959	1.50	0.44	0.206
	16.0	58.65	59.11	58.65	59.11	58.75	1.48	15.0	1.919	1.48	0.46	0.206
	18.0	58.64	59.11	58.64	59.11	58.74	1.47	17.0	0.959	1.47	0.47	0.206
	20.0	58.63	59.12	58.63	59.12	58.74	1.46	19.0	1.919	1.46	0.49	0.206
	22.0	58.63	59.13	58.63	59.13	58.74	1.46	21.0	0.959	1.46	0.50	0.206
	24.0	58.62	59.13	58.62	59.13	58.73	1.45	23.0	0.959	1.45	0.51	0.206
	26.0	58.62	59.14	58.62	59.14	58.73	1.45	25.0	0.959	1.45	0.52	0.206
	28.00	58.62	59.15	58.62	59.15	58.74	1.45	27.0	0.959	1.45	0.53	0.206
	30.00	58.62	59.15	58.62	59.15	58.74	1.45	29.0	0.000	1.45	0.53	0.206
	35.00	58.61	59.17	58.61	59.17	58.73	1.44	32.5	1.151	1.44	0.56	0.206
	40.00	58.6	59.18	58.60	59.18	58.73	1.43	37.5	0.768	1.43	0.58	0.206
	45.00	58.59	59.20	58.59	59.20	58.72	1.42	42.5	1.151	1.42	0.61	0.206
	50.00	58.59	59.21	58.59	59.21	58.73	1.42	47.5	0.384	1.42	0.62	0.206
	55.00	58.58	59.23	58.58	59.23	58.72	1.41	52.5	1.151	1.41	0.65	0.206
	60.00	58.57	59.25	58.57	59.25	58.72	1.40	57.5	1.151	1.40	0.68	0.206
	70.00	58.57	59.27	58.57	59.27	58.72	1.40	65.0	0.384	1.40	0.70	0.206
	80.00	58.56	59.30	58.56	59.30	58.72	1.39	75.0	0.768	1.39	0.74	0.206
	90.00	58.55	59.32	58.55	59.32	58.72	1.38	85.0	0.576	1.38	0.77	0.206
	100.00	58.53	59.34	58.53	59.34	58.71	1.36	95.0	0.768	1.37	0.81	0.206
	110.00	58.53	59.34	58.53	59.34	58.71	1.36	105.0	0.000	1.36	0.81	0.206
	120.00	58.53	59.40	58.53	59.40	58.72	1.36	115.0	1.151	1.36	0.87	0.206
	130.00	58.52	59.42	58.52	59.42	58.72	1.35	125.0	0.576	1.35	0.90	0.206
	140	58.51	59.45	58.51	59.45	58.72	1.34	135.0	0.768	1.34	0.94	0.206
	150	58.50	59.46	58.50	59.46	58.71	1.33	145.0	0.384	1.33	0.96	0.206
	160	58.50	59.49	58.50	59.49	58.72	1.33	155.0	0.576	1.33	0.99	0.206
	180	58.48	59.53	58.48	59.53	58.71	1.31	170.0	0.576	1.32	1.05	0.206
	217	58.47	59.62	58.47	59.62	58.72	1.30	198.5	0.519	1.30	1.15	0.206
	277	58.42	59.76	58.42	59.76	58.71	1.25	247.0	0.608	1.27	1.34	0.206
	337	58.39	59.89	58.39	59.89	58.72	1.22	307.0	0.512	1.23	1.50	0.206
	907	58.06	61.00	58.06	61.00	58.71	0.89	622.0	0.485	1.05	2.94	0.206
	967	58.02	61.09	58.02	61.09	58.70	0.85	937.0	0.416	0.87	3.07	0.206
	1027	58.00	61.18	58.00	61.18	58.70	0.83	997.0	0.352	0.84	3.18	0.206
	1087	57.96	61.26	57.96	61.26	58.69	0.79	1057.0	0.384	0.81	3.30	0.206
	1147	57.93	61.35	57.93	61.35	58.68	0.76	1117.0	0.384	0.77	3.42	0.206
	1207	57.90	61.44	57.90	61.44	58.68	0.73	1177.0	0.384	0.74	3.54	0.206
	1267	57.87	61.51	57.87	61.51	58.67	0.70	1237.0	0.320	0.71	3.64	0.206
	1327	57.84	61.59	57.84	61.59	58.67	0.67	1297.0	0.352	0.68	3.75	0.206
	1387	57.82	61.66	57.82	61.66	58.66	0.65	1357.0	0.288	0.66	3.84	0.206
	1447	57.79	61.72	57.79	61.72	58.65	0.62	1417.0	0.288	0.63	3.93	0.206
	2647	57.48	62.82	57.48	62.82	58.65	0.31	2047.0	0.225	0.46	5.34	0.206
	2947	57.42	62.96	57.42	62.96	58.64	0.25	2797.0	0.128	0.28	5.54	0.206
				#N/A	#N/A	#N/A	#N/A	0.0	#N/A	#N/A	#N/A	0.000
				#N/A	#N/A	#N/A	#N/A	0.0	#N/A	#N/A	#N/A	0.000

Figure 1

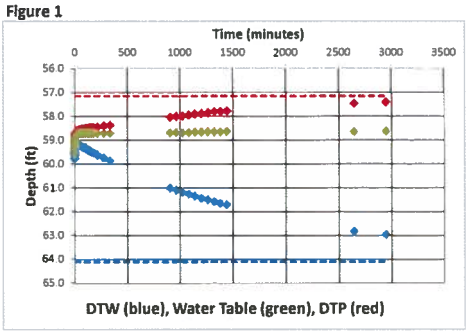
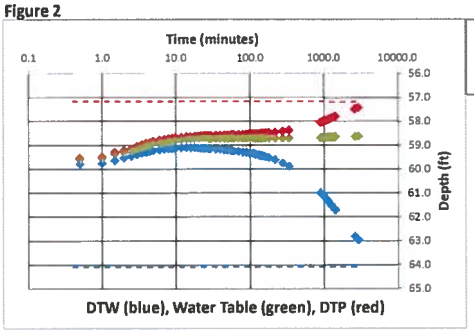


Figure 2



0.4	57.17
2947	57.17
0.4	64.1
2947	64.1

736.8	#N/A
736.8	#N/A

Figure 3

Q_n (ft³/d)	s_n (ft)
0	0
0.8	1.6

Drawdown Adjust.	
Δs_n (ft)	0.004

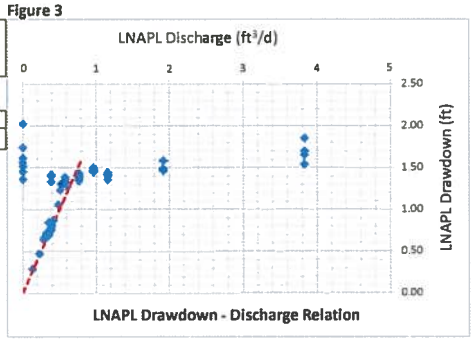


Figure 4

b_n	s_n
0	1.6
6.4	0

J-ratio	-0.250

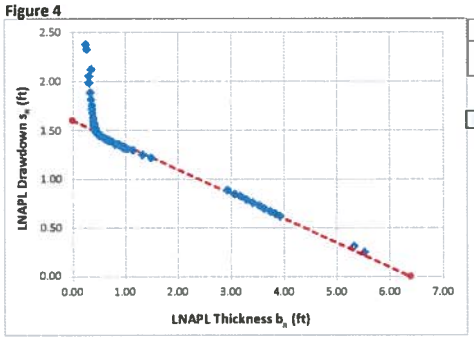


Figure 5

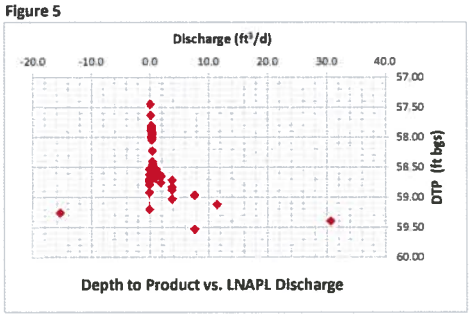


Figure 6

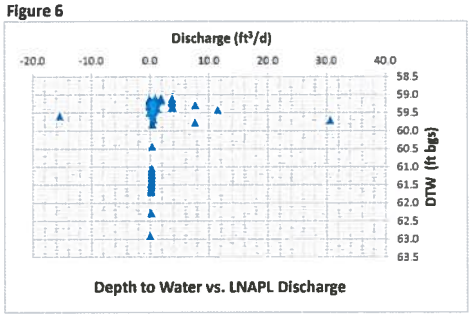


Figure 7

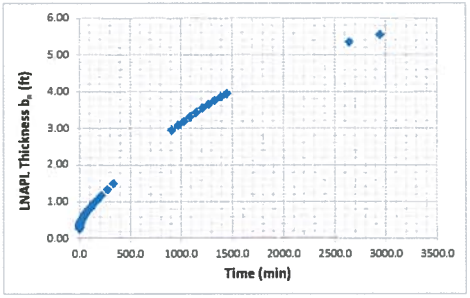


Figure 8

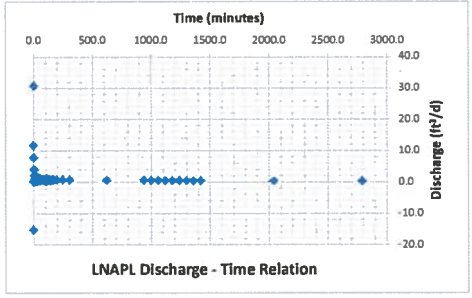


Figure 9

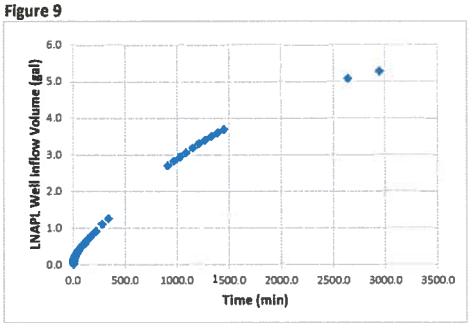
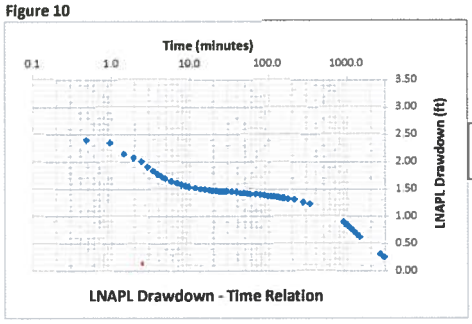


Figure 10



t (min)	s_n (ft)
2.5	0.115
2.5	0.145

Generalized Bouwer and Rice (1976)

Well Designation:	W-3
Date:	2-Jun-15

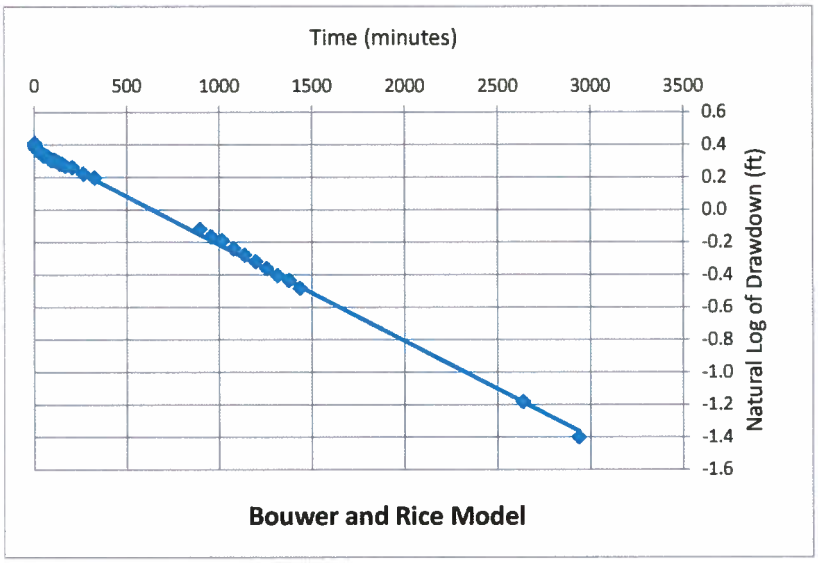
$$T_n = \frac{r_e^{\,2} \ln(R/r_e) \ln(s_n(t_1)/s_n(t))}{2(-J)(t - t_1)}$$

Enter early time cut-off for least-squares model fit

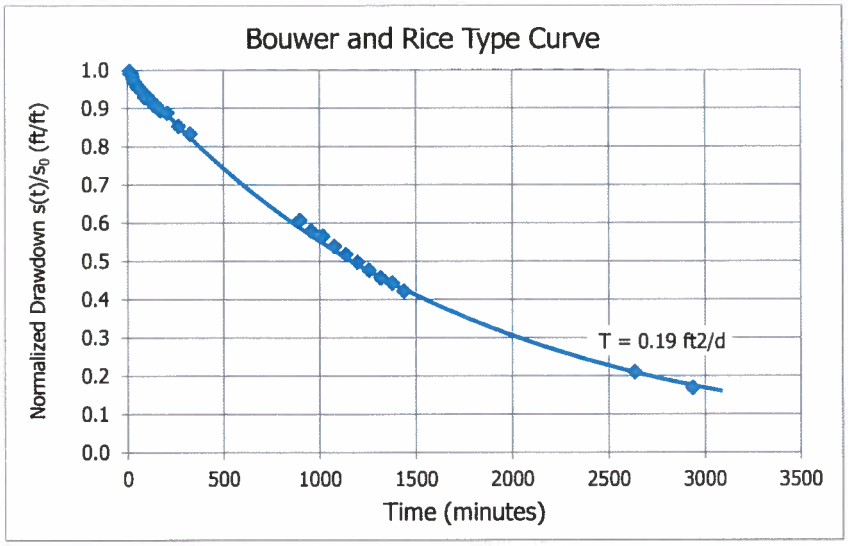
$Time_{cut}$	10	<- Enter or change value here

Model Results: T_n (ft^2/d) = 0.19 +/- 0.00 ft^2/d

L_e/r_e 33.6
C 2.14
R/r_e 14.25
J-Ratio -0.250
Coef. Of Variation 0.01



C coefficient calculated from Eq. 6.5(c) of Butler, The Design, Performance, and Analysis of Slug Tests, CRC Press, 2000.



Cooper and Jacob (1946)

Well Designation:	W-3
Date:	2-Jun-15

$$V_n(t_i) = \sum_j^i \frac{4\pi T_n s_j}{\ln\left(\frac{2.25 T_n t_j}{r_e^2 S_n}\right)} \Delta t_j$$

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	5	<- Enter or change values here
Time Adjustment (min):	2	

Trial S_n: d <-- Enter d for default or enter S_n value

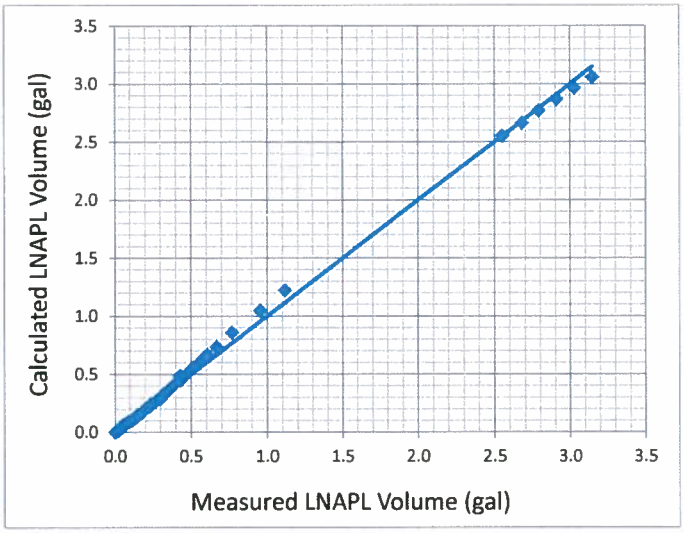
Root-Mean-Square Error: 0.247 <-- Minimize this using "Solver"

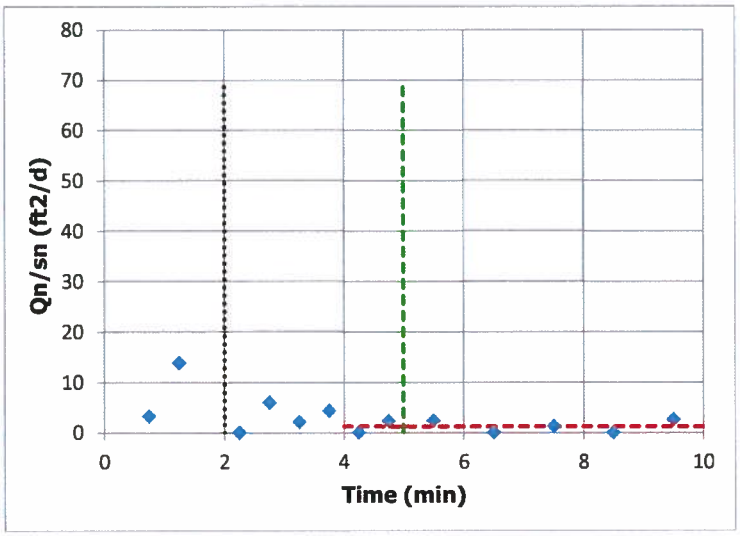
0.0010 <-- Working S_n

Trial T_n (ft^2/d): 0.3000 <-- By changing T_n through "Solver"

Add constraint T_n > 0.00001

Model Result: T_n (ft^2/d) = **0.30**





Height
70

Cooper, Bredehoeft and Papadopulos (1967)

Well Designation:	W-3
Date:	2-Jun-15

Enter early time cut-off for least-squares model fit

$Time_{cut}$ (min):	7	<- Enter or change values here
Initial Drawdown s_n (ft):	2.9	

Trial S_n: d <-- Enter d for default

Root-Mean-Square Error: 0.143 <-- Minimize this using "Solver"

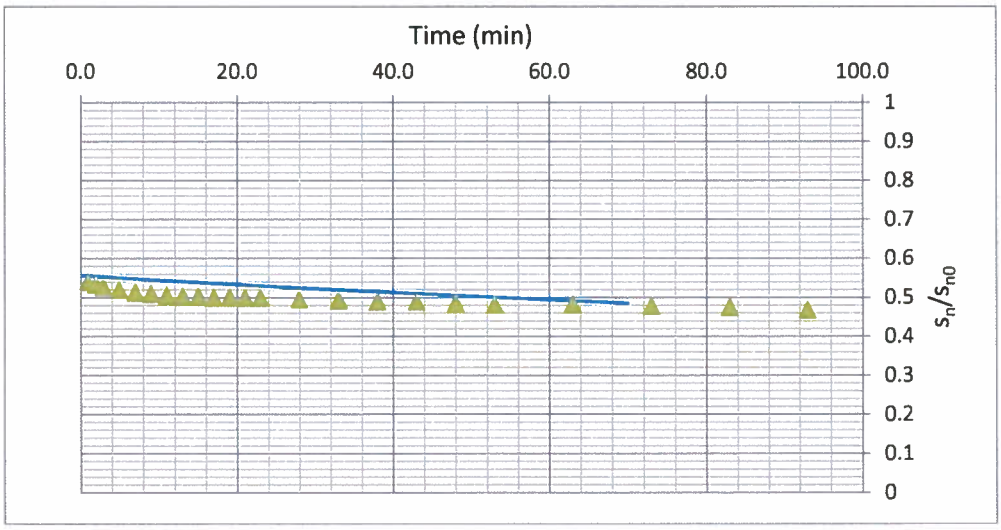
Trial T_n (ft^2/d): 0.230 <-- By changing T_n through "Solver"

0.5300 <-- Working S_n

Add constraint Tn > 0.00001

T_{min}	0.2
T_{max}	70

Model Result: T_n (ft^2/d) = **0.23**



J-Ratio
-0.250

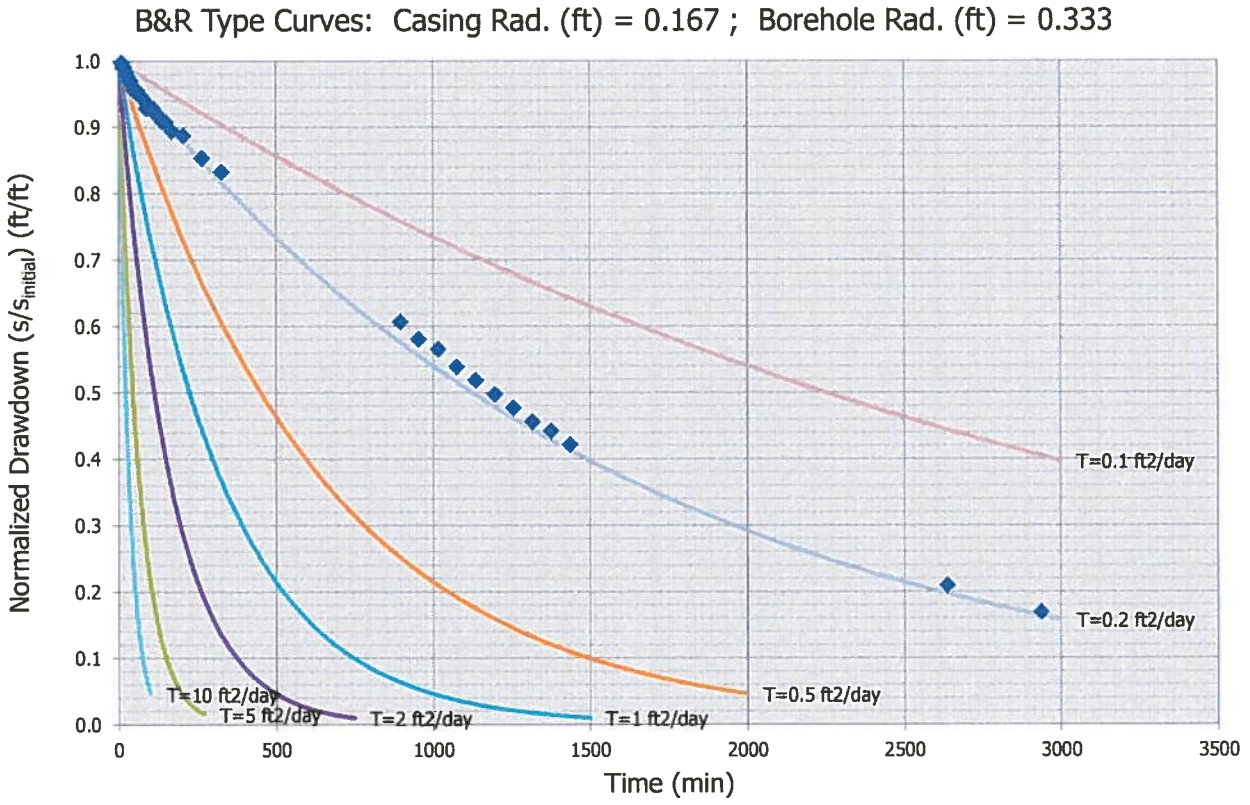
Bouwer and Rice Short Term LNAPL Mobility Test Type Curves

B&R Type Curves: Casing Rad. (ft) = 0.167 ; Borehole Rad. (ft) = 0.333

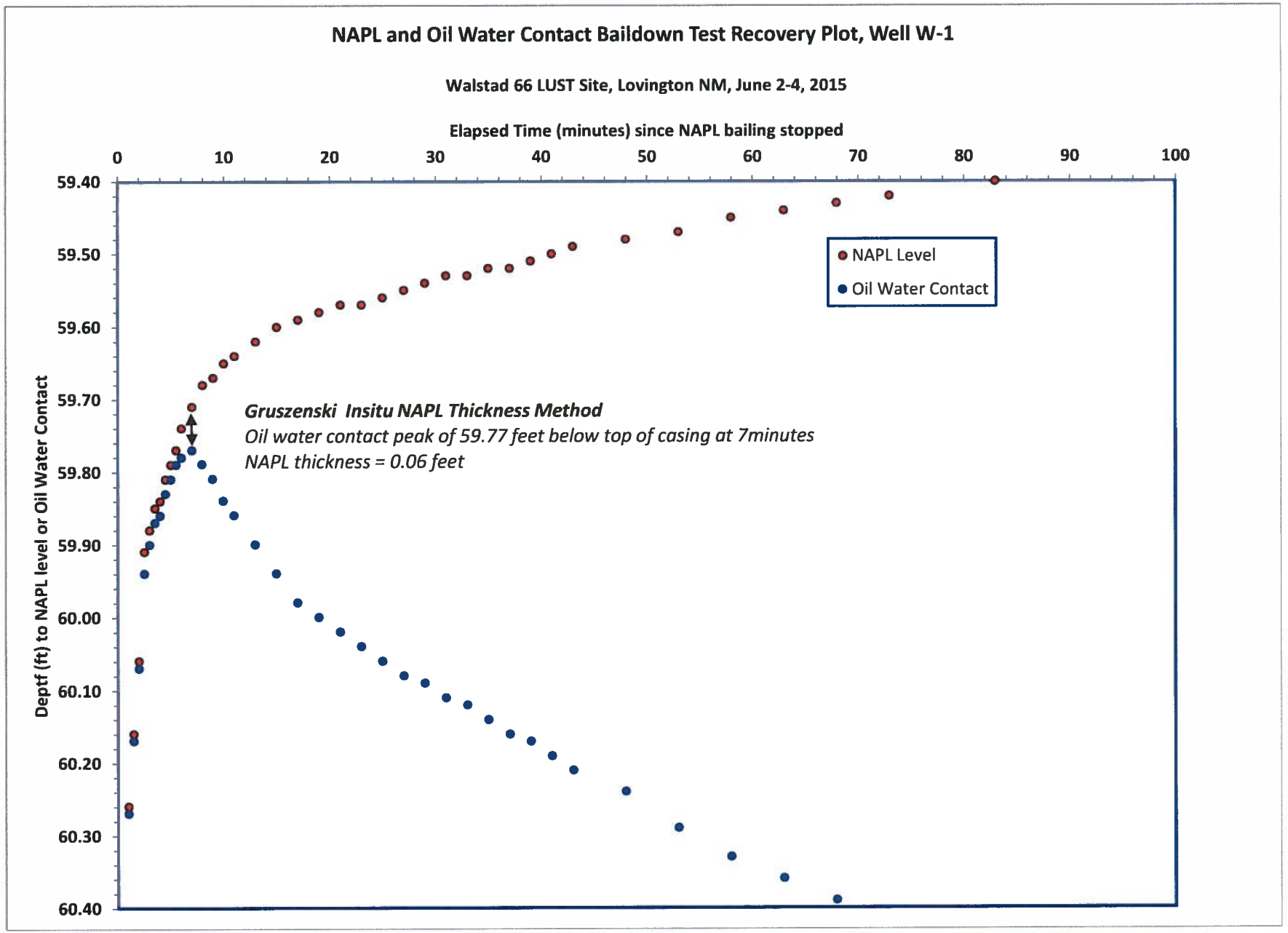
Enter these values

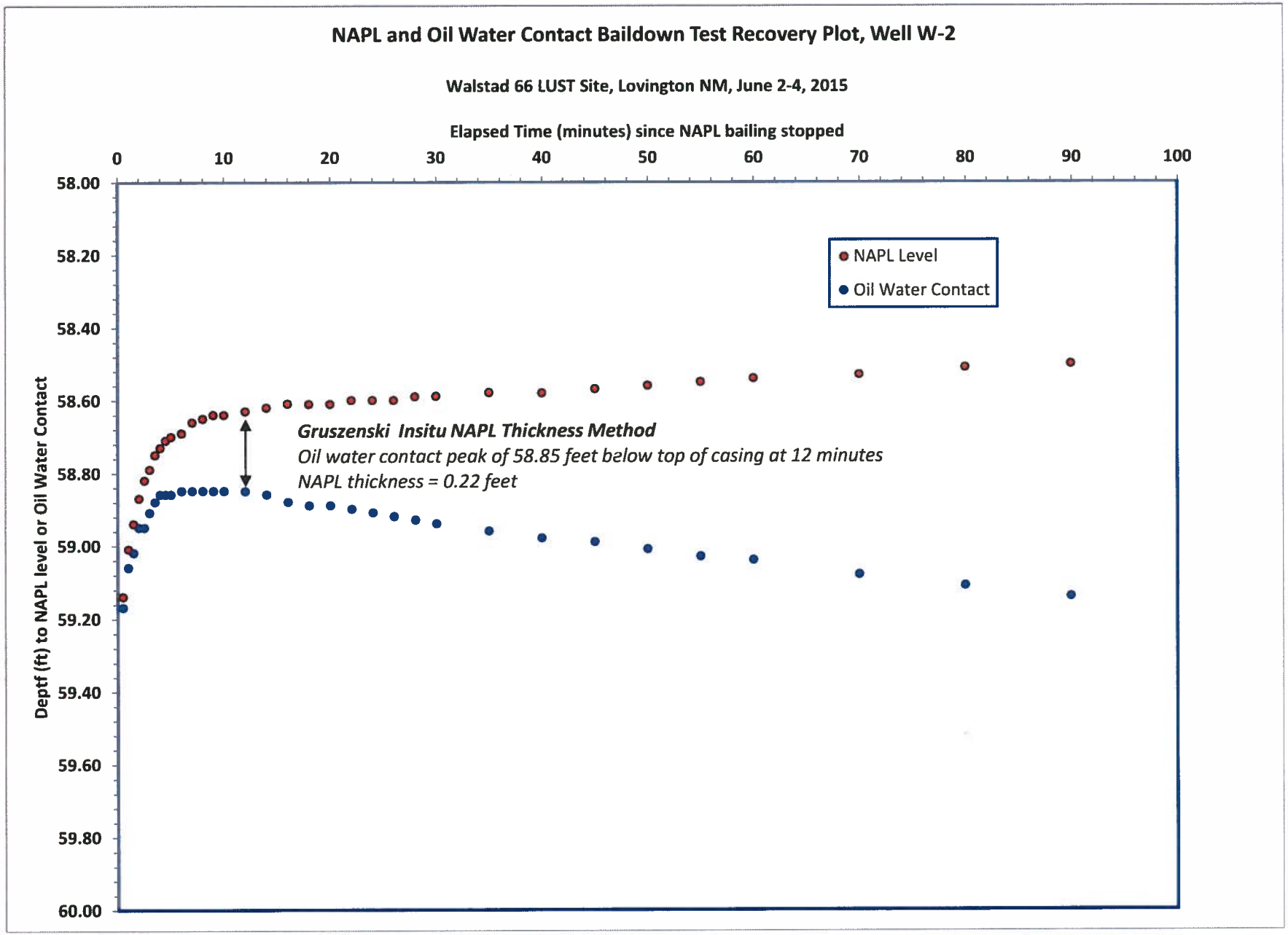
Type Curve ID	Type Curve Name	Notes	Max Time (min)	Transmissivity (ft^2/day)
1	T=10 ft2/day		100	10
2	T=5 ft2/day		270	5
3	T=2 ft2/day		750	2
4	T=1 ft2/day		1500	1
5	T=0.5 ft2/day		2000	0.5
6	T=0.2 ft2/day		3000	0.2
7	T=0.1 ft2/day		3000	0.1

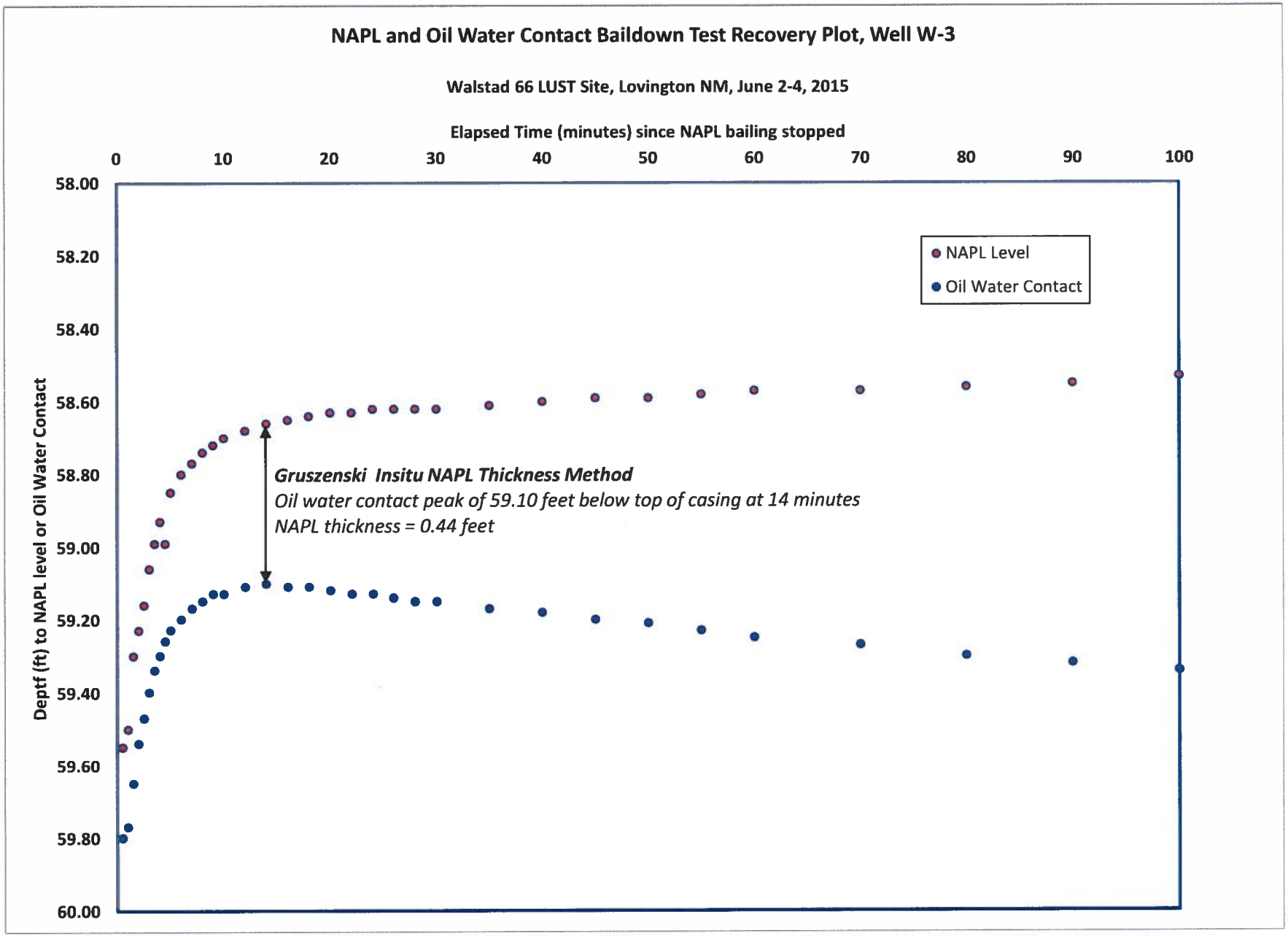
J-Ratio	
-0.250	<-- If uncertain u:
	-0.22



GRUSZCZENSKI FORMATION NAPL THICKNESS PLOTS


NAPL and Oil Water Contact Baildown Test Recovery Plot, Well W-1
Walstad 66 LUST Site, Lovington NM, June 2-4, 2015
Elapsed Time (minutes) since NAPL bailing stopped
0
10
20
30
40
50
60
70
80
90
100
Deptf (ft) to NAPL level or Oil Water Contact
59.40
59.50
59.60
59.70
59.80
59.90
60.00
60.10
60.20
60.30
60.40
NAPL Level
Oil Water Contact
Gruszenski Insitu NAPL Thickness Method
Oil water contact peak of 59.77 feet below top of casing at 7minutes
NAPL thickness = 0.06 feet


NAPL and Oil Water Contact Baildown Test Recovery Plot, Well W-2
Walstad 66 LUST Site, Lovington NM, June 2-4, 2015
Elapsed Time (minutes) since NAPL bailing stopped
0
10
20
30
40
50
60
70
80
90
100
58.00
58.20
58.40
58.60
58.80
59.00
59.20
59.40
59.60
59.80
60.00
Deptf (ft) to NAPL level or Oil Water Contact
NAPL Level
Oil Water Contact
Gruszenski Insitu NAPL Thickness Method
Oil water contact peak of 58.85 feet below top of casing at 12 minutes
NAPL thickness = 0.22 feet


NAPL and Oil Water Contact Baildown Test Recovery Plot, Well W-3
Walstad 66 LUST Site, Lovington NM, June 2-4, 2015
Elapsed Time (minutes) since NAPL bailing stopped
0
10
20
30
40
50
60
70
80
90
100
Deptf (ft) to NAPL level or Oil Water Contact
58.00
58.20
58.40
58.60
58.80
59.00
59.20
59.40
59.60
59.80
60.00
NAPL Level
Oil Water Contact
Gruszenski Insitu NAPL Thickness Method
Oil water contact peak of 59.10 feet below top of casing at 14 minutes
NAPL thickness = 0.44 feet

Tom Blaine, P.E.
State Engineer

Roswell Office
1900 WEST SECOND STREET
ROSWELL, NM 88201

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

Trn Nbr: 568362
File Nbr: L 13918

May. 06, 2015

CLAY KILMER
GOLDER ASSOCIATES INC
5200 PASADENA AVE NE STE C
ALBUQUERQUE, NM 87113

Greetings:

Enclosed is your copy of the above numbered permit that has been approved subject to the conditions set forth on the approval page. In accordance with the conditions of approval, the well can only be tested for 10 cumulative days, and the well is to be plugged on or before 05/31/2016, unless a permit to use the water is acquired from this office.

A Well Record & Log (OSE Form wr-20) shall be filed in this office within twenty (20) days after completion of drilling, but no later than 05/31/2016.

Appropriate forms can be downloaded from the OSE website www.ose.state.nm.us or will be mailed upon request.

Sincerely,

Juan Hernandez
(575)622-6521

Enclosure

explore

File No. L-13918

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO DRILL A WELL WITH NO CONSUMPTIVE USE OF WATER

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/ 2-35845

Purpose:	☐ Pollution Control And / Or Recovery	☐ Geo-Thermal
☐ Exploratory	☐ Construction Site De-Watering	☐ Other (Describe):
☒ Monitoring	☐ Mineral De-Watering	

A separate permit will be required to apply water to beneficial use.

☒ Temporary Request - Requested Start Date: 4/10/5 Requested End Date: 4/10/25

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1. APPLICANT(S)

Name: Golder Associates, Inc.	Name:
Contact or Agent: check here if Agent ☒ Clay Kilmer	Contact or Agent: check here if Agent ☐
Mailing Address: 5200 Pasadena Ave NE Ste C	Mailing Address:
City: Albuquerque	City:
State: NM Zip Code: 87113	State: Zip Code:
Phone: ☐ Home ☐ Cell Phone (Work): 505-821-3043	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): ckilmer@golder.com	E-mail (optional):

FOR OSE INTERNAL USE Application for Permit, Form wr-07, Rev 4/12/12

File Number: L-13918	Trn Number: 568362
Trans Description (optional):	
Sub-Basin:	
PCW/LOG Due Date: 5-31-16	

2. **WELL(S)** Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☐ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☒ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
W-4	103d 20m 55.72s	32d 56m 38.94s	SW1/4 SW1/4 SW1/4 S. 3 T.16 S. R. 36 E.

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ Yes ☒ No **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:

Well is on land owned by: Pearson Oil Company, Hobbs, NM

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. **Attached?** ☐ Yes ☐ No
If yes, how many_____

Approximate depth of well (feet): 75	Outside diameter of well casing (inches): 4.5
Driller Name: Harrison-Cooper Drilling, Wolfforth TX	Driller License Number: 1271

3. **ADDITIONAL STATEMENTS OR EXPLANATIONS**

STATE ENGINEER OFFICE
2015 MAY -1 A 10:32

FOR OSE INTERNAL USE — Application for Permit, Form wr-07

File Number: L-13918	Trn Number: 568362

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory:	**Pollution Control and/or Recovery:**	**Construction De-Watering:**	**Mine De-Watering:**
☐ Include a description of any proposed pump test, if applicable.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum. ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ☒ Include the reason for the monitoring well, and, ☒ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ☐ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Geo-Thermal:** ☐ Include a description of the geothermal heat exchange project, ☐ The amount of water to be diverted and re-injected for the project, ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Clay Kilmer
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Clay Kilmer 4/29/2015
Applicant Signature

Applicant Signature

STATE ENGINEER OFFICE
2015 MAY -1 AM 10:32

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 6th day of May 20 15, for the State Engineer,

Tom Blaine, P.E., State Engineer

By: _____
Signature

Print

Title: Juan Hernandez, Engr Specialist Supervisor
Print

FOR OSE INTERNAL USE

Application for Permit, Form wr-07

File Number: L-13918 | Trn Number: 568362

Reason For Monitoring

The New Mexico Environment Department has determined that an additional monitoring well is needed for this Leaking Underground Storage Tank site.

Duration of Use

The site is in active regulatory enforcement for corrective action for fuel contamination associated with a Leaking Underground Storage Tank that was formerly on this location. It is anticipated that the site may remain in enforcement requiring groundwater monitoring from this well for ten years.

Golder Associates Inc.

5200 Pasadena N.E., Suite C
Albuquerque, NM USA 87113
Telephone (505) 821-3043
Fax (505) 821-5273
www.golder.com

Golder Associates

RIGHT OF ENTRY FORM
GOLDER ASSOCIATES INC.

The undersigned, who is (are) the fee owner(s) of record (hereinafter referred to as Owner) with the sole right to the property in question, does hereby consent and grant Golder Associates Inc., its agents, employees, and assignees the right to enter the property stated below to install monitor wells and perform testing as required by the New Mexico Environment Department, and to conduct other activities as may be required in connection therewith. This Right of Entry is effective upon completion of this document.

Property Owner:	Keith Pearson, Pearson Oil Company
Property Street Address:	424 South Main Street McDonald's Restaurant (See attached Figure)
City, State:	Lovington, New Mexico

This Right of Entry is granted in consideration of the following Golder Associates Inc. commitments:

1. Golder Associates, Inc. agrees that in consideration of Owners(s) granting this Right of Entry, the affected property will be restored as much as reasonably possible to its condition proceeding our entry. If monitoring wells are developed, these wells will be plugged and abandoned upon project termination in accordance with New Mexico's applicable rules and regulations.

2. Golder Associates Inc. agrees to coordinate with Mr. Ken Fadke (McDonald's franchise owner) to plan and execute the site work to minimize impact to the restaurant business.

3. Golder Associates, Inc. agrees to protect Owner from any and all liability which might arise as a result of the foregoing activities on the described property.

4. Owner(s) retain the discretion to terminate this agreement at any time, after 30 days written notice, if it is in his or his successor's interests.

5. Golder Associates Inc. will provide owner(s) with all analytical results and final investigation reports upon request. Golder Associates, Inc. agrees to provide owner with all future laboratory results and keep the owner informed of all future developments concerning subject property as it pertains to this investigation as requested by owner.

Owner(s) Agent
M. K. Pearson

6-2-14
Date

Golder Associates Inc.
Clay Kilmer
Project Manager

May 30, 2014
Date

STATE ENGINEER OFFICE
2015 MAY -1 AM 10:22

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL

1B Depth of the well shall not exceed the thickness of the Ogallala formation.

4 No water shall be appropriated and beneficially used under this permit.

6 The well shall be plugged upon completion of the permitted use, and a plugging report shall be filed with the State Engineer within 10 days.

7 The Permittee shall utilize the highest and best technology available to ensure conservation of water to the maximum extent practical.

B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 New Mexico Statutes Annotated.

C Driller's well record must be filed with the State Engineer within 20 days after the well is drilled or driven. Well record forms will be provided by the State Engineer upon request.

C2 No water shall be diverted from this well except for testing purposes which shall not exceed ten (10) cumulative days, and well shall be plugged or capped on or before , unless a permit to use water from this well is acquired from the Office of the State Engineer.

P The well shall be constructed, maintained, and operated to prevent inter-aquifer exchange of water and to prevent loss of hydraulic head between geologic zones.

Trn Desc: L 13918 POD1

File Number: L 13918
Trn Number: 568362

Locator Tool Report

General Information:

Application ID: 29 Date: 05-05-2015 Time: 11:35:40

WR File Number: L-MON
Purpose: OTHER

Applicant First Name: GOLDER ASSOC INC
Applicant Last Name: CLAY KILMER

GW Basin: LEA COUNTY
County: LEA

Critical Management Area Name(s): NONE
Special Condition Area Name(s): NONE
Land Grant Name: NON GRANT

PLSS Description (New Mexico Principal Meridian):

SE 1/4 of SW 1/4 of SW 1/4 of SW 1/4 of Section 03, Township 16S, Range 36E.

Coordinate System Details:

Geographic Coordinates:

Latitude:	32 Degrees	56 Minutes	39.3 Seconds	N
Longitude:	103 Degrees	20 Minutes	56.6 Seconds	W

Universal Transverse Mercator Zone: 13N

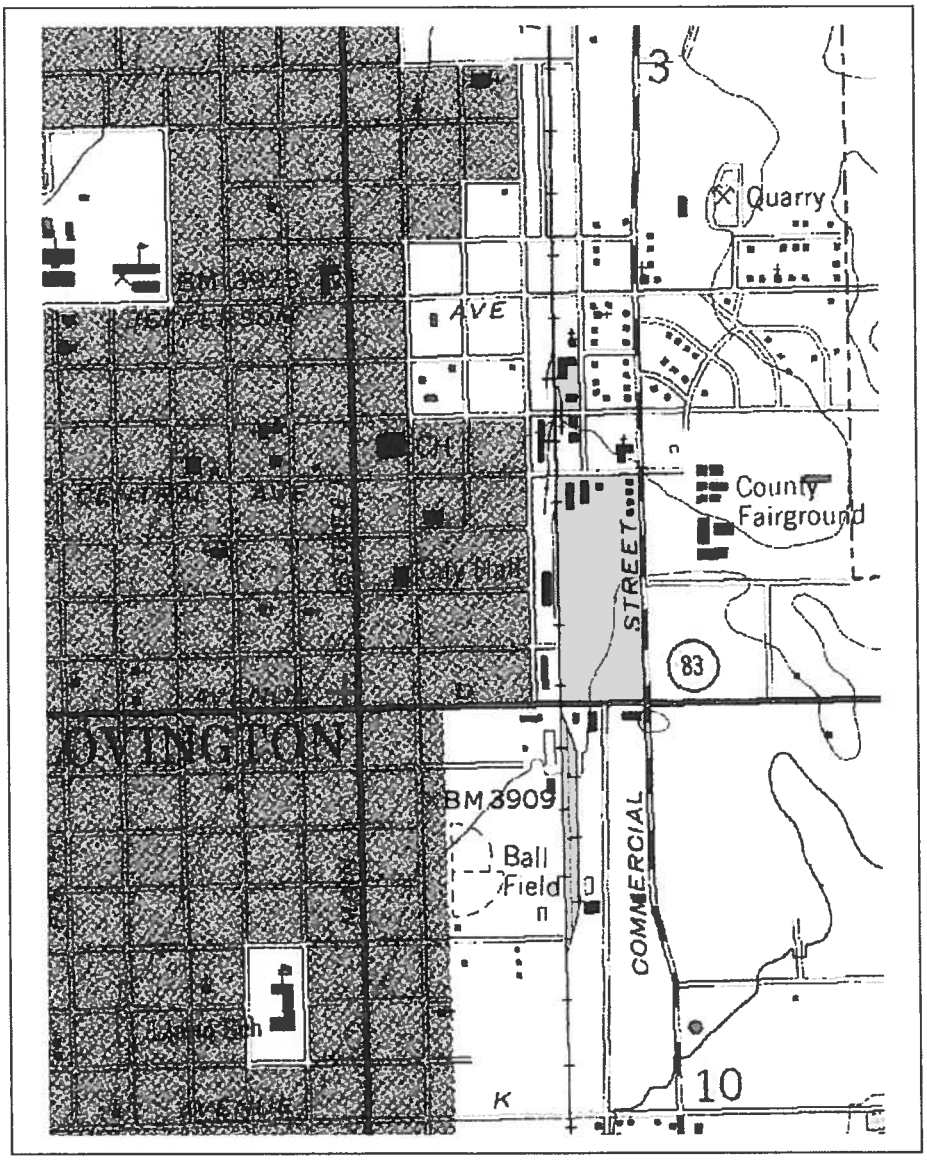
NAD 1983(92) (Meters)	N: 3,646,316	E: 654,330
NAD 1983(92) (Survey Feet)	N: 11,962,955	E: 2,146,748
NAD 1927 (Meters)	N: 3,646,112	E: 654,380
NAD 1927 (Survey Feet)	N: 11,962,287	E: 2,146,913

State Plane Coordinate System Zone: New Mexico East

NAD 1983(92) (Meters)	N: 216,001	E: 257,035
NAD 1983(92) (Survey Feet)	N: 708,664	E: 843,290
NAD 1927 (Meters)	N: 215,981	E: 244,484
NAD 1927 (Survey Feet)	N: 708,599	E: 802,112

NEW MEXICO OFFICE OF STATE ENGINEER

Locator Tool Report



WR File Number: L-MON Scale: 1:14,368

Northing/Easting: UTM83(92) (Meter): N: 3,646,316 E: 654,330

Northing/Easting: SPCS83(92) (Feet): N: 708,664 E: 843,290

GW Basin: Lea County

Print Date: 05/05/2015

OFFICE OF THE STATE ENGINEER/INTERSTATE STREAM COMMISSION – ROSWELL OFFICE

OFFICIAL RECEIPT NUMBER: 2 - 35845 DATE: 5/1/15 FILE NO.: Lea County

TOTAL: 5.00 RECEIVED: Five 00/100 DOLLARS CHECK NO.: 111 CASH: _____

PAYOR: Clay Kilmer ADDRESS: 3312 June NE CITY: Albuquerque STATE: NM

ZIP: 87111 RECEIVED BY: AR

INSTRUCTIONS: Indicate the number of actions to the left of the appropriate type of filing. Complete the receipt information. **Original** to payor; **pink** copy to Program Support/ASD; and **yellow** copy for Water Rights. If a mistake is made, void the original and all copies and submit to Program Support/ASD as part of your daily deposit.

A. Ground Water Filing Fees

___	1. Change of Ownership of Water Right	$ 2.00
___	2. Application to Appropriate or Supplement Domestic 72-12-1 Well	$ 125.00
___	3. Application to Repair or Deepen 72-12-1 Well	$ 75.00
___	4. Application for Replacement 72-12-1 Well	$ 75.00
___	5. Application to Change Purpose of Use 72-12-1 Well	$ 75.00
___	6. Application for Stock Well	$ 5.00
___	7. Application to Appropriate Irrigation, Municipal, or Commercial Use	$ 25.00
___	8. Declaration of Water Right	$ 1.00
___	9. Application for Supplemental Non 72-12-1 Well	$ 25.00
___	10. Application to Change Place or Purpose of Use Non 72-12-1 Well	$ 25.00
___	11. Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Ground Water	$ 50.00
___	12. Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Ground Water	$ 50.00
___	13. Application to Change Point of Diversion of Non 72-12-1 Well	$ 25.00
___	14. Application to Repair or Deepen Non 72-12-1 Well	$ 5.00
1	15. Application for Test, Expl. Observ. Well	$ (5.00)
___	16. Application for Extension of Time	$ 25.00
___	17. Proof of Application to Beneficial Use	$ 25.00
___	18. Notice of Intent to Appropriate	$ 25.00

B. Surface Water Filing Fees

___	1. Change of Ownership of a Water Right	$ 5.00
___	2. Declaration of Water Right	$ 10.00
___	3. Amended Declaration	$ 25.00
___	4. Application to Change Point of Diversion and Place and/or Purpose of Use from Surface Water to Surface Water	$ 200.00
___	5. Application to Change Point of Diversion and Place and/or Purpose of Use from Ground Water to Surface Water	$ 200.00
___	6. Application to Change Point of Diversion	$ 100.00
___	7. Application to Change Place and/or Purpose of Use	$ 100.00
___	8. Application to Appropriate	$ 25.00
___	9. Notice of Intent to Appropriate	$ 25.00
___	10. Application for Extension of Time	$ 50.00
___	11. Supplemental Well to a Surface Right	$ 100.00
___	12. Return Flow Credit	$ 100.00
___	13. Proof of Completion of Works	$ 25.00
___	14. Proof of Application of Water to Beneficial Use	$ 25.00
___	15. Water Development Plan	$ 100.00
___	16. Declaration of Livestock Water Impoundment	$ 10.00
___	17. Application for Livestock Water Impoundment	$ 10.00

All fees are non-refundable.

C. Well Driller Fees

___	1. Application for Well Driller's License	$ 50.00
___	2. Application for Renewal of Well Driller's License	$ 50.00
___	3. Application to Amend Well Driller's License	$ 50.00

D. Reproduction of Documents

___ @ 0.25¢ $_____

___ Map(s) $_____

E. Certification $_____

F. Other $_____

G. Comments:

Mail

APPENDIX G
SOIL AND WATER DISPOSAL MANIFESTS

1404221-5

N.M.E.D. - DP-1041	**Gandy Marley, Inc.** P.O. BOX 1658 · ROSWELL, NM 88202	LOAD INSPECTION FORM No. 15389

Date of Receipt: 06/03/15 Time of Receipt: 16:50 AM PM Cell Placement: UST-LBB3

Quantity: 48 Gallons T/CY: Gallons Description: Gasoline Contaminated Purge H_2O Walstad Phillips 66 Lovington NM.

Name/Address of Generator: Golder Associates Inc. 5200 Pasadena Ave NE Suite C

Origin of Materials (if different): Albuquerque, NM

Transporter Name: CMB SCC ID No. _____

Name of Laboratory Performing Sample Analysis: HEAL ON FILE

TCLP (EPA Method 1311) _____ BTEX ✓ MTBE ✓ TPH ✓ Non-Hazardous ✓ Exempt _____

Verification of No Free Liquids _____ Paint Filter Liquids Test Performed _____

Verification of Property Completed Manifest _____ Generator Manifest Number 15389

As a condition to Gandy Marley, Inc's acceptance of the materials shipped as represented on this Load Inspection Form, Generator represents and warrants that the waste material shipped herewith is exempt from the Resource Conservation and Recovery Act of 1976, as amended from time to time, 40 U.S.C Section 6901, et seq., The New Mexico Health and Safety Code, section 391.001, et seq., and regulations related thereto, OR has been characterized as non-hazardous material by virtue of appropriate laboratory analysis done in accordance with EPA-approved testing methods.

Further, as a condition to Gandy Marley, Inc's acceptance of the materials shipped as represented on this Load Inspection Form, Transporter represents and warrants that only the material delivered by Generator to Transporter to Gandy Marley, Inc.'s facility for disposal.

THIS WILL CERTIFY that the above Transporter loaded the material as represented on this Load Inspection Form at the above described location, and that it was tendered by the above described Generator. THIS WILL CERTIFY that no additional materials were added to this load, and that the material was delivered without incident.

Transporter: Clayton M Barnhill (Print Name) _____ (Signature)

GMI Employee: D. TOLTON (Print Name) D Tolton (Signature)

(Gandy Marley 34265)

GANDY•MARLEY, INC.

P.O. Box 1658
Roswell, NM 88202
(575) 347-0434
Fax (575) 347-0435

No. 34265

LEASE OPERATOR/SHIPPER/COMPANY: Gorrie

LEASE NAME: [illegible]

TRANSPORTER COMPANY: [illegible] **TIME:** [illegible] AM/PM

DATE: 07 **VEHICLE NO.:** 352 **DRIVER NO.:** [illegible]

CHARGE TO:

TYPE OF MATERIAL

OCD

[ ] Other Material: [ ] Contaminated soil [ ] C-117 No.: _____

[ ] BS&W content: _____

Description: [illegible]

COMPANY CONTACT:

VOLUME OF MATERIAL [ ]: ~~YARDS~~ 39 **: CELL#** _____ **: [ ]** _____

AS A CONDITION TO GANDY MARLEY, INC.'S ACCEPTANCE OF THE MATERIALS SHIPPED WITH THIS JOB TICKET, OPERATOR/SHIPPER REPRESENTS AND WARRANTS THAT THE WASTE MATERIAL SHIPPED HEREWITH IS MATERIAL EXEMPT FROM THE RESOURCE, CONSERVATION AND RECOVERY ACT OF 1976, AS AMENDED FROM TIME TO TIME, 40 U.S.C. §6901, et seq., THE NM HEALTH AND SAF. CODE, §361.001, et seq. AND REGULATIONS RELATED THERETO, BY VIRTUE OF THE EXEMPTION AFFORDED CONTAMINATED SOILS AND OTHER WASTE ASSOCIATED WITH THE EXPLORATION, DEVELOPMENT OR PRODUCTION OF CRUDE OIL OR NATURAL GAS OR GEOTHERMAL ENERGY.

ALSO AS A CONDITION TO GANDY•MARLEY, INC.'S ACCEPTANCE OF THE MATERIALS SHIPPED WITH THIS JOB TICKET, TRANSPORTER REPRESENTS AND WARRANTS THAT ONLY THE MATERIAL DELIVERED BY OPERATOR/SHIPPER TO TRANSPORTER IS NOW DELIVERED BY TRANSPORTER TO GANDY•MARLEY, INC.'S FACILITY FOR DISPOSAL.

THIS WILL CERTIFY that the above Transporter loaded the material represented by this Transporter Statement at the above described location, and that it was tendered by the above described shipper. This will certify that no additional materials were added to this load, and that the material was delivered without incident.

DRIVER: Tosa [illegible]

FACILITY REPRESENTATIVE: [illegible]

White - GMI Canary - Shipper Pink - GMI Gold - Transporter

24-HOUR SERVICE, CALL
LOVINGTON (575) 396-4948
TATUM (575) 398-4960

GANDY CORPORATION

KILL TRUCKS - VACUUM TRUCKS - WINCH TRUCKS
ROLL OFFS - TANK CLEANING - ROUSTABOUTING
PRC #14225

20-7847
P.O. BOX 2140
LOVINGTON, NEW MEXICO 88260

522829

Date 7-12-15 Truck No. 352

Company GOLDER ASSOCIATES INC Purchase Order No. _____ Invoice No. _____

From LOVINGTON 66 (MCDONALD'S 410 S MAIN) Rig No. _____ Location _____

To Lease GMA Well No. _____ Location _____

Time Out 6:15 A.M. / P.M. Time In 6:45 A.M. / (P.M.)

Diesel | Brine Water | Fresh Water
Crude Oil | (Produced Water)

Bbls. Hauled 2039 gal

	TIME	RATE	AMOUNT
		0.50	1019.50
Driver, Operator or Pusher ROGELIO GALDARA	12.50	85.00	1062.50
Helper			
Helper			
Helper			
Other Charges			

Description of Work HAULED 2039 GALLON OF WATER TO GMA
STAND BY [redacted] PUMPING INTO TRUCK

2039 GALLONS

GME Hict # 34265

Sub Total	2082.00
Sales Tax	114.51
TOTAL	2196.51

Authorized By: [signature]

SUPERIOR PRINTING SERVICE, INC.

Contaminated Soils Shipment Manifest

1. Manifest Document No. 5228219

2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address

Golder Associates Inc c/o Walsted Oil Company
5200 Paseo NE Ste C
Albuquerque, NM 87113

4. Generator Phone No.

505-821-3043

5. Generator Contact

Clay Kilmer

6. Transporter 1 Company Name

Gandy Corp

7. ID No.

14225

8. Transporter 2 Company Name

9. ID No.

10. Designated Disposal Facility Name and Site Address

Gandy Marley, Inc. Contaminated Soils Landfarm
7200 East Second Street
PO Box 1658
Roswell, NM 88201

11. Facility Permit Number

0001002484

12. Facility Phone No.

(575) 398-0107

13. Description of Waste	14. Containers No	14. Containers Type	15. Total Quantity	16. Unit Wt./Vol.
a. UST (gasoline)	1	Tanker Truck	2039 Gal	
b.				
c.				

17. Special Handling Instructions and Additional Information

18. Generator's Certification: *I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable federal, state, and international laws.*

FURTHER. I represent and warrant that the waste material as described on this manifest is either exempt from the Resource Conservation and Recovery Act of 1976, OR has been characterized as non-hazardous material by virtue of appropriate laboratory analysis done in accordance with EPA-approved testing methods.

Printed/Typed Name	Signature	Date
Phillip Carrillo		07/21/15

TRANSPORTER

19. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date
Rogelio Gandara		07/21/15

20. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date

GMI

21. Discrepancy Information

22. Facility Owner or Operator Certification of receipt of materials described on this manifest except as noted in item 21.

Printed/Typed Name	Signature	Date
David E. Rice		07/21/15

Instructions for Proper Completion of Manifest

GENERATORS

Item 1 Enter the number assigned to the Manifest by the generator.

Item 2 Enter the page number and the total number of pages used to complete the Manifest, if any.

Item 3 Enter the name and mailing address of the generator. The address should be the location that will manage the returned Manifest forms.

Item 4 Enter a telephone number where an authorized agent of the generator may be reached in the event of an emergency.

Item 5 Enter the name of the authorized agent of the generator who is knowledgeable of the shipment and who should be contacted in the event of an emergency.

Item 6 Enter the company name of the first transporter who will transport the waste.

Item 7 Enter the appropriate identification number for the first transporter. (e.g., State Corporation Commission or EPA identification number.)

Item 8 If applicable, enter the company name of the second transporter who will transport the waste.

Item 9 If applicable, enter the appropriate identification number for the second transporter.

Item 10 Enter the company name and site address of the facility designated to receive the waste listed on the Manifest. The address must be the site address, which may differ from the company mailing address.

Item 11 Enter the appropriate permit number of the facility designated to receive the waste listed on the Manifest.

Item 12 Enter the phone number of the facility designated to receive the waste listed on the Manifest.

Item 13 Enter a brief description of each waste being shipped under the Manifest.

Item 14 Enter the number of containers for each waste and the appropriate abbreviation below for the type of container.

DM = Metal drums, barrels, kegs	TC = Tank cars
CW = Wooden boxes, cartons, cases	DW = Wooden drums, barrels, kegs
DT = Dump truck	CF = Fiber/plastic boxes, cartons, cases
DF = Fiberboard or plastic drums	CY = Cylinders
BA = Burlap, cloth, paper, plastic bags	TP = Tanks portable
CM = Metal boxes, cartons, cases	TT = Cargo tanks (tank trucks)

Item 15 Enter the total quantity of waste described on each line.

Item 16 Enter the appropriate abbreviation from below for the unit of measure.

G = Gallons	P = Pounds	T = Tons
Y = Cubic yards	L = Liters	K = Kilograms
M = Metric tons	N = Cubic meters	

Item 17 Generators may use this space to indicate special transportation, treatment, storage, or disposal information or Bill of Lading information.

Item 18 The generator must read, sign (by hand), and date the certification statement. If a mode *other than* highway is used, the word "highway" should be lined out and the appropriate mode (rail, water, or air) inserted in the space below. If another mode *in addition to* the highway mode is used, enter the appropriate additional mode (e.g., *and rail*) in the space below.

TRANSPORTERS

Item 19 Enter the name of the person accepting the waste on behalf of the first transporter. That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt.

Item 20 Enter, if applicable, the name of the person accepting the waste on behalf of the second transporter. That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt.

OWNERS AND OPERATORS OF DESIGNATED DISPOSAL FACILITIES

Item 21 The authorized representative of the designated facility's owner or operator must note in this space any significant discrepancy between the waste described on the Manifest and the waste actually received at the facility.

Item 22 Print or type the name of the person accepting the waste on behalf of the owner or operator of the facility. That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt.

Gandy W · 522830

GANDY·MARLEY, INC.

P.O. Box 1658
Roswell, NM 88202
(575) 347-0434
Fax (575) 347-0435

No. 34302

LEASE OPERATOR/SHIPPER/COMPANY:

LEASE NAME:

TRANSPORTER COMPANY: **TIME:** **AM/PM**

DATE: **VEHICLE NO.:** **DRIVER NO.:**

CHARGE TO:

TYPE OF MATERIAL

OCD

[ ] Other Material: [ ] Contaminated soil [ ] C-117 No.: _____

[ ] BS&W content: _____

Description:

COMPANY CONTACT:

VOLUME OF MATERIAL [ ]: ~~YARDS~~ : CELL# _____: [ ] _____

AS A CONDITION TO GANDY·MARLEY, INC.'S ACCEPTANCE OF THE MATERIALS SHIPPED WITH THIS JOB TICKET, OPERATOR/SHIPPER REPRESENTS AND WARRANTS THAT THE WASTE MATERIAL SHIPPED HEREWITH IS MATERIAL EXEMPT FROM THE RESOURCE, CONSERVATION AND RECOVERY ACT OF 1976, AS AMENDED FROM TIME TO TIME, 40 U.S.C. §6901, et seq., THE NM HEALTH AND SAF. CODE, §361.001, et seq. AND REGULATIONS RELATED THERETO, BY VIRTUE OF THE EXEMPTION AFFORDED CONTAMINATED SOILS AND OTHER WASTE ASSOCIATED WITH THE EXPLORATION, DEVELOPMENT OR PRODUCTION OF CRUDE OIL OR NATURAL GAS OR GEOTHERMAL ENERGY.

ALSO AS A CONDITION TO GANDY·MARLEY, INC.'S ACCEPTANCE OF THE MATERIALS SHIPPED WITH THIS JOB TICKET, TRANSPORTER REPRESENTS AND WARRANTS THAT ONLY THE MATERIAL DELIVERED BY OPERATOR/SHIPPER TO TRANSPORTER IS NOW DELIVERED BY TRANSPORTER TO GANDY·MARLEY, INC.'S FACILITY FOR DISPOSAL.

THIS WILL CERTIFY tha the above Transporter loaded the material epresented by this Transporter Statement at th above described location, and that it was tendered by the above described shipper. This will certify that o additional materials were added to this load, and that the material was delivered without incident.

DRIVER:

FACILITY REPRESENTATIVE: JOSE

White - GMI **Canary - Shipper** **Pink - GMI** **Gold - Transporter**

24-HOUR SERVICE, CALL
LOVINGTON (575) 396-4948
TATUM (575) 398-4960

GANDY CORPORATION

KILL TRUCKS - VACUUM TRUCKS - WINCH TRUCKS
ROLL OFFS - TANK CLEANING - ROUSTABOUTING
PRC #14225

P.O. BOX 2140
LOVINGTON, NEW MEXICO 88260

522830

Date 7-13-15 Truck No. 352

Company GOLDER ASSOCIATES Purchase Order No. _____ Invoice No. _____

From LOVINGTON Loc (MCDONALD'S MAIN ST) Rig No. _____ Location _____

To Lease GMI Well No. _____ Location _____

Time Out 5:45 A.M. / P.M. Time In 6:00 A.M. / P.M.

Diesel | Brine Water | Fresh Water
Crude Oil | Produced Water | ~~Bbls. Hauled~~ 1933 GALLONS

	TIME	RATE	AMOUNT
1933 GALLONS		0-50	966.50
Driver, Operator or Pusher ROGELIO GANDARA	12.25	85.00	1041.25
Helper			
Helper			
Helper			
Other Charges			

Description of Work HAULED 1933 GALLONS OF MIX WATER WITH GASOLINE TO GMI

STAND BY, WHILE RUNNING TEST AND AT THE SAME TIME PUMPINING INTO TRUCK.

1933 GALLONS

GMI ticket = 34302

Sub Total	2007.75
Sales Tax	110.43
TOTAL	2118.18

Authorized By: _____

SUPERIOR PRINTING SERVICE, INC.

Contaminated Soils Shipment Manifest

1. Manifest Document No. 5228310

2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address
GOLDER ASSOCIATES INC c/o WAINOCO OIL COMPANY
5203 PASADENA, NE STE C
ALBUQUERQUE NM 87113

4. Generator Phone No.
505-821-3043

5. Generator Contact
CLAY KILMER

6. Transporter 1 Company Name
GANDY CORP

7. ID No.
14225

8. Transporter 2 Company Name

9. ID No.
14225

10. Designated Disposal Facility Name and Site Address
Gandy Marley, Inc. Contaminated Soils Landfarm
7200 East Second Street
PO Box 1658
Roswell, NM 88201

11. Facility Permit Number
0001002484

12. Facility Phone No.
(575) 398-0107

13. Description of Waste	14. Containers No	14. Containers Type	15. Total Quantity	16. Unit Wt./Vol.
a. UST (GASOLINE)	1	TRUCK TANK	1933 gal	
b.				
c.				

17. Special Handling Instructions and Additional Information

18. **Generator's Certification:** *I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable federal, state, and international laws.*

FURTHER. I represent and warrant that the waste material as described on this manifest is either exempt from the Resource Conservation and Recovery Act of 1976, OR has been characterized as non-hazardous material by virtue of appropriate laboratory analysis done in accordance with EPA-approved testing methods.

Printed/Typed Name	Signature	Date
Phillip Camillo		07/31/15

TRANSPORTER

19. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date
ROGELIO GANDARA		07/31/15

20. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date

GMI

21. Discrepancy Information

22. Facility Owner or Operator Certification of receipt of materials described on this manifest except as noted in item 21.

Printed/Typed Name	Signature	Date
David E. Dice	DEDice	07/31/15

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DT = Dump truck	CF = Fiber/plastic boxes, cartons, cases
DF = Fiberboard or plastic drums	CY = Cylinders
BA = Burlap, cloth, paper, plastic bags	TP = Tanks portable
CM = Metal boxes, cartons, cases	TT = Cargo tanks (tank trucks)

Item 15 Enter the total quantity of waste described on each line.

Item 16 Enter the appropriate abbreviation from below for the unit of measure.

G = Gallons	P = Pounds	T = Tons
Y = Cubic yards	L = Liters	K = Kilograms
M = Metric tons	N = Cubic meters	

Item 17 Generators may use this space to indicate special transportation, treatment, storage, or disposal information or Bill of Lading information.

Item 18 The generator must read, sign (by hand), and date the certification statement. If a mode *other than* highway is used, the word "highway" should be lined out and the appropriate mode (rail, water, or air) inserted in the space below. If another mode *in addition to* the highway mode is used, enter the appropriate additional mode (e.g., *and rail*) in the space below.

TRANSPORTERS

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Item 22 Print or type the name of the person accepting the waste on behalf of the owner or operator of the facility. That person must acknowledge acceptance of the waste described on the Manifest by signing and entering the date of receipt.

140422I-2

24-HOUR SERVICE, CALL
LOVINGTON 396-4948
TATUM 398-4960

GANDY MARLEY

P.O. BOX 1658 • ROSWELL, NEW MEXICO 88202

P.O. BOX 2140
LOVINGTON, NEW MEXICO 88260

19227

AUTHORIZATION FOR WORK

Date _____ YOUR NO. _____

COMPANY Golden & Assoc. LEASE Lovington

MAIL INVOICE TO _____ WELL _____

DESCRIPTION OF WORK

Picked up 5 dumps @ Lovington McDonalds

Equipment Used	@ $ 5	Hrs. worked	100	Total	$500
Box Rent	@ $	Hrs. worked		Total	
Liner	@ $	Hrs. worked		Total	
Jet Out	@ $	Hrs. worked		Total	
Disposal	@ $	Hrs. worked		Total	
Disposal Facility GMI	@ $	Hrs. worked		Total	
Box No. Delivered	@ $	Hrs. worked		Total	
Box No. Picked Up	@ $	Hrs. worked		Total	
				Sub Total	
				Sales Tax	
				TOTAL	

Driver Allen Hallaw Approved by _____

Superior Printing Service, Inc. - 104

1404221-42

N.M.E.D. ~~NM4041~~

Gandy Marley, Inc.

P.O. BOX 1658 • ROSWELL, NM 88202

LOAD INSPECTION FORM NO 15968

Date of Receipt: _____ Time of Receipt _____ AM PM Cell Placement: 1404221-2

Quantity 5 T/CY: dims Description: Ust

Name/Address of Generator: Golder & Assoc.

Origin of Materials (if different) Lovington NM

Transporter Name: _____ SCC ID No. _____

Name of Laboratory Performing Sample Analysis _____

TCLP (EPA Method 1311) _____ BTEX _____ MTBE _____ TPH _____ Non-Hazardous NO Exempt _____

Verification of No Free Liquids _____ Paint Filter Liquids Test Performed _____

Verification of Property Completed Manifest NO Generator Manifest Number 19227

As a condition to Gandy Marley, Inc.'s acceptance of the materials shipped as represented on this Load Inspection Form, Generator represents and warrants that the waste material shipped herewith is exempt from the Resource Conservation and Recovery Act of 1976, as amended from time to time, 40 U.S.C. Section 6901, et seq., The New Mexico Health and Safety Code, section 361.001, et seq., and regulations related thereto, OR has been characterized as non-hazardous material by virtue of appropriate laboratory analysis done in accordance with EPA-approved testing methods.

Further, as a condition to Gandy Marley, Inc.'s acceptance of the materials shipped as represented on this Load Inspection Form, Transporter represents and warrants that only the material delivered by Generator to Transporter is now delivered by Transporter to Gandy Marley, Inc.'s facility for disposal.

THIS WILL CERTIFY that the above Transporter loaded the material as represented on this Load Inspection Form at the above described location, and that it was tendered by the above described Generator. THIS WILL CERTIFY that no additional materials were added to this load, and that the material was delivered without incident.

Transporter: Allen Holloway 11:00 _____

Print Name Signature

GMI Employee: Bill Marley _____

Print Name Signature

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

June 26, 2015

Clay Kilmer
Golder Associates
5200 Pasadena, NE Suite C
Albuquerque, NM 87113
TEL: (505) 821-3043
FAX (505) 821-5273

RE: Lovington 66 OrderNo.: 1506728

Dear Clay Kilmer:

Hall Environmental Analysis Laboratory received 2 sample(s) on 6/15/2015 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1506728-001
Matrix: MEOH (SOIL)
Client Sample ID: DPE-1 55'-60'
Collection Date: 6/14/2015 11:50:00 AM
Received Date: 6/15/2015 12:54:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 6010B: SOIL METALS						Analyst: **ELS**	
Lead	0.93	0.26		mg/Kg	1	6/25/2015 11:43:22 AM	19875
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	3000	200		mg/Kg	50	6/17/2015 10:13:01 PM	R26901
Surr: BFB	217	75.4-113	S	%REC	50	6/17/2015 10:13:01 PM	R26901
EPA METHOD 8260B: VOLATILES						Analyst: **cadg**	
Benzene	1.3	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Toluene	57	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Ethylbenzene	93	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Methyl tert-butyl ether (MTBE)	0.82	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2,4-Trimethylbenzene	200	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,3,5-Trimethylbenzene	61	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,2-Dichloroethane (EDC)	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2-Dibromoethane (EDB)	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Naphthalene	70	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1-Methylnaphthalene	48	32		mg/Kg	200	6/19/2015 4:38:47 AM	19772
2-Methylnaphthalene	99	32		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Acetone	ND	12		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Bromobenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Bromodichloromethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Bromoform	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Bromomethane	ND	2.4		mg/Kg	20	6/19/2015 5:07:34 AM	19772
2-Butanone	ND	8.0		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Carbon disulfide	ND	8.0		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Carbon tetrachloride	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Chlorobenzene	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Chloroethane	ND	1.6		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Chloroform	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Chloromethane	ND	2.4		mg/Kg	20	6/19/2015 5:07:34 AM	19772
2-Chlorotoluene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
4-Chlorotoluene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
cis-1,2-DCE	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
cis-1,3-Dichloropropene	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2-Dibromo-3-chloropropane	ND	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Dibromochloromethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Dibromomethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2-Dichlorobenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,3-Dichlorobenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,4-Dichlorobenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

- * Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1506728-001

Client Sample ID: DPE-1 55'-60'
Collection Date: 6/14/2015 11:50:00 AM
Matrix: MEOH (SOIL) **Received Date:** 6/15/2015 12:54:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **cadg**	
Dichlorodifluoromethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,1-Dichloroethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,1-Dichloroethene	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2-Dichloropropane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,3-Dichloropropane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
2,2-Dichloropropane	ND	1.6		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,1-Dichloropropene	ND	1.6		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Hexachlorobutadiene	ND	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
2-Hexanone	ND	8.0		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Isopropylbenzene	13	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
4-Isopropyltoluene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
4-Methyl-2-pentanone	ND	8.0		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Methylene chloride	ND	2.4		mg/Kg	20	6/19/2015 5:07:34 AM	19772
n-Butylbenzene	24	24		mg/Kg	200	6/19/2015 4:38:47 AM	19772
n-Propylbenzene	43	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
sec-Butylbenzene	8.0	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Styrene	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
tert-Butylbenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,1,1,2-Tetrachloroethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,1,2,2-Tetrachloroethane	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Tetrachloroethene (PCE)	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
trans-1,2-DCE	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
trans-1,3-Dichloropropene	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2,3-Trichlorobenzene	ND	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,2,4-Trichlorobenzene	ND	8.0		mg/Kg	200	6/19/2015 4:38:47 AM	19772
1,1,1-Trichloroethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,1,2-Trichloroethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Trichloroethene (TCE)	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Trichlorofluoromethane	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
1,2,3-Trichloropropane	ND	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Vinyl chloride	ND	0.80		mg/Kg	20	6/19/2015 5:07:34 AM	19772
Xylenes, Total	330	16		mg/Kg	200	6/19/2015 4:38:47 AM	19772
Surr: Dibromofluoromethane	94.4	70-130		%REC	20	6/19/2015 5:07:34 AM	19772
Surr: 1,2-Dichloroethane-d4	102	70-130		%REC	20	6/19/2015 5:07:34 AM	19772
Surr: Toluene-d8	98.2	70-130		%REC	20	6/19/2015 5:07:34 AM	19772
Surr: 4-Bromofluorobenzene	85.4	70-130		%REC	200	6/19/2015 4:38:47 AM	19772

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Client Sample ID: MeOH Blank
Project: Lovington 66
Collection Date:
Lab ID: 1506728-002
Matrix: MEOH BLAN
Received Date: 6/15/2015 12:54:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	5.0		mg/Kg	1	6/17/2015 11:39:07 PM	R26901
Surr: BFB	88.5	75.4-113		%REC	1	6/17/2015 11:39:07 PM	R26901
EPA METHOD 8260B: VOLATILES						Analyst: **cadg**	
Benzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Toluene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Ethylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Methyl tert-butyl ether (MTBE)	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2,4-Trimethylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,3,5-Trimethylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2-Dichloroethane (EDC)	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2-Dibromoethane (EDB)	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Naphthalene	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1-Methylnaphthalene	ND	0.20		mg/Kg	1	6/19/2015 12:31:04 PM	19772
2-Methylnaphthalene	ND	0.20		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Acetone	ND	0.75		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Bromobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Bromodichloromethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Bromoform	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Bromomethane	ND	0.15		mg/Kg	1	6/19/2015 12:31:04 PM	19772
2-Butanone	ND	0.50		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Carbon disulfide	ND	0.50		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Carbon tetrachloride	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Chlorobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Chloroethane	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Chloroform	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Chloromethane	ND	0.15		mg/Kg	1	6/19/2015 12:31:04 PM	19772
2-Chlorotoluene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
4-Chlorotoluene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
cis-1,2-DCE	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
cis-1,3-Dichloropropene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2-Dibromo-3-chloropropane	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Dibromochloromethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Dibromomethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2-Dichlorobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,3-Dichlorobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,4-Dichlorobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Dichlorodifluoromethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1-Dichloroethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1-Dichloroethene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Client Sample ID: MeOH Blank
Project: Lovington 66
Collection Date:
Lab ID: 1506728-002
Matrix: MEOH BLAN
Received Date: 6/15/2015 12:54:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **cadg**	
1,2-Dichloropropane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,3-Dichloropropane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
2,2-Dichloropropane	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1-Dichloropropene	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Hexachlorobutadiene	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
2-Hexanone	ND	0.50		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Isopropylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
4-Isopropyltoluene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
4-Methyl-2-pentanone	ND	0.50		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Methylene chloride	ND	0.15		mg/Kg	1	6/19/2015 12:31:04 PM	19772
n-Butylbenzene	ND	0.15		mg/Kg	1	6/19/2015 12:31:04 PM	19772
n-Propylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
sec-Butylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Styrene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
tert-Butylbenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1,1,2-Tetrachloroethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1,2,2-Tetrachloroethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Tetrachloroethene (PCE)	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
trans-1,2-DCE	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
trans-1,3-Dichloropropene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2,3-Trichlorobenzene	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2,4-Trichlorobenzene	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1,1-Trichloroethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,1,2-Trichloroethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Trichloroethene (TCE)	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Trichlorofluoromethane	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
1,2,3-Trichloropropane	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Vinyl chloride	ND	0.050		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Xylenes, Total	ND	0.10		mg/Kg	1	6/19/2015 12:31:04 PM	19772
Surr: Dibromofluoromethane	111	70-130		%REC	1	6/19/2015 12:31:04 PM	19772
Surr: 1,2-Dichloroethane-d4	110	70-130		%REC	1	6/19/2015 12:31:04 PM	19772
Surr: Toluene-d8	93.0	70-130		%REC	1	6/19/2015 12:31:04 PM	19772
Surr: 4-Bromofluorobenzene	103	70-130		%REC	1	6/19/2015 12:31:04 PM	19772

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1506728**

26-Jun-15

Client: Golder Associates

Project: Lovington 66

Sample ID	5ML RB	SampType:	MBLK	TestCode:	EPA Method 8015D: Gasoline Range					
Client ID:	PBS	Batch ID:	R26901	RunNo:	26901					
Prep Date:		Analysis Date:	6/17/2015	SeqNo:	803064	Units:	mg/Kg			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	900		1000		89.8	75.4	113			

Sample ID	2.5UG GRO LCS	SampType:	LCS	TestCode:	EPA Method 8015D: Gasoline Range					
Client ID:	LCSS	Batch ID:	R26901	RunNo:	26901					
Prep Date:		Analysis Date:	6/17/2015	SeqNo:	803065	Units:	mg/Kg			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	26	5.0	25.00	0	104	64	130			
Surr: BFB	960		1000		96.5	75.4	113			

Sample ID	1506728-001AMS	SampType:	MS	TestCode:	EPA Method 8015D: Gasoline Range					
Client ID:	DPE-1 55'-60'	Batch ID:	R26901	RunNo:	26901					
Prep Date:		Analysis Date:	6/17/2015	SeqNo:	803067	Units:	mg/Kg			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	3500	200	1002	2999	48.2	47.9	144			
Surr: BFB	76000		40100		189	75.4	113			S

Sample ID	1506728-001AMSD	SampType:	MSD	TestCode:	EPA Method 8015D: Gasoline Range					
Client ID:	DPE-1 55'-60'	Batch ID:	R26901	RunNo:	26901					
Prep Date:		Analysis Date:	6/17/2015	SeqNo:	803068	Units:	mg/Kg			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	3400	200	1002	2999	36.6	47.9	144	3.40	29.9	S
Surr: BFB	76000		40100		189	75.4	113	0	0	S

Qualifiers:

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- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1506728**

26-Jun-15

Client: Golder Associates

Project: Lovington 66

Sample ID **mb-19772**	SampType: **MBLK**	TestCode: **EPA Method 8260B: Volatiles**	
Client ID: **PBS**	Batch ID: **19772**	RunNo: **26939**	
Prep Date: **6/17/2015**	Analysis Date: **6/18/2015**	SeqNo: **804350**	Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Methyl tert-butyl ether (MTBE)	ND	0.050								
1,2,4-Trimethylbenzene	ND	0.050								
1,3,5-Trimethylbenzene	ND	0.050								
1,2-Dichloroethane (EDC)	ND	0.050								
1,2-Dibromoethane (EDB)	ND	0.050								
Naphthalene	ND	0.10								
1-Methylnaphthalene	ND	0.20								
2-Methylnaphthalene	ND	0.20								
Acetone	ND	0.75								
Bromobenzene	ND	0.050								
Bromodichloromethane	ND	0.050								
Bromoform	ND	0.050								
Bromomethane	ND	0.15								
2-Butanone	ND	0.50								
Carbon disulfide	ND	0.50								
Carbon tetrachloride	ND	0.050								
Chlorobenzene	ND	0.050								
Chloroethane	ND	0.10								
Chloroform	ND	0.050								
Chloromethane	ND	0.15								
2-Chlorotoluene	ND	0.050								
4-Chlorotoluene	ND	0.050								
cis-1,2-DCE	ND	0.050								
cis-1,3-Dichloropropene	ND	0.050								
1,2-Dibromo-3-chloropropane	ND	0.10								
Dibromochloromethane	ND	0.050								
Dibromomethane	ND	0.050								
1,2-Dichlorobenzene	ND	0.050								
1,3-Dichlorobenzene	ND	0.050								
1,4-Dichlorobenzene	ND	0.050								
Dichlorodifluoromethane	ND	0.050								
1,1-Dichloroethane	ND	0.050								
1,1-Dichloroethene	ND	0.050								
1,2-Dichloropropane	ND	0.050								
1,3-Dichloropropane	ND	0.050								
2,2-Dichloropropane	ND	0.10								

Qualifiers:

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- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1506728**

26-Jun-15

Client: Golder Associates

Project: Lovington 66

Sample ID **mb-19772**	SampType: **MBLK**	TestCode: **EPA Method 8260B: Volatiles**
Client ID: **PBS**	Batch ID: **19772**	RunNo: **26939**
Prep Date: **6/17/2015**	Analysis Date: **6/18/2015**	SeqNo: **804350** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	0.10								
Hexachlorobutadiene	ND	0.10								
2-Hexanone	ND	0.50								
Isopropylbenzene	ND	0.050								
4-Isopropyltoluene	ND	0.050								
4-Methyl-2-pentanone	ND	0.50								
Methylene chloride	ND	0.15								
n-Butylbenzene	ND	0.15								
n-Propylbenzene	ND	0.050								
sec-Butylbenzene	ND	0.050								
Styrene	ND	0.050								
tert-Butylbenzene	ND	0.050								
1,1,1,2-Tetrachloroethane	ND	0.050								
1,1,2,2-Tetrachloroethane	ND	0.050								
Tetrachloroethene (PCE)	ND	0.050								
trans-1,2-DCE	ND	0.050								
trans-1,3-Dichloropropene	ND	0.050								
1,2,3-Trichlorobenzene	ND	0.10								
1,2,4-Trichlorobenzene	ND	0.050								
1,1,1-Trichloroethane	ND	0.050								
1,1,2-Trichloroethane	ND	0.050								
Trichloroethene (TCE)	ND	0.050								
Trichlorofluoromethane	ND	0.050								
1,2,3-Trichloropropane	ND	0.10								
Vinyl chloride	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: Dibromofluoromethane	0.54		0.5000		107	70	130			
Surr: 1,2-Dichloroethane-d4	0.54		0.5000		107	70	130			
Surr: Toluene-d8	0.45		0.5000		89.6	70	130			
Surr: 4-Bromofluorobenzene	0.52		0.5000		103	70	130			

Sample ID **lcs-19772**	SampType: **LCS**	TestCode: **EPA Method 8260B: Volatiles**
Client ID: **LCSS**	Batch ID: **19772**	RunNo: **26939**
Prep Date: **6/17/2015**	Analysis Date: **6/18/2015**	SeqNo: **804351** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.1	0.050	1.000	0	105	70	130			
Toluene	0.92	0.050	1.000	0	92.3	70	130			
Chlorobenzene	1.0	0.050	1.000	0	100	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1506728**

26-Jun-15

Client: Golder Associates

Project: Lovington 66

Sample ID **lcs-19772**	SampType: **LCS**	TestCode: **EPA Method 8260B: Volatiles**
Client ID: **LCSS**	Batch ID: **19772**	RunNo: **26939**
Prep Date: **6/17/2015**	Analysis Date: **6/18/2015**	SeqNo: **804351** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	1.1	0.050	1.000	0	110	60.6	134			
Trichloroethene (TCE)	0.92	0.050	1.000	0	91.6	70	130			
Surr: Dibromofluoromethane	0.52		0.5000		103	70	130			
Surr: 1,2-Dichloroethane-d4	0.53		0.5000		107	70	130			
Surr: Toluene-d8	0.44		0.5000		88.2	70	130			
Surr: 4-Bromofluorobenzene	0.51		0.5000		103	70	130			

Qualifiers:

- * Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1506728**

26-Jun-15

Client: Golder Associates

Project: Lovington 66

Sample ID	**MB-19875**	SampType:	**MBLK**	TestCode:	**EPA Method 6010B: Soil Metals**					
Client ID:	**PBS**	Batch ID:	**19875**	RunNo:	**27084**					
Prep Date:	**6/23/2015**	Analysis Date:	**6/25/2015**	SeqNo:	**809623**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	ND	0.25								

Sample ID	**LCS-19875**	SampType:	**LCS**	TestCode:	**EPA Method 6010B: Soil Metals**					
Client ID:	**LCSS**	Batch ID:	**19875**	RunNo:	**27084**					
Prep Date:	**6/23/2015**	Analysis Date:	**6/25/2015**	SeqNo:	**809624**	Units:	**mg/Kg**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	25	0.25	25.00	0	101	80	120			

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Golder Assoc | Work Order Number: 1506728 | RcptNo: 1

Received by/date: KS 06/15/15

Logged By: Celina Sessa 6/15/2015 12:54:00 PM Celina Sessa

Completed By: Celina Sessa 6/16/2015 10:36:31 AM Celina Sessa

Reviewed By: JR 06/16/15

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Client		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	# of preserved bottles checked for pH: (<2 or >12 unless noted)
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted?
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by:

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.3	Good	Not Present			

Chain-of-Custody Record

Client: Golder Associates Inc

Mailing Address: 5200 Pasadena NE Ste C
Albuquerque, NM 87113

Phone #: 505-821-3043

email or Fax#: Clay_Kilmer@golder.com

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: Lovington 66

Project #: 140-4221

Project Manager: Clay Kilmer

Sampler: P. Cerrillo

On Ice: ☒ Yes ☐ No

Sample Temperature: 3.3

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1506728	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO3,NO2,PO4,SO4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	EPA 6010 13 Pb per May 05 addition			Air Bubbles (Y or N)
6/14	11:50	Soil	DPE-1 55'-60'	4 / Glass		-001			X							X		X			
6/12	NA	NA	MeOH Blank			-002															

Analysis Request

Date	Time	Relinquished by:	Received by:	Date	Time
6/15	12:54			6/15/15	12:54

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

July 27, 2015

Clay Kilmer
Golder Associates
5200 Pasadena, NE Suite C
Albuquerque, NM 87113
TEL: (505) 821-3043
FAX (505) 821-5273

RE: Lovington 66 OrderNo.: 1507551

Dear Clay Kilmer:

Hall Environmental Analysis Laboratory received 2 sample(s) on 7/14/2015 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1507551**
Date Reported: **7/27/2015**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1507551-001

Client Sample ID: Trip Blank
Collection Date:
Matrix: TRIP BLANK
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **BCN**	
Benzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Toluene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Ethylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Naphthalene	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1-Methylnaphthalene	ND	4.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
2-Methylnaphthalene	ND	4.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Acetone	ND	10		µg/L	1	7/14/2015 4:00:54 PM	R27487
Bromobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Bromodichloromethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Bromoform	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Bromomethane	ND	3.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
2-Butanone	ND	10		µg/L	1	7/14/2015 4:00:54 PM	R27487
Carbon disulfide	ND	10		µg/L	1	7/14/2015 4:00:54 PM	R27487
Carbon Tetrachloride	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Chlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Chloroethane	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Chloroform	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Chloromethane	ND	3.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
2-Chlorotoluene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
4-Chlorotoluene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
cis-1,2-DCE	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Dibromochloromethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Dibromomethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2-Dichlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,3-Dichlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,4-Dichlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Dichlorodifluoromethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1-Dichloroethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1-Dichloroethene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2-Dichloropropane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,3-Dichloropropane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
2,2-Dichloropropane	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Client Sample ID: Trip Blank
Project: Lovington 66
Collection Date:
Lab ID: 1507551-001
Matrix: TRIP BLANK
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **BCN**	
1,1-Dichloropropene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Hexachlorobutadiene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
2-Hexanone	ND	10		µg/L	1	7/14/2015 4:00:54 PM	R27487
Isopropylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
4-Isopropyltoluene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
4-Methyl-2-pentanone	ND	10		µg/L	1	7/14/2015 4:00:54 PM	R27487
Methylene Chloride	ND	3.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
n-Butylbenzene	ND	3.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
n-Propylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
sec-Butylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Styrene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
tert-Butylbenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
trans-1,2-DCE	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1,1-Trichloroethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,1,2-Trichloroethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Trichloroethene (TCE)	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Trichlorofluoromethane	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
1,2,3-Trichloropropane	ND	2.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Vinyl chloride	ND	1.0		µg/L	1	7/14/2015 4:00:54 PM	R27487
Xylenes, Total	ND	1.5		µg/L	1	7/14/2015 4:00:54 PM	R27487
Surr: 1,2-Dichloroethane-d4	99.8	70-130		%REC	1	7/14/2015 4:00:54 PM	R27487
Surr: 4-Bromofluorobenzene	91.8	70-130		%REC	1	7/14/2015 4:00:54 PM	R27487
Surr: Dibromofluoromethane	108	70-130		%REC	1	7/14/2015 4:00:54 PM	R27487
Surr: Toluene-d8	89.9	70-130		%REC	1	7/14/2015 4:00:54 PM	R27487

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1507551-002
Matrix: AQUEOUS
Client Sample ID: DPE-1
Collection Date: 7/12/2015 3:00:00 PM
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA 6010B: TOTAL RECOVERABLE METALS						Analyst: **MED**	
Lead	1.3	0.010		mg/L	2	7/23/2015 12:33:24 PM	20355
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **DJF**	
Gasoline Range Organics (GRO)	260	50		mg/L	1E	7/15/2015 4:51:34 PM	R27517
Surr: BFB	102	70-130		%REC	1E	7/15/2015 4:51:34 PM	R27517
EPA METHOD 8260B: VOLATILES						Analyst: **BCN**	
Benzene	28000	2000		µg/L	2E	7/17/2015 7:58:35 PM	R27580
Toluene	60000	2000		µg/L	2E	7/17/2015 7:58:35 PM	R27580
Ethylbenzene	7500	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Methyl tert-butyl ether (MTBE)	39000	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2,4-Trimethylbenzene	13000	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,3,5-Trimethylbenzene	3600	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2-Dichloroethane (EDC)	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2-Dibromoethane (EDB)	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Naphthalene	6900	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
1-Methylnaphthalene	5000	800		µg/L	200	7/17/2015 8:27:25 PM	R27580
2-Methylnaphthalene	11000	800		µg/L	200	7/17/2015 8:27:25 PM	R27580
Acetone	ND	2000		µg/L	200	7/17/2015 8:27:25 PM	R27580
Bromobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Bromodichloromethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Bromoform	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Bromomethane	ND	600		µg/L	200	7/17/2015 8:27:25 PM	R27580
2-Butanone	ND	2000		µg/L	200	7/17/2015 8:27:25 PM	R27580
Carbon disulfide	ND	2000		µg/L	200	7/17/2015 8:27:25 PM	R27580
Carbon Tetrachloride	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Chlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Chloroethane	ND	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
Chloroform	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Chloromethane	ND	600		µg/L	200	7/17/2015 8:27:25 PM	R27580
2-Chlorotoluene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
4-Chlorotoluene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
cis-1,2-DCE	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
cis-1,3-Dichloropropene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2-Dibromo-3-chloropropane	ND	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
Dibromochloromethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Dibromomethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2-Dichlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,3-Dichlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,4-Dichlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1507551-002 **Matrix:** AQUEOUS

Client Sample ID: DPE-1
Collection Date: 7/12/2015 3:00:00 PM
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **BCN**	
Dichlorodifluoromethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1-Dichloroethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1-Dichloroethene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2-Dichloropropane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,3-Dichloropropane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
2,2-Dichloropropane	ND	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1-Dichloropropene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Hexachlorobutadiene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
2-Hexanone	ND	2000		µg/L	200	7/17/2015 8:27:25 PM	R27580
Isopropylbenzene	560	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
4-Isopropyltoluene	220	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
4-Methyl-2-pentanone	ND	2000		µg/L	200	7/17/2015 8:27:25 PM	R27580
Methylene Chloride	ND	600		µg/L	200	7/17/2015 8:27:25 PM	R27580
n-Butylbenzene	1300	600		µg/L	200	7/17/2015 8:27:25 PM	R27580
n-Propylbenzene	1900	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
sec-Butylbenzene	500	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Styrene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
tert-Butylbenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1,1,2-Tetrachloroethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1,2,2-Tetrachloroethane	ND	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
Tetrachloroethene (PCE)	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
trans-1,2-DCE	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
trans-1,3-Dichloropropene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2,3-Trichlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2,4-Trichlorobenzene	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1,1-Trichloroethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,1,2-Trichloroethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Trichloroethene (TCE)	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Trichlorofluoromethane	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
1,2,3-Trichloropropane	ND	400		µg/L	200	7/17/2015 8:27:25 PM	R27580
Vinyl chloride	ND	200		µg/L	200	7/17/2015 8:27:25 PM	R27580
Xylenes, Total	24000	300		µg/L	200	7/17/2015 8:27:25 PM	R27580
Surr: 1,2-Dichloroethane-d4	105	70-130		%REC	200	7/17/2015 8:27:25 PM	R27580
Surr: 4-Bromofluorobenzene	75.8	70-130		%REC	200	7/17/2015 8:27:25 PM	R27580
Surr: Dibromofluoromethane	111	70-130		%REC	200	7/17/2015 8:27:25 PM	R27580
Surr: Toluene-d8	96.6	70-130		%REC	200	7/17/2015 8:27:25 PM	R27580

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**	
Client ID: **PBW**	Batch ID: **R27487**	RunNo: **27487**	
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **824923**	Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								

Qualifiers:

- * Value exceeds Maximum Contaminant Level.
- B Analyte detected in the associated Method Blank
- D Sample Diluted Due to Matrix
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- R RPD outside accepted recovery limits
- RL Reporting Detection Limit
- S % Recovery outside of range due to dilution or matrix

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **R27487**	RunNo: **27487**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **824923** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.6		10.00		96.3	70	130			
Surr: 4-Bromofluorobenzene	9.8		10.00		97.7	70	130			
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.6		10.00		95.8	70	130			

Sample ID **1507551-002ams**	SampType: **MS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **DPE-1**	Batch ID: **R27487**	RunNo: **27487**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **825483** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	42000	100	2000	41010	60.7	70	130			ES
Toluene	59000	100	2000	68970	-507	70	130			ES
Chlorobenzene	2000	100	2000	30.00	96.3	70	130			

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- B Analyte detected in the associated Method Blank
- D Sample Diluted Due to Matrix
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- R RPD outside accepted recovery limits
- RL Reporting Detection Limit
- S % Recovery outside of range due to dilution or matrix

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **1507551-002ams**	SampType: **MS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **DPE-1**	Batch ID: **R27487**	RunNo: **27487**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **825483** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1-Dichloroethene	2200	100	2000	0	109	70	130			
Trichloroethene (TCE)	1900	100	2000	0	96.3	70	130			
Surr: 1,2-Dichloroethane-d4	970		1000		97.2	70	130			
Surr: 4-Bromofluorobenzene	800		1000		80.2	70	130			
Surr: Dibromofluoromethane	1100		1000		114	70	130			
Surr: Toluene-d8	980		1000		97.9	70	130			

Sample ID **1507551-002amsd**	SampType: **MSD**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **DPE-1**	Batch ID: **R27487**	RunNo: **27487**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **825484** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	43000	100	2000	41010	97.0	70	130	1.70	20	E
Toluene	63000	100	2000	68970	-306	70	130	6.64	20	ES
Chlorobenzene	2200	100	2000	30.00	106	70	130	9.58	20	
1,1-Dichloroethene	2300	100	2000	0	114	70	130	4.79	20	
Trichloroethene (TCE)	2100	100	2000	0	105	70	130	8.87	20	
Surr: 1,2-Dichloroethane-d4	1000		1000		100	70	130	0	0	
Surr: 4-Bromofluorobenzene	780		1000		77.5	70	130	0	0	
Surr: Dibromofluoromethane	1200		1000		119	70	130	0	0	
Surr: Toluene-d8	1100		1000		106	70	130	0	0	

Sample ID **100ng LCS2**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **R27487**	RunNo: **27487**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **825485** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	110	70	130			
Toluene	21	1.0	20.00	0	104	70	130			
Chlorobenzene	20	1.0	20.00	0	101	70	130			
1,1-Dichloroethene	24	1.0	20.00	0	119	70	130			
Trichloroethene (TCE)	21	1.0	20.00	0	106	70	130			
Surr: 1,2-Dichloroethane-d4	9.4		10.00		93.7	70	130			
Surr: 4-Bromofluorobenzene	9.4		10.00		93.9	70	130			
Surr: Dibromofluoromethane	10		10.00		101	70	130			
Surr: Toluene-d8	9.2		10.00		92.4	70	130			

Qualifiers:

- * Value exceeds Maximum Contaminant Level.
- B Analyte detected in the associated Method Blank
- D Sample Diluted Due to Matrix
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- R RPD outside accepted recovery limits
- RL Reporting Detection Limit
- S % Recovery outside of range due to dilution or matrix

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **R27517**	RunNo: **27517**
Prep Date:	Analysis Date: **7/15/2015**	SeqNo: **825967** Units: **%REC**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 1,2-Dichloroethane-d4	9.8		10.00		97.8	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		101	70	130			
Surr: Dibromofluoromethane	10		10.00		103	70	130			
Surr: Toluene-d8	9.6		10.00		95.6	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **R27517**	RunNo: **27517**
Prep Date:	Analysis Date: **7/15/2015**	SeqNo: **825969** Units: **%REC**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 1,2-Dichloroethane-d4	10		10.00		101	70	130			
Surr: 4-Bromofluorobenzene	9.8		10.00		98.1	70	130			
Surr: Dibromofluoromethane	10		10.00		102	70	130			
Surr: Toluene-d8	9.6		10.00		96.3	70	130			

Sample ID **rb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **R27580**	RunNo: **27580**
Prep Date:	Analysis Date: **7/17/2015**	SeqNo: **827914** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **R27580**	RunNo: **27580**
Prep Date:	Analysis Date: **7/17/2015**	SeqNo: **827914** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb1**	SampType: **MBLK**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **PBW**	Batch ID: **R27580**	RunNo: **27580**
Prep Date:	Analysis Date: **7/17/2015**	SeqNo: **827914** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	9.9		10.00		98.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		95.5	70	130			
Surr: Dibromofluoromethane	10		10.00		105	70	130			
Surr: Toluene-d8	10		10.00		99.9	70	130			

Sample ID **100ng lcs**	SampType: **LCS**	TestCode: **EPA Method 8260B: VOLATILES**
Client ID: **LCSW**	Batch ID: **R27580**	RunNo: **27580**
Prep Date:	Analysis Date: **7/17/2015**	SeqNo: **827915** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	19	1.0	20.00	0	93.3	70	130			
Toluene	21	1.0	20.00	0	105	70	130			
Chlorobenzene	19	1.0	20.00	0	94.6	70	130			
1,1-Dichloroethene	21	1.0	20.00	0	105	70	130			
Trichloroethene (TCE)	18	1.0	20.00	0	90.4	70	130			
Surr: 1,2-Dichloroethane-d4	9.6		10.00		95.7	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.5	70	130			
Surr: Dibromofluoromethane	10		10.00		100	70	130			
Surr: Toluene-d8	11		10.00		107	70	130			

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- B Analyte detected in the associated Method Blank
- D Sample Diluted Due to Matrix
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected below quantitation limits
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- R RPD outside accepted recovery limits
- RL Reporting Detection Limit
- S % Recovery outside of range due to dilution or matrix

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **MB-20355**	SampType: **MBLK**	TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **PBW**	Batch ID: **20355**	RunNo: **27712**
Prep Date: **7/21/2015**	Analysis Date: **7/23/2015**	SeqNo: **832847** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	ND	0.0050								

Sample ID **LCS-20355**	SampType: **LCS**	TestCode: **EPA 6010B: Total Recoverable Metals**
Client ID: **LCSW**	Batch ID: **20355**	RunNo: **27712**
Prep Date: **7/21/2015**	Analysis Date: **7/23/2015**	SeqNo: **832848** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Lead	0.51	0.0050	0.5000	0	102	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507551**

27-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **rb**	SampType: **MBLK**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBW**	Batch ID: **R27517**	RunNo: **27517**
Prep Date:	Analysis Date: **7/15/2015**	SeqNo: **825974** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	9.7		10.00		97.0	70	130			

Sample ID **2.5ug gro lcs**	SampType: **LCS**	TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSW**	Batch ID: **R27517**	RunNo: **27517**
Prep Date:	Analysis Date: **7/15/2015**	SeqNo: **825976** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.49	0.050	0.5000	0	98.4	80.6	122			
Surr: BFB	10		10.00		102	70	130			

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- D Sample Diluted Due to Matrix
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- R RPD outside accepted recovery limits
- S % Recovery outside of range due to dilution or matrix
- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- P Sample pH Not In Range
- RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Golder Assoc | Work Order Number: 1507551 | RcptNo 1

Received by/date: 07/14/15

Logged By: Lindsay Mangin 7/14/2015 9:25:00 AM

Completed By: Lindsay Mangin 7/14/2015 9:40:29 AM

Reviewed By: CS 07/14/15

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Client		

Log In

4. Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☑	No ☐	NA ☐
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☑	No ☐	No VOA Vials ☐
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: 1 (<2 or >12 unless noted)
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted? NO
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding

Client Instructions

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.5	Good	Not Present			

Chain-of-Custody Record

Client: **Golder Associates Inc.**

Mailing Address: **5200 Pasadena NE Suite C Albuquerque, NM 87113**

Phone #: (505) 821-3043

email or Fax#: Clay_Kilmer@golder.com

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation:
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☐ Standard ☐ Rush _____

Project Name: **Lovington 66**

Project #: **140-4221**

Project Manager: **Clay Kilmer**

Sampler: **P. Carrillo**

On Ice: ☑ Yes ☐ No

Sample Temperature: 4.5 - 1.0CF = 3.5°C

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1507551	EPA 8260B	EPA 8015 GRO	EPA 6010B LEAD	Air Bubbles (Y or N)
7/9/2015	N/A	AQ	Trip Blank	Glass Bottle - 2	HCl	-001	X			
7/12/2015	15:00	AQ	DPE-1	Glass Bottle - 6	HCl	-002	X	X		
7/12/2015	15:00	AQ	DPE-1	Plastic Bottle - 1	HNO_3	-003			X	

Date:	Time:	Relinquished by:	Received by:	Date	Time
7/14/15	9:25			7/14/15	0925
Date:	Time:	Relinquished by:	Received by:	Date	Time

Analysis Request

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

July 20, 2015

Clay Kilmer
Golder Associates
5200 Pasadena, NE Suite C
Albuquerque, NM 87113
TEL: (505) 821-3043
FAX (505) 821-5273

RE: Lovington 66 OrderNo.: 1507550

Dear Clay Kilmer:

Hall Environmental Analysis Laboratory received 1 sample(s) on 7/14/2015 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1507550-001 **Matrix:** AIR

Client Sample ID: DPE-1
Collection Date: 7/12/2015 2:53:00 PM
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
Benzene	1500	50		µg/L	500	7/15/2015 12:43:43 PM	R27517
Toluene	3600	50		µg/L	500	7/15/2015 12:43:43 PM	R27517
Ethylbenzene	420	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Methyl tert-butyl ether (MTBE)	620	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2,4-Trimethylbenzene	66	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,3,5-Trimethylbenzene	30	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2-Dichloroethane (EDC)	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2-Dibromoethane (EDB)	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Naphthalene	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
1-Methylnaphthalene	ND	20		µg/L	50	7/14/2015 1:38:46 PM	R27501
2-Methylnaphthalene	ND	20		µg/L	50	7/14/2015 1:38:46 PM	R27501
Acetone	ND	50		µg/L	50	7/14/2015 1:38:46 PM	R27501
Bromobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Bromodichloromethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Bromoform	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Bromomethane	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
2-Butanone	ND	50		µg/L	50	7/14/2015 1:38:46 PM	R27501
Carbon disulfide	ND	50		µg/L	50	7/14/2015 1:38:46 PM	R27501
Carbon tetrachloride	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Chlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Chloroethane	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
Chloroform	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Chloromethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
2-Chlorotoluene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
4-Chlorotoluene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
cis-1,2-DCE	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
cis-1,3-Dichloropropene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2-Dibromo-3-chloropropane	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
Dibromochloromethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Dibromomethane	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2-Dichlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,3-Dichlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,4-Dichlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Dichlorodifluoromethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1-Dichloroethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1-Dichloroethene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2-Dichloropropane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,3-Dichloropropane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
2,2-Dichloropropane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Golder Associates
Project: Lovington 66
Lab ID: 1507550-001 **Matrix:** AIR

Client Sample ID: DPE-1
Collection Date: 7/12/2015 2:53:00 PM
Received Date: 7/14/2015 9:25:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8260B: VOLATILES						Analyst: **DJF**	
1,1-Dichloropropene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Hexachlorobutadiene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
2-Hexanone	ND	50		µg/L	50	7/14/2015 1:38:46 PM	R27501
Isopropylbenzene	20	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
4-Isopropyltoluene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
4-Methyl-2-pentanone	ND	50		µg/L	50	7/14/2015 1:38:46 PM	R27501
Methylene chloride	ND	15		µg/L	50	7/14/2015 1:38:46 PM	R27501
n-Butylbenzene	ND	15		µg/L	50	7/14/2015 1:38:46 PM	R27501
n-Propylbenzene	41	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
sec-Butylbenzene	5.4	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Styrene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
tert-Butylbenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1,1,2-Tetrachloroethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1,2,2-Tetrachloroethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Tetrachloroethene (PCE)	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
trans-1,2-DCE	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
trans-1,3-Dichloropropene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2,3-Trichlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2,4-Trichlorobenzene	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1,1-Trichloroethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,1,2-Trichloroethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Trichloroethene (TCE)	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Trichlorofluoromethane	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
1,2,3-Trichloropropane	ND	10		µg/L	50	7/14/2015 1:38:46 PM	R27501
Vinyl chloride	ND	5.0		µg/L	50	7/14/2015 1:38:46 PM	R27501
Xylenes, Total	950	7.5		µg/L	50	7/14/2015 1:38:46 PM	R27501
Surr: Dibromofluoromethane	90.0	70-130		%REC	50	7/14/2015 1:38:46 PM	R27501
Surr: 1,2-Dichloroethane-d4	115	70-130		%REC	50	7/14/2015 1:38:46 PM	R27501
Surr: Toluene-d8	109	70-130		%REC	50	7/14/2015 1:38:46 PM	R27501
Surr: 4-Bromofluorobenzene	109	70-130		%REC	50	7/14/2015 1:38:46 PM	R27501

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507550**

20-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **1507550-001a dup** SampType: **DUP** TestCode: **EPA Method 8260B: Volatiles**

Client ID: **DPE-1** Batch ID: **R27501** RunNo: **27501**

Prep Date: Analysis Date: **7/14/2015** SeqNo: **825196** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Ethylbenzene	360	5.0						15.3	20	
Methyl tert-butyl ether (MTBE)	580	5.0						6.51	20	
1,2,4-Trimethylbenzene	52	5.0						23.8	20.4	R
1,3,5-Trimethylbenzene	24	5.0						21.8	20	R
1,2-Dichloroethane (EDC)	ND	5.0						0	20	
1,2-Dibromoethane (EDB)	ND	5.0						0	20	
Naphthalene	ND	10						0	20	
1-Methylnaphthalene	ND	20						0	20	
2-Methylnaphthalene	ND	20						0	20	
Acetone	70000	50						200	20	ER
Bromobenzene	ND	5.0						0	20	
Bromodichloromethane	ND	5.0						0	20	
Bromoform	ND	5.0						0	20	
Bromomethane	ND	10						0	20	
2-Butanone	10000	50						200	20	ER
Carbon disulfide	ND	50						0	20	
Carbon tetrachloride	ND	5.0						0	20	
Chlorobenzene	ND	5.0						0	20	
Chloroethane	ND	10						0	20	
Chloroform	ND	5.0						0	20	
Chloromethane	110	5.0						200	20	R
2-Chlorotoluene	ND	5.0						0	20	
4-Chlorotoluene	ND	5.0						0	20	
cis-1,2-DCE	ND	5.0						0	20	
cis-1,3-Dichloropropene	ND	5.0						0	20	
1,2-Dibromo-3-chloropropane	ND	10						0	20	
Dibromochloromethane	ND	5.0						0	20	
Dibromomethane	ND	10						0	20	
1,2-Dichlorobenzene	ND	5.0						0	20	
1,3-Dichlorobenzene	ND	5.0						0	20	
1,4-Dichlorobenzene	ND	5.0						0	20	
Dichlorodifluoromethane	ND	5.0						0	20	
1,1-Dichloroethane	ND	5.0						0	20	
1,1-Dichloroethene	ND	5.0						0	20	
1,2-Dichloropropane	ND	5.0						0	20	
1,3-Dichloropropane	ND	5.0						0	20	
2,2-Dichloropropane	10	5.0						200	20	R
1,1-Dichloropropene	ND	5.0						0	20	
Hexachlorobutadiene	ND	5.0						0	20	

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1507550**

20-Jul-15

Client: Golder Associates

Project: Lovington 66

Sample ID **1507550-001a dup**	SampType: **DUP**	TestCode: **EPA Method 8260B: Volatiles**
Client ID: **DPE-1**	Batch ID: **R27501**	RunNo: **27501**
Prep Date:	Analysis Date: **7/14/2015**	SeqNo: **825196** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Hexanone	ND	50						0	20	
Isopropylbenzene	17	5.0						17.5	20	
4-Isopropyltoluene	ND	5.0						0	20	
4-Methyl-2-pentanone	ND	50						0	20	
Methylene chloride	ND	15						0	20	
n-Butylbenzene	ND	15						0	20	
n-Propylbenzene	32	5.0						24.7	20	R
sec-Butylbenzene	ND	5.0						200	20	R
Styrene	ND	5.0						0	20	
tert-Butylbenzene	ND	5.0						0	20	
1,1,1,2-Tetrachloroethane	ND	5.0						0	20	
1,1,2,2-Tetrachloroethane	ND	5.0						0	20	
Tetrachloroethene (PCE)	ND	5.0						0	20	
trans-1,2-DCE	ND	5.0						0	20	
trans-1,3-Dichloropropene	ND	5.0						0	20	
1,2,3-Trichlorobenzene	ND	5.0						0	20	
1,2,4-Trichlorobenzene	ND	5.0						0	20	
1,1,1-Trichloroethane	ND	5.0						0	20	
1,1,2-Trichloroethane	ND	5.0						0	20	
Trichloroethene (TCE)	ND	5.0						0	20	
Trichlorofluoromethane	ND	5.0						0	20	
1,2,3-Trichloropropane	ND	10						0	20	
Vinyl chloride	ND	5.0						0	20	
Xylenes, Total	830	7.5						13.6	20	
Surr: Dibromofluoromethane	46		50.00		91.0	70	130	0	0	
Surr: 1,2-Dichloroethane-d4	52		50.00		105	70	130	0	0	
Surr: Toluene-d8	55		50.00		109	70	130	0	0	
Surr: 4-Bromofluorobenzene	52		50.00		103	70	130	0	0	

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- E Value above quantitation range
- J Analyte detected below quantitation limits
- O RSD is greater than RSDlimit
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- P Sample pH Not In Range
- RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Golder Assoc | Work Order Number: 1507550 | RcptNo: 1

Received by/date: [signature] 07/14/15

Logged By: Lindsay Mangin 7/14/2015 9:25:00 AM [signature]

Completed By: Lindsay Mangin 7/14/2015 9:37:24 AM [signature]

Reviewed By: CS 07/14/15

Chain of Custody

1. Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
2. Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
3. How was the sample delivered?	Client		

Log In

4. Was an attempt made to cool the samples?	Yes ☐	No ☐	NA ☑
5. Were all samples received at a temperature of >0° C to 6.0°C	Yes ☐	No ☐	NA ☑
6. Sample(s) in proper container(s)?	Yes ☑	No ☐	
7. Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8. Are samples (except VOA and ONG) properly preserved?	Yes ☑	No ☐	
9. Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10. VOA vials have zero headspace?	Yes ☐	No ☐	No VOA Vials ☑
11. Were any sample containers received broken?	Yes ☐	No ☑	
12. Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ☑	No ☐	# of preserved bottles checked for pH: (<2 or >12 unless noted)
13. Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	Adjusted?
14. Is it clear what analyses were requested?	Yes ☑	No ☐	
15. Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ☑	No ☐	Checked by:

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	NA	Good	Not Present			

Chain-of-Custody Record

Client:	Golder Associates Inc.
Mailing Address:	5200 Pasadena NE Suite C Albuquerque, NM 87113
Phone #:	(505) 821-3043
email or Fax#:	Clay_Kilmer@golder.com
QA/QC Package:	☐ Standard ☐ Level 4 (Full Validation)
Accreditation:	☐ NELAP ☐ Other ____
☐ EDD (Type)	____

Turn-Around Time:	☐ Standard ☐ Rush ____
Project Name:	Lovington 66
Project #:	140-4221
Project Manager:	Clay Kilmer
Sampler:	P. Carrillo
On Ice:	☐ Yes ☐ No
Sample Temperature:	N/A

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1507550	Analysis Request: EPA 8260B	Air Bubbles (Y or N)
7/12/2015	14:53	Vapor	DPE-1	Tedlar Bag - 1	N/A	-001	X	

Date: 7/14/15	Time: 9:25	Relinquished by:	Received by:	Date: 7/14/15	Time: 0925
Date:	Time:	Relinquished by:	Received by:	Date:	Time:

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

APPENDIX I

ACUVAC REMEDIATION, LLC DUAL PHASE EXTRACTION PILOT TEST REPORTS

AcuVac Remediation, LLC

1656-H Townhurst, Houston, Texas 77043
713.468.6688 • www.acuvac.com

July 15, 2015

Mr. Clay Kilmer:
Senior Hydrogeologist
Golder Associates, Inc.
5200 Pasadena Avenue N.E. Suite C
Albuquerque, NM 87113

Dear Clay:

Re: Walstadd 66, Lovington, NM

At your request, we performed one Mobile Dual Phase (MDP) Pilot Test on July 12, 2015 at the above referenced sites. An Engineer and an Environmental Specialist, with over 14,500 hours of on-site testing, conducted the Pilot Test. The total MDP test time, including static data time, was 8.6 hours. The contaminant was weathered gasoline.

OBJECTIVES

The Objectives of an MDP Pilot Test are to:

- Evaluate the potential for removing liquid and vapor LNAPL and contaminated groundwater (GW) from soils in the subsurface formations.
- Expose the capillary fringe area and below to induced soil vacuum extraction (SVE) in the extraction well (EW).
- With induced vacuums, increase the GW specific yields. Stress the GW System and monitor its response.
- Maintain a near constant GW depression in the EW.
- Create an induced hydraulic gradient (IHG) to gain hydraulic control of the area.
- Record GW depression and pump rates to accomplish the above objectives.

The purpose of the EW induced vacuum variable rate test is to define the pressure/flow characteristics of sub-surface soils around the EW and to estimate potential conditions for an operational Dual Phase System. Starting a test with lower variable rates of vacuum and flow allows the EW and outer wells sufficient time to adjust and stabilize and minimizes the risk of developing preferential paths. This will also assist the development of newly installed extraction wells.

METHODS AND EQUIPMENT

The tests were conducted using AcuVac's I-6 System, with Roots RAI-33 and RAI-22 blowers, various instrumentation, including the HORIBA® Analyzer, Solinst Interface Probes, Lumidor O_2 Meter, vapor flow gauges, liquid volume/flow meter, a sensitive instrument to determine barometric pressure, V-1 vacuum box to capture non-diluted vapor samples, Redi-Flo 2 total fluids (TF) pump and other special equipment. The vacuum extraction portion of the AcuVac System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes light hydrocarbons in the soil and on the GW to volatilize and flow through a moisture knockout tank, to the vacuum pump and the IC engine where they are burned as part of the normal combustion process. Propane is used as auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

The GW Extraction is provided by an in-well, Redi-Flo 2 total fluids pump that has the discharge line connected to a total volume meter. The discharge line from the volume meter is then connected to the stand-by tank truck. The electrical power for the GW pump was supplied from a 120v Honda generator. The GW flow rate can be adjusted to maintain a target level. Interface meters are used to measure Depth to Groundwater (DTGW)/Depth to Light Non-Aqueous Petroleum Liquids (DTLNAPL).

The AcuVac IC engine is fully loaded for maximum power that is necessary to achieve and maintain high induced vacuums and/or high well vapor flows required to maximize the vacuum SVE Radius of Influence (ROI) for Pilot Tests and short term Event remediation. The lower part of the IC engine is encased with a liquid collection pan designed to catch any oil drips or liquid leaks if it should occur.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all IC engine driven equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the AcuVac System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

The design of the AcuVac System enables complete independent control of both the Induced Well Vacuum and the GW pumping functions such that the AcuVac System operator can control the IHG to expose the maximum amount of the formation to SVE. The ability to separate the induced vacuum and liquid flows within the EW improves the LNAPL recovery rates, and enables the test data to be recorded independently. All the systems are properly grounded to eliminate any static electrical charge.

PROJECT SCOPE AND PROCEDURES

- Gauge the DTGW and DTLNAPL in the EW.
- Calculate the Hydro-equivalent in the EW.
- Determine the appropriate placement for the GW pump inlet.

- Calculate the GW depression necessary to gain hydraulic control of the area.
- Record the distances from the selected EW to the outer wells.
- Install the GW pump into the EW (A-1).
- Connect the ground wires for the AcuVac System and Honda generator.
- Set pump and data probe at the selected depth from TOC.
- Connect discharge hoses to liquid volume meter and then connect to the on-site tank truck.
- Connect the AcuVac System to the selected EW manifold and seal the selected outer observation wells with plugs designed to accept magnehelic gauges or digital manometers.
- Record the static well data, DTGW/DTLNAPL, well size, TD, screen intervals and then apply EW induced vacuum. Record the vacuum and well flow, all System data (including fuel flow of propane), temperature and barometric pressure.
- The test procedures are to provide variable rates of induced vacuum and GW pumping rates over the test period.
- Start the GW pump and set at proper flow rate to achieve the selected GW drawdown.
- Monitor the GW pump and adjust the flow to maintain the selected GW drawdown.
- Record pump flow rate and total liquid volume.
- Collect GW/LNAPL samples in a 2,000 ml beaker to determine the percentage of LNAPL in the recovered liquid volume.
- Install and observe the digital manometer on the outer observation wells to determine if the selected EW induced vacuum is in vacuum communication with the outer observation wells.
- Gauge the outer wells to determine the GW drawdown.
- Record the data at a selected interval of time.
- Operate the AcuVac System in such a manner that all well vapors are passed through the engine and catalytic converters, to destruct the contaminants and exhausted, to meet air emission standards. Comply with all security and safety regulations.
- Complete the tests by providing a report consisting of operating and analytical data, projection of SVE radius of influence (ROI), the IHG ROI and the collected volumes of GW and LNAPL.

CONDITIONS AFFECTING PILOT TESTS

- Generally, a decreasing barometric pressure results in increased well pressures (decreased vacuums) on those wells plugged and sealed at the TOC, while an increasing barometric pressure results in increased well vacuums. This is the function of GW levels increasing and decreasing. **There are many variables that can affect Pilot Test data, but barometric pressure fluctuations have the most immediate and profound effect.** This assumes that SVE short-circuiting is not a factor.
- To offset the induced vacuum/pressure as a result of GW depression or upwelling in the outer monitoring wells, the wells are vented periodically to atmosphere and then re-plugged prior to recording data at select intervals. The potential for increased vacuum or pressure as a result of in/decreasing GW levels will be minimized. GW depression surrounding an outer observation well will result in an induced vacuum not associated with the induced vacuum created in the EW. Likewise, GW mounding will create the opposite effect creating well pressures.

TEST #MDP-1
WALSTADD 66
LOVINGTON, NM
JULY 12, 2015

PRE-TEST FUNCTIONS - PILOT TEST #MDP-1

Prior to starting the MDP test with GW Extraction, all systems were checked for normal and safe operation. The DTGW/DTLNAPL, barometric and absolute pressure and ambient air temperature were recorded. The hydro equivalent (HE) was calculated. Based upon the HE, the GW pump inlet was set at 65 ft below the top of the well casing. The pump hose was then connected to the total volume meter. The discharge hose was connected to the on-site 3,000 gal liquid collection tank truck. Each magnehelic gauge was checked and calibrated to zero. The outer monitoring wells were plugged with expandable well plugs designed to accept a digital manometer. Static well data and the atmospheric effect on the outer wells were recorded prior to engaging the AcuVac System. The propane tank fuel level was recorded so that accurate fuel consumption could be estimated for the total test period. All safety checks were performed on the Systems. (See list of Attached Schedules and Figures, Page 11.)

DISCUSSION OF DATA - TEST #MDP-1

Test #MDP-1, with vacuum and GW/LNAPL extraction, was an 8.6 hour MDP test including static well data, conducted from well A-1 as the EW. Immediately prior to starting the test, the selected outer monitoring wells were recording zero vacuums. The general weather conditions were clear and cool. At the start of the MDP test, the EW induced vacuum was set at 40"H_2O, with an initial well vapor flow of 12.19 scfm. The data probe static reading was 7.5 ft, immediately decreasing to 2.0 ft when the GW pump was engaged. Based upon the data probe, it was determined that a constant drawdown creating a GW depression (GWD) of approximately 5.5 ft below HE static level would be appropriate for this test (see Table #1A). The initial GW pump rate was set at 3.5 gpm to achieve the selected GWD and then remained constant for 2.0 hours. The GWD and related GW pump rate are monitored constantly throughout the test and recorded every 30 minutes. Table #1A summarizes the GWD, GW pump rate and the drawdown in the EW and Table #1B summarizes the GWD in the outer observation wells.

During the first 2.0 hours of the test, the EW induced vacuum remained constant at 40"H_2O with a well vapor flow of 12.19 scfm. Outer well W-2, which is located 16.2 ft from the EW, immediately recorded a well vacuum increasing from 0 to 0.07"H_2O and continued on an increasing trend during the test period to 0.88"H_2O. Outer wells W-1 and W-3 which are located 25.8 and 38.3 ft from the EW, recorded a slight increasing vacuum level and then continued on a slight increasing vacuum trend to 0.36 and 0.17"H_2O. The ambient air temperature increased from 72.4 to 79.6°F and the barometric pressure was mostly steady at 30.10"Hg. The GW depression averaged 5.5 ft below static level. The total collected liquid volume was 420 gals and **38.9 gals of liquid LNAPL were observed on the collected GW**.

EXTRACTION WELL A-1
OPERATING DATA TEST #MDP-1
Table #1A

Location: Walstadd 66, Lovington, NM						
Project Date 07/12/2015			**A-1 DTGW ft**	**GWD ft**	**EW GWR gpm**	**Total Volume gal**	**EW Vacuum "H_2O**
Well Data							
TD			75.0	-	-	-	-
Screen			45.0-75.0	-	-	-	-
Well Size			4.0	-	-	-	-
DTGW	0715	hrs	64.08	-	-	-	-
DTGW Hydro Equivalent			59.14	-	-	-	-
DTLNAPL	0715	hrs	57.40	-	-	-	-
LNAPL	0715	hrs	6.68	-	-	-	-
Drawdown Data							
Data Probe	0730	hrs Start	7.50	-	-	-	-
Data Probe	0800	hrs	2.00	-5.50	3.50	105	40
Data Probe	0830	hrs	2.00	-5.50	3.50	210	40
Data Probe	0900	hrs	2.00	-5.50	3.50	315	40
Data Probe	0930	hrs	2.00	-5.50	3.50	420	40
Data Probe	1000	hrs	2.00	-5.50	4.30	549	60
Data Probe	1030	hrs	2.00	-5.50	4.30	678	60
Data Probe	1100	hrs	2.00	-5.50	4.30	807	60
Data Probe	1130	hrs	2.00	-5.50	4.30	936	60
Data Probe	1200	hrs	2.00	-5.50	4.30	1065	60
Data Probe	1230	hrs	2.00	-5.50	4.30	1194	60
Data Probe	1300	hrs	2.00	-5.50	4.30	1323	60
Data Probe	1330	hrs	2.00	-5.50	4.60	1460	75
Data Probe	1400	hrs	2.00	-5.50	4.60	1598	75
Data Probe	1430	hrs	2.00	-5.50	4.60	1736	75
Data Probe	1500	hrs	2.00	-5.50	5.20	1892	90
Data Probe	1530	hrs Stop	2.00	-5.50	5.20	2048	90
Data Probe	1600	hrs Static	7.46	-0.04	0.00	-	-
DTGW	1600	hrs	61.65	-	-	-	-
DTGW Hydro Equivalent			61.64	-	-	-	-
DTLNAPL	1600	hrs	61.61	-	-	-	-
LNAPL	1600	hrs	0.04	-	-	-	-
Average GW Depression			-	-5.50	-	-	-

OBSERVATION WELLS
INDUCED HYDRAULIC GRADIENT DATA
TEST #MDP-1
TABLE #1B

Location: Walstadd 66, Lovington, NM								
Project Date 07/12/2015		**W-2**		**W-1**		**W-3**		
Well Data								
TD	ft	75.0		80.0		75.0		
Screen	ft	50.0 - 70.0		50.0 - 70.0		50.0 - 70.0		
Well Size	in	4.0		4.0		4.0		
		DTGW ft	**Change in GWD ft**	**DTGW ft**	**Change in GWD ft**	**DTGW ft**	**Change in GWD ft**	**GW Pump Rate gpm**
Static/Start Data								
DTGW 0730 hrs	ft	63.92		64.62		63.81		3.50
DTGW Hydro Equivalent	ft	58.87	0	59.84	0	58.94	0	
DTLNAPL 0730 hrs	ft	57.10		58.16		57.23		
LNAPL 0730 hrs	ft	6.82		6.46		6.58		
Drawdown Data								
DTGW 1030 hrs	ft	64.13		64.82		63.87		4.30
DTGW Hydro Equivalent	ft	58.99	-0.11	59.91	-0.07	58.97	-0.03	
DTLNAPL 1030 hrs	ft	57.18		58.19		57.25		
LNAPL 1030 hrs	ft	6.95		6.63		6.62		
Drawdown Data								
DTGW 1330 hrs	ft	64.81		65.28		64.08		4.60
DTGW Hydro Equivalent	ft	59.46	-0.59	60.16	-0.32	59.14	-0.20	
DTLNAPL 1330 hrs	ft	57.58		58.36		57.41		
LNAPL 1330 hrs	ft	7.23		6.92		6.67		
Drawdown Data								
DTGW 1530 hrs	ft	64.91		65.38		64.21		5.20
DTGW Hydro Equivalent	ft	59.53	-0.66	60.21	-0.37	59.18	-0.24	
DTLNAPL 1530 hrs	ft	57.64		58.39		57.41		
LNAPL 1530 hrs	ft	7.27		6.99		6.80		
Maximum Drawdown	ft		-0.66		-0.37		-0.24	
Distance From EW		16.2		25.8		38.3		

Specific Gravity .74

HORIBA® analytical data indicated the two influent vapor samples taken from the EW had HC concentrations of 76,990 and 74,020 ppmv, with CO_2 at 4.72 and 5.12%, CO at 3.82 and 3.09%, O_2 at 6.8 and 6.1% and H_2S at 0 ppm. The propane flow to the IC engine averaged 0 cfh, with a well flow of 12.19 scfm. The influent vapors were supplying 100% of the IC engine required fuel. The HC levels were within the mid to high range normally found in soil gas samples collected from an area contaminated with weathered gasoline.

At test hour 2.0, the test continued with the induced vacuum increased to 60"H_2O and a well flow of 19.88 scfm. The test period was 3.5 hours with the EW induced vacuum and well flow remaining steady. Outer well W-2 continued on an increasing vacuum trend to 1.14"H_2O in response to the EW vacuum increase and then developed a slight decreasing trend when the barometric pressure decreased. Outer wells W-1 and W-3 recorded an increased vacuum trend to 0.43 and 0.15"H_2O and then decreased to 0.38 and 0.12"H_2O. The GW pump rate increased to 4.30 gpm and remained steady during this test period. The collected volume was 903 gals which brings the total to 1,323 gals, with a GW depression average of 5.5 ft. The ambient air temperature increased to 91.8°F and the barometric pressure decreased from 30.10 to 30.07"Hg. The influent vapor temperature increased to 71°F. **A total LNAPL volume of 14.4 gals was observed on the collected GW.**

Additional HORIBA® analytical data indicated the influent vapor samples recorded HC levels of 71,750, 68,490 and 61,890 ppmv, with CO_2 at 4.60, 5.24 and 5.12%, CO at 2.37, 2.55 and 1.88%, O_2 at 5.8, 6.4 and 8.3% and H_2S at 0 ppm. The influent vapors continued to supply 100% of the IC engine's fuel and the TPH levels continued to be within the range of weathered gasoline vapors.

At test hour 5.5, the test continued with the induced vacuum increased to 75"H_2O, and a vapor well flow of 21.34 scfm. The test period was 1.5 hours with the EW vacuum and well flow remaining steady. The outer observation wells, W-2, W-1 and W-3, immediately recorded increased vacuum levels for 1.0 hour, and then developed a decreasing trend as the barometric pressure continued to decrease. This is an excellent example of the effect of barometric pressure oscillations on the vacuum/pressures observed on the outer observation wells. The average GW drawdown in the EW was 5.5 ft. A drawdown of 0.59 ft was recorded in W-2, 0.32 ft in W-1 and 0.2 ft in W-3. The GW pump rate averaged 4.60 gpm with a collected volume 413 gals. The total collected volume increased to 1,736 gals and **7.6 gals of liquid LNAPL was observed on the GW.** The ambient air temperature increased from 91.8 to 93.3°F and the barometric pressure decreased from 30.07 to 30.04"Hg.

Additional HORIBA® analytical data indicated the influent vapor samples recorded a HC level of 61,720 ppmv, with CO_2 at 5.20%, CO at 1.75%, O_2 at 8.7% and H_2S at 0 ppmv. The influent vapors continued to supply 100% of the IC engine's fuel. Although the HORIBA® Analyzer has been proven to be reasonably accurate compared to laboratory analysis of influent vapors, projections should be based on analytical results from a Certified Testing Laboratory qualified to conduct tests on air emission samples.

At test hour 7.0, the test continued with the induced vacuum increased to 90"H_2O and a vapor well flow of 27.95 scfm. The test period was 1.0 hour with the EW vacuum and well flow remaining steady. Outer observation well W-2 recorded an increased vacuum level from 1.10 to 1.23"H_2O and continued to increase to 1.54"H_2O during the test period. Outer well W-1 recorded an increasing vacuum ranging from 0.37 to a maximum of 0.60"H_2O and well W-3 recorded an increase from 0.09 to 0.20"H_2O. The average GW drawdown in the EW was 5.5 ft. A maximum drawdown of 0.66 ft was recorded in W-2, 0.37 ft in W-1 and 0.24 ft in W-3. This was the maximum recorded drawdown before any required well vacuum adjustments resulting from the decreasing barometric pressure. The GW pump rate averaged 5.2 gpm with a collected volume of 312 gals. The total collected volume increased to 2,048 gals and **6.2 gals of liquid LNAPL was observed on the GW.** The ambient air temperature increased from 95.3 to 96.1°F and the barometric pressure decreased from 30.04 to 30.02"Hg.

Immediately before the conclusion of this test period, the outer observation wells were gauged. The gauging data is included on Table #1B.

RADIUS OF INFLUENCE & INDUCED HYDRAULIC GRADIENT

Figure #1A indicates that the effective vacuum radius of influence from Test #MDP-1 with groundwater extraction (GWE) would be from 25.91 to 32.64 ft, with extraction well flow of 22.0 to 24.0 scfm and extraction well vacuum in the 80 to 85"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is **0.50 to 0.70"H_2O.** It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. **Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically.**

Figure #1B indicates that the effective vacuum radius of influence from Test #MDP-1 with groundwater extraction (GWE) would be from 22.02 to 24.53 ft, with extraction well flow of 22.0 to 24.0 scfm and extraction well vacuum in the 80 to 85"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is **0.75 to 0.85"H_2O or approximately 1.0% of the EW induced vacuum.** It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. **Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically.**

Figure #2 indicates that the effective induced hydraulic gradient from Test #MDP-1 with vacuum and groundwater extraction would be greater than approximately 31.0 ft, with a pump rate of 4.0 to 4.3 gpm. An approximation of the radius of influence may be obtained by determining the point at which the measured GW level effect on the outer wells is greater than 0.30 ft. At the point at which the measured GW level effect on the outer wells is greater than 0.20 ft, **the effective induced hydraulic gradient with vacuum would be greater than approximately 46 ft. Under continuous operation, the gradient effect of the GW pump rate and depression may cover a larger area.**

The effective vacuum radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

PRODUCT RECOVERY

A total liquid volume of 2,048 gals were recovered during the test of which 3.11% or 63.64 gals was liquid gasoline. A calculated volume of 22.63 gals of gasoline contaminant were removed as part of the influent vapors and were burned as IC engine fuel bringing the total gasoline recovery to 86.27 gals or an average of 10.78 gals/hr.

GROUNDWATER RECOVERY

GW recovery was monitored in well A-1 for 30 minutes after the vacuum had ceased. The GW recovery was recorded with the interface meter. In 30 minutes, the recovery for A-1 was equal to 54.5% based on the hydro equivalent.

EMISSION DATA

During this Pilot Test, HORIBA® data indicated that the influent vapors had an average hydrocarbon level (TPH) of 69,142 ppmv. Laboratory analysis of influent vapor samples from previous pilot tests indicated that those vapor samples had a benzene level of approximately 2.0% of the 69,142 ppmv. Using an average well flow of 18.83 scfm from this extended test, **the calculated emissions from <u>one</u> extraction well without vapor treatment were as follows:**

HC	=	42.5 lbs/day	=	17.7 lbs/hr
Benzene	=	8.5 lbs/day	=	0.35 lbs/hr

ADDITIONAL INFORMATION

The HORIBA® analytical instrument is calibrated with Hexane and CO_2. One sample was collected for laboratory analysis.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

To calculate MDP well placement, the equation we use is as follows:

$L = 2\ ROI\ Cos\ 30°$ (L = distance between wells; ROI = radius of influence)

All other data, including the groundwater depth, well placement, extraction well screened intervals, induced vacuum and vapor well flow and liquid recovery rate, must be considered in the final design for a Corrective Action Plan (CAP).

Static (baseline) data, recorded 0.5 hours after the conclusion of the test, indicates that W-1 was recording a pressure of 0.19"H_2O, W-1 was recording a well pressure of 0.15"H_2O and W-3 was recording a well pressure of 0.17"H_2O. The well pressure was the result of the decreasing barometric pressure.

The test provided excellent data to use in the calculation and projection of an SVE vacuum radius of influence and excellent data to project an induced hydraulic gradient.

CONCLUSION

Pilot Tests are conducted to provide information on short term tests that can be projected into long term remedial plans. These feasibility tests indicated that Mobile Dual Phase Extraction (MDP) with groundwater depression should provide an excellent method of remediation for this facility. Although the observed vacuum of the most distant outer monitoring well was moderately low, the duration of the pilot tests was short compared to continuous operation. **However, the tests results provided excellent data to project that wells W-2, W-1 and W-3 were in vacuum communication with the selected extraction well.** The vacuum radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on the soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities. **The induced hydraulic gradient (IHG) defines the region within which a selected GW depression is recorded in the outer monitoring wells.** The IHG depends on the hydraulic properties of the underlying sub-surface, aquifer characteristics and the effect of the induced vacuum on specific yields.

SUMMARY AND OBSERVATIONS - TEST #MDP-1

- Based on the recorded test data, the sub-surface medium is most likely isotropic.
- Due to the age of the contaminant, the recovered gasoline may contain tetraethyl lead.
- An average induced vacuum of 60.3"H_2O was required to produce an average well vapor flow of 18.83 scfm. The ratio of the average EW induced vacuum to the EW well flow was 3.21:1.
- The average well flow per foot of EW well screen was 0.96 scfm with a maximum of 1.42 scfm.
- The GW pump rate was increased to provide a sufficient GW depression when the EW induced vacuum was increased. The average GW pump rate was 4.22 gpm with a maximum of 5.20 gpm.
- During each increase of the induced vacuum, outer observation wells W-2, W-1 and W-3 recorded increased vacuum levels. Additionally, GW drawdown in the observation wells continued to decrease during the test period.

- The average maximum percent of induced vacuum observed in outer observation wells W-2 at 16.2 ft was 1.74-2.30%, W-1 at 25.8 ft was 0.66-0.95% and W-3 was 0.25-0.50%.
- The HC levels recorded during the test period were **within** the range normally associated with soil gas samples taken from an area that is highly saturated with weathered gasoline.
- **The test provided excellent data for the calculation and projection of a vacuum radius of influence, excellent data for the projection of an induced hydraulic gradient and excellent data to support the collection and removal of liquid and vapor phase gasoline with Dual Phase Recovery.**
- **SVE without GW extraction would not be an effective remediation option at this site. The higher vacuums would result in GW upwelling in the EW which may cover the well screen and render the SVE ineffective.**

ATTACHED SCHEDULES AND FIGURES

Schedule A: Summary of Data
Schedule B: Graphic Summary of Data
Figure #1A: Plot of Observed Vacuum vs Distance at the Facility (ROI) at 0.75% of Induced Vacuum
Figure #1B: Plot of Observed Vacuum vs Distance at the Facility (ROI) at 1.00% of Induced Vacuum
Figure #2: Plot of Recorded GW Induced Hydraulic Gradient vs Distance at the Facility (ROI)

Additional Information (this should be read as part of the report):

- Field Operating Data and Notes – Test #MDP-1
- Site Photographs

Once you have reviewed the report, please call me if you have any questions.

Sincerely,
ACUVAC REMEDIATION, LLC

James E. Sadler,
VP Engineering/Environmental

cc: Paul Faucher

Attachment A

Acronyms and Definitions

A	Annulus - the space between the pipes and lines in the extraction well and the outer casing
ACFM	Actual Cubic Feet Per Minute
AI (AS)	Air Injection (Sparging) the mass transfer of O_2 from air to groundwater
BGL	Below Ground Level
BGS	Below Ground Surface
BP	Barometric Pressure (Atmospheric Pressure)
BTOC	Below Top of Casing
CFH	Cubic Feet Per Hour
DNAPL	Dense Non-Aqueous Petroleum Liquid
DPVE	Dual Phase Vacuum Extraction
DTGW	Depth to Groundwater
DTPSH	Depth to Phase Separated Hydrocarbons/NAPL
DT	Drop Tube
EVR	Enhanced Vacuum Recovery, also referred to as SVE/GWD
EW	Extraction Well
GW	Groundwater
GWD	Groundwater Depression
GWE	Groundwater Extraction
GWUP	Groundwater Upwelling
HC	Hydrocarbon Concentration (Petroleum-TPH)
"H_2O	Inches of Water
"Hg	Inches of Mercury
IHG	Induced Hydraulic Gradient
IV	Induced Vacuum, normally from a vacuum pump connected to the extraction well or vapor recovery well
LNAPL	Light Non-Aqueous Petroleum Liquids
MDP	Mobile Dual Phase
NAPL	Non-Aqueous Petroleum Liquids
P	Pressure, the existence of above atmospheric pressure
ROI	Radius of Influence
RPM	Revolutions Per Minute
SCFM	Standard Cubic Feet Per Minute
SVE	Soil Vacuum Extraction
TD	Total Depth
QT	Quick Test, a short duration SVE Test
V	Vacuum, the existence of below atmospheric pressure
VEGE	Vacuum Enhanced Groundwater Extraction
VER	Vacuum Enhanced Recovery
VEW	Vapor Extraction Well
VWF	Vapor Well Flow
WVF	Well Vapor Flow

SCHEDULE A
Test # MDP-1

Walstadd 66
Lovington, NM
July 12, 2015

7/12/2015	DATA ELEMENT						
	Static 7:25	Start 7:30	8:00	8:30	9:00	9:30	10:00
Influent Vapor Data							
Horiba HC ppmv	ND	ND	76,990	ND	74,020	ND	71,750
Horiba CO_2%	ND	ND	4.72	ND	5.12	ND	4.60
Horiba CO%	ND	ND	3.82	ND	3.09	ND	2.37
Lumidor O_2%	ND	ND	6.8	ND	6.1	ND	5.8
Lumidor H_2S ppm	ND	ND	0	ND	0	ND	0
Influent Vapor Temp °F	OFF	69.0	69.0	69.0	69.0	70.0	70.0
Atmospheric Conditions							
Barometric Pressure "Hg	30.10	30.10	30.10	30.09	30.09	30.10	30.09
Absolute Pressure "Hg	26.09	26.09	26.09	26.08	26.08	26.09	26.08
Groundwater Data							
Groundwater Pump Rate (gpm)	OFF	3.50	3.50	3.50	3.50	3.50	4.30
Total Liquid Vol (gal)	0	0	105	210	315	420	549
Extraction Well Data - Well A-1							
Flow SCFM	OFF	12.19	12.19	12.19	12.19	12.19	19.88
Vacuum "H_2O	OFF	40.0	40.0	40.0	40.0	40.0	60.0
Well Vapor Flow SCFM / "H_2O	OFF	0.30	0.30	0.30	0.30	0.30	0.33
Well Vapor Flow SCFM / ft Well Screen	OFF	0.621	0.621	0.621	0.621	0.621	1.013
Observation Well Data - Vacuum "H_2O							
Well W-2 Dist. 16.2 ft	0.00	0.07	0.86	0.88	0.92	0.88	1.07
Well W-1 Dist. 25.8 ft	0.00	0.05	0.31	0.37	0.38	0.36	0.38
Well W-3 Dist. 38.3 ft	0.00	0.02	0.13	0.17	0.20	0.17	0.14

( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE A
Test # MDP-1

Walstadd 66
Lovington, NM
July 12, 2015

7/12/2015	DATA ELEMENT						
	10:30	11:00	11:30	12:00	12:30	13:00	13:30
Influent Vapor Data							
Horiba HC ppmv	ND	68,490	ND	ND	ND	61,880	ND
Horiba CO_2%	ND	5.24	ND	ND	ND	5.12	ND
Horiba CO%	ND	2.55	ND	ND	ND	1.88	ND
Lumidor O_2%	ND	6.4	ND	ND	ND	8.3	ND
Lumidor H_2S ppm	ND	0	ND	ND	ND	0	ND
Influent Vapor Temp °F	70.0	70.0	71.0	71.0	71.0	71.0	71.0
Atmospheric Conditions							
Barometric Pressure "Hg	30.09	30.09	30.09	30.08	30.08	30.07	30.06
Absolute Pressure "Hg	26.08	26.08	26.08	26.07	26.08	26.07	26.06
Groundwater Data							
Groundwater Pump Rate (gpm)	4.30	4.30	4.30	4.30	4.30	4.30	4.60
Total Liquid Vol (gal)	678	807	936	1,065	1,194	1,323	1,460
Extraction Well Data - Well A-1							
Flow SCFM	19.88	19.88	19.88	19.88	19.88	19.88	21.34
Vacuum "H_2O	60.0	60.0	60.0	60.0	60.0	60.0	75.0
Well Vapor Flow SCFM / "H_2O	0.33	0.33	0.33	0.33	0.33	0.33	0.28
Well Vapor Flow SCFM / ft Well Screen	1.013	1.013	1.013	1.013	1.013	1.013	1.087
Observation Well Data - Vacuum "H_2O							
Well W-2 Dist. 16.2 ft	1.09	1.14	1.13	1.12	1.13	1.10	1.14
Well W-1 Dist. 25.8 ft	0.42	0.42	0.41	0.42	0.43	0.38	0.43
Well W-3 Dist. 38.3 ft	0.16	0.16	0.15	0.14	0.15	0.12	0.14

( ) Indicates Well Pressure
ND - No Recorded Data

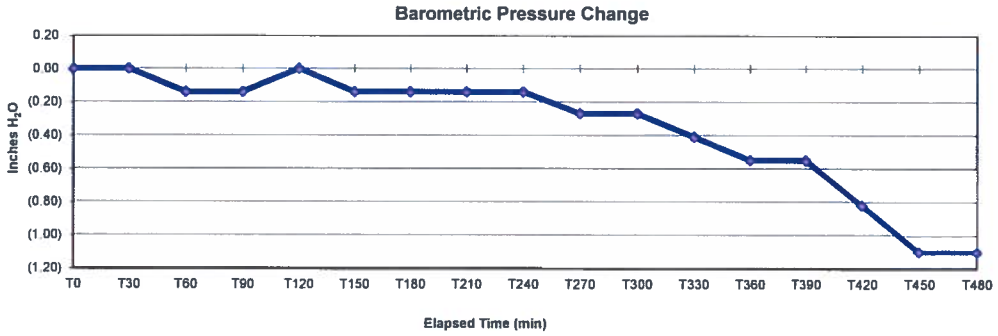
SCHEDULE A
Test # MDP-1

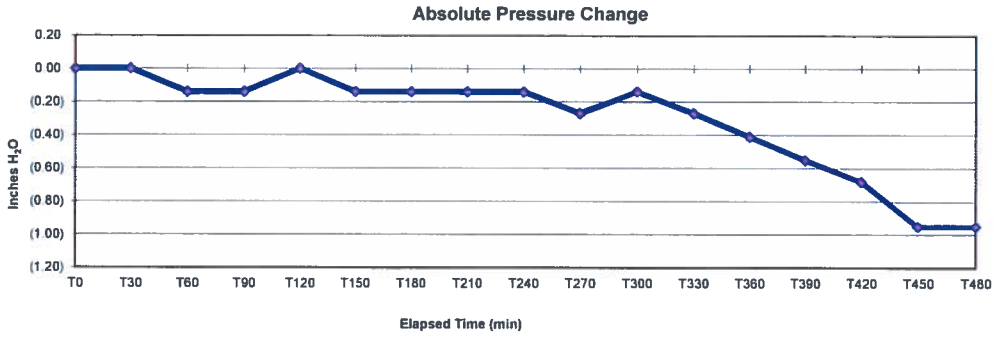
Walstadd 66
Lovington, NM
July 12, 2015

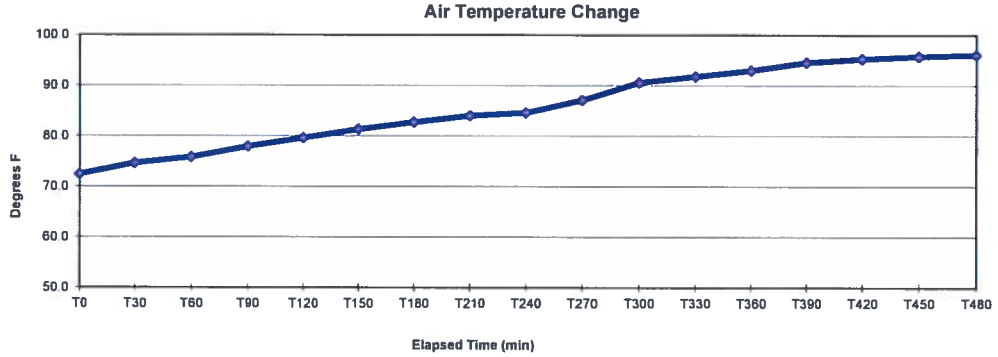
7/12/2015	DATA ELEMENT						
				End	Static	8 Hrs	
	14:00	14:30	15:00	15:30	16:00	Average	Maximum
Influent Vapor Data							
Horiba HC ppmv	ND	ND	61,720	ND	ND	69,142	76,990
Horiba CO_2%	ND	ND	5.20	ND	ND	5.00	5.24
Horiba CO%	ND	ND	1.75	ND	ND	2.58	3.82
Lumidor O_2%	ND	ND	8.7	ND	ND	7.0	8.7
Lumidor H_2S ppm	ND	ND	0	ND	ND	0	0
Influent Vapor Temp °F	71	71	71	72	OFF	70	72
Atmospheric Conditions							
Barometric Pressure "Hg	30.06	30.04	30.02	30.02	30.02	30.08	30.10
Absolute Pressure "Hg	26.05	26.04	26.02	26.02	26.02	26.07	26.09
Groundwater Data							
Groundwater Pump Rate (gpm)	4.60	4.60	5.20	5.20	OFF	4.22	5.20
Total Liquid Vol (gal)	1,598	1,736	1,892	2,048	-	-	-
Extraction Well Data - Well A-1							
Flow SCFM	21.34	21.34	27.95	27.95	OFF	18.83	27.95
Vacuum "H_2O	75.0	75.0	90.0	90.0	OFF	60.3	90.0
Well Vapor Flow SCFM / "H_2O	0.28	0.28	0.31	0.31	OFF	0.31	0.33
Well Vapor Flow SCFM / ft Well Screen	1.087	1.087	1.423	1.423	OFF	0.960	1.420
Observation Well Data - Vacuum "H_2O							
Well W-2 Dist. 16.2 ft	1.14	1.10	1.23	1.54	(0.19)	0.97	1.54
Well W-1 Dist. 25.8 ft	0.43	0.37	0.43	0.60	(0.15)	0.37	0.60
Well W-3 Dist. 38.3 ft	0.14	0.09	0.15	0.20	(0.17)	0.14	0.20

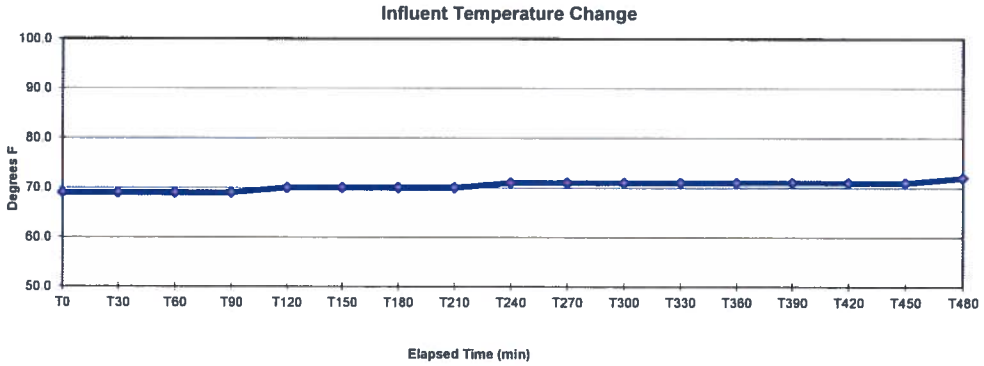
( ) Indicates Well Pressure
ND - No Recorded Data

SCHEDULE B
Summary of TEST # MDP-1
Atmospheric Conditions

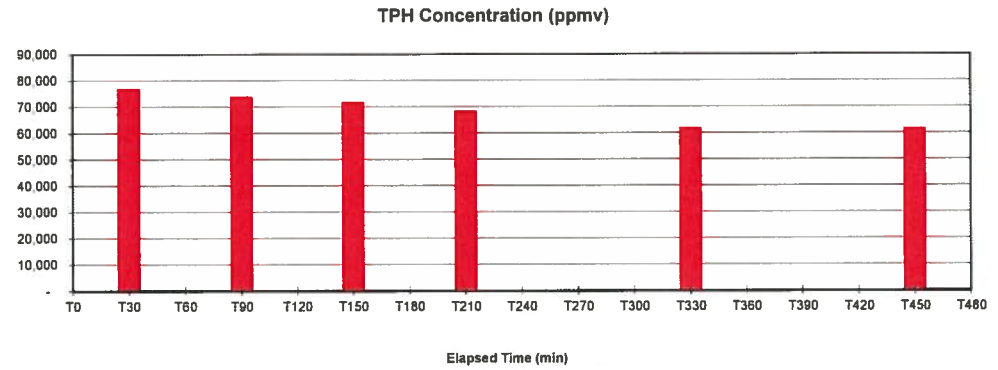


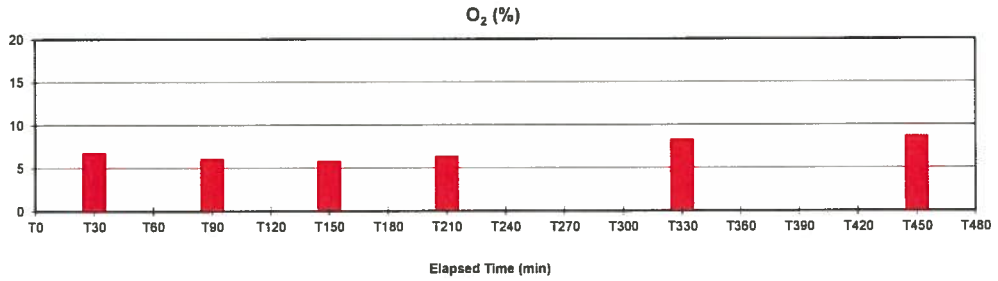


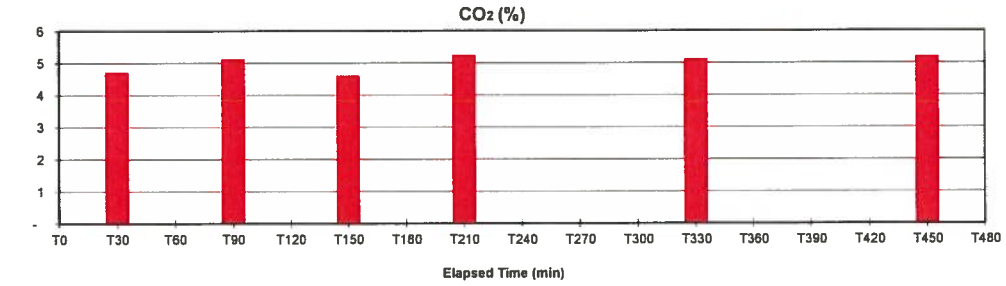


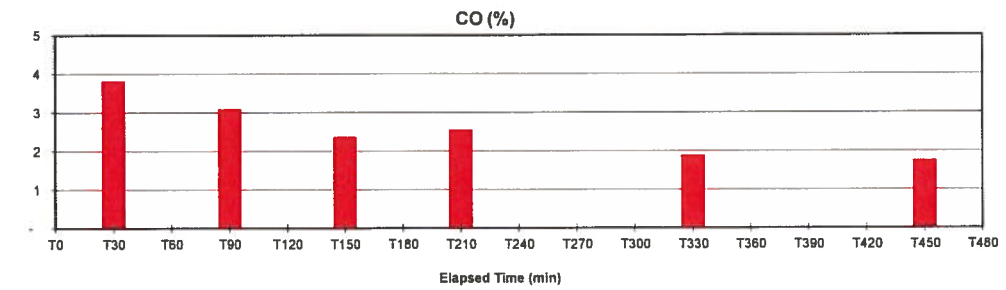


SCHEDULE B
Summary of TEST # MDP-1
Atmospheric Conditions



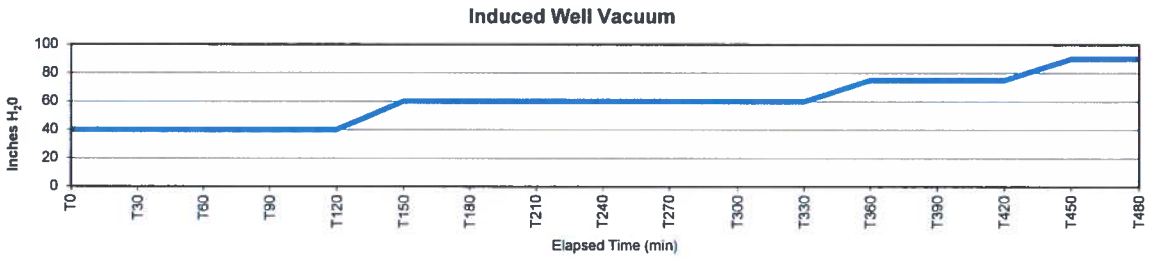


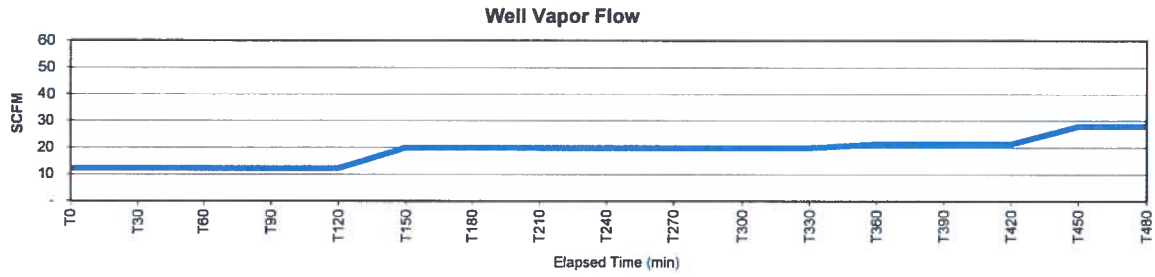


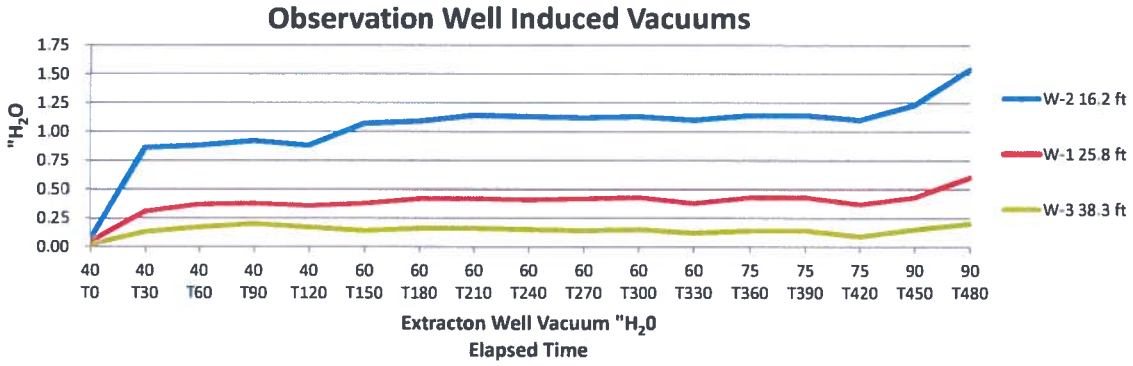


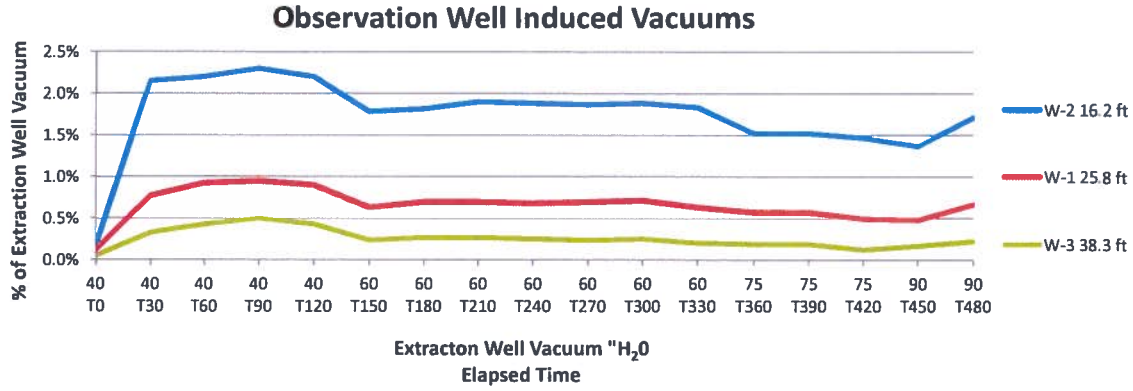
SCHEDULE B
Summary of ACUVAC TEST # MDP-1
Recorded Well Vacuums and/or (Pressures)

Walstadd 66
Lovington, NM
July 12, 2015









AcuVac Remediation, LLC
July 12, 2015

Walstadd 66
Lovington, NM

Figure #1A
Radius of Influence
Data from Pilot Test #MDP-1 at 0.75% of Induced Vacuum

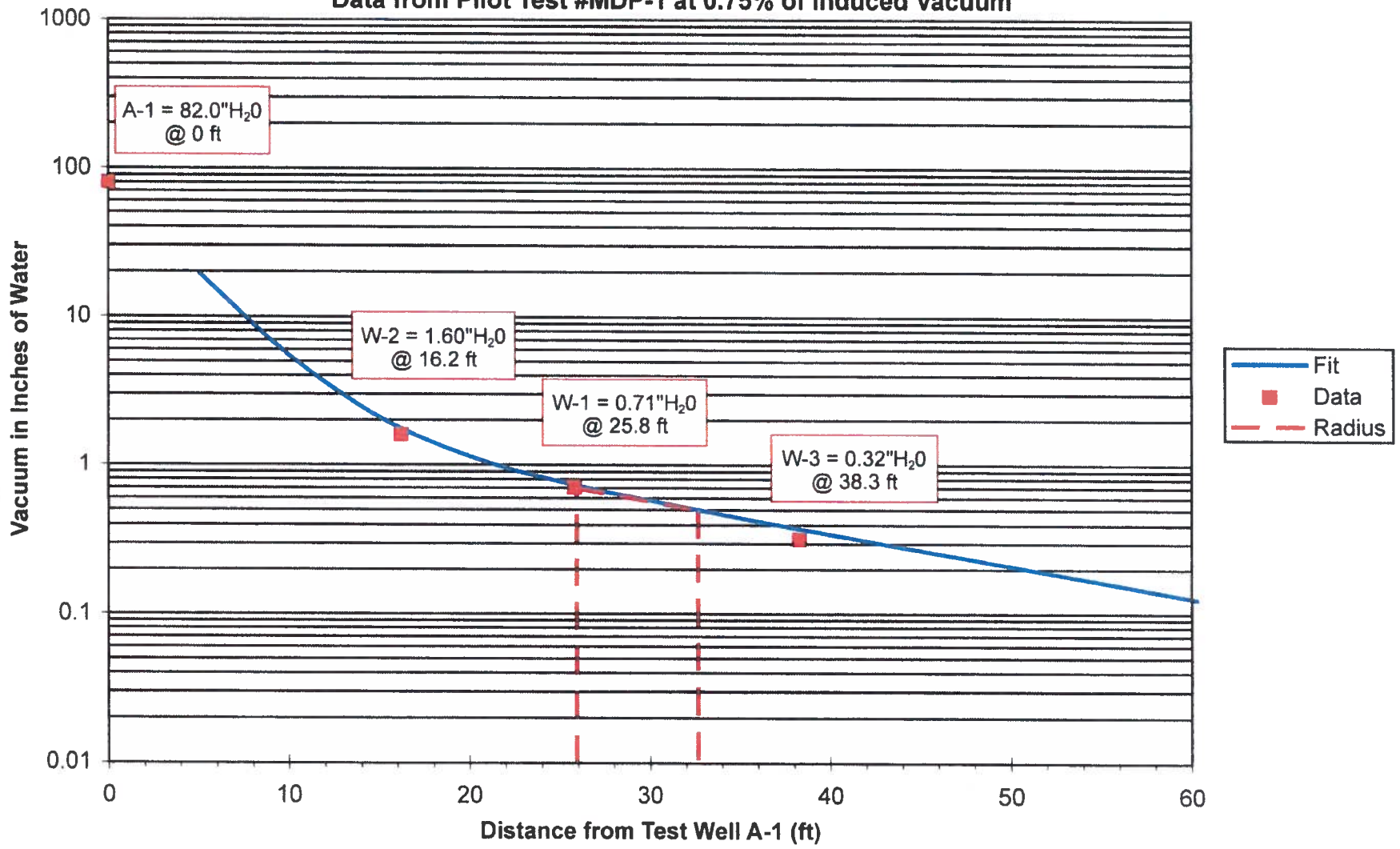


Figure #1B
Radius of Influence
Data from Pilot Test #MDP-1 at 1% of Induced Vacuum

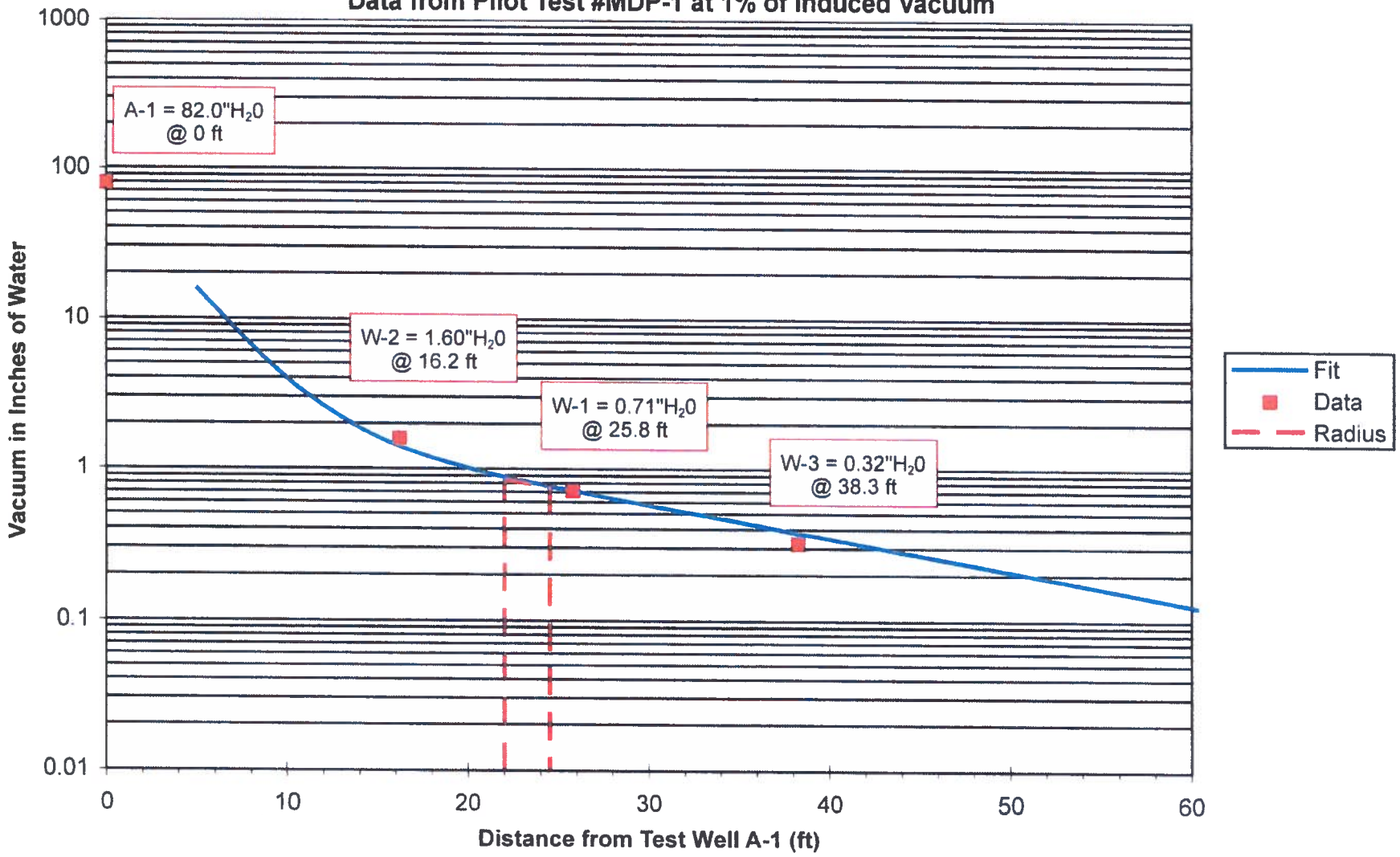
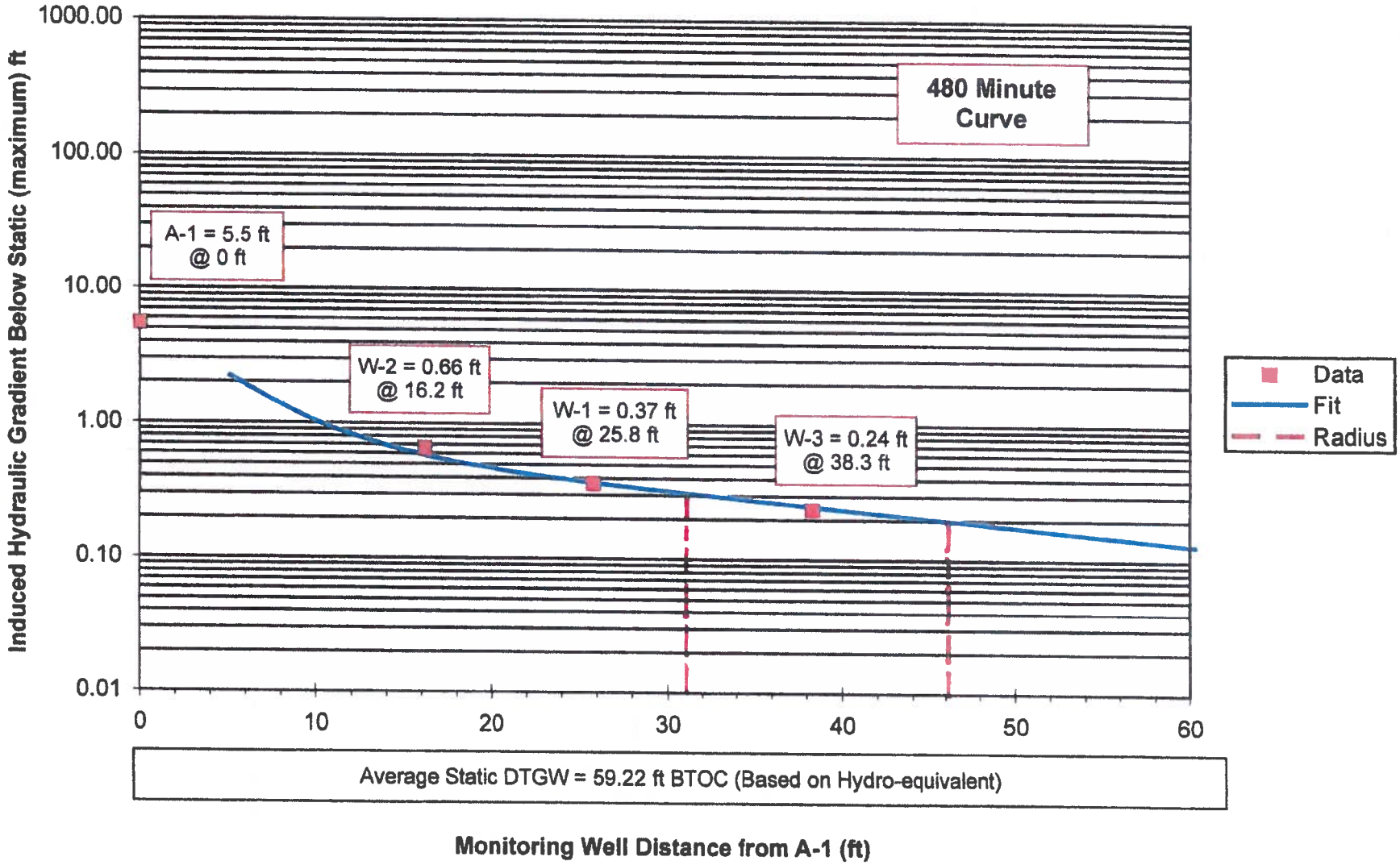


Figure #2
Drawdown at 480 Minutes vs Monitoring Well Distance



OPERATING DATA - PILOT TEST # 1 PAGE # 1 ACUVAC MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66, Lovington, NM Project Managers: Sadler/Faucher

		Date:	7-12-15	-	-	-	-	
Parameters			Time 0725	Time 0730	Time 0800	Time 0830	Time 0900	Time 0930
	Well # A-1		Hr Meter 7279.9	Hr Meter 7280.0	Hr Meter 7280.5	Hr Meter 7281.0	Hr Meter 7281.5	Hr Meter 7282.0
ENGINE/BLOWER	R.P.M.		1000	2200	2200	2200	2200	2200
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	155	160	160	160	160	160
	Volts		13.5	14.0	14.0	14.0	14.0	14.0
	Intake Vacuum	"Hg	19	18	18	18	18	18
	Gas Flow Fuel/Propane	cfh	100	0	0	0	0	0
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	OFF	ON	ON	ON	ON	ON
	Extraction Well Flow	scfm	OFF	12.19	12.19	12.19	12.19	12.19
	Extraction Well Vac.	"H_2O	OFF	40	40	40	40	40
	Pump Rate	gals/min	N/A	3.50	3.50	3.50	3.50	3.50
	Total Volume	gals	-	-	105	210	315	420
	Influent Vapor Temp.	°F	-	69	69	69	69	70
	Air Temp	°F	72.3	72.4	74.6	75.8	77.9	79.6
	Barometric Pressure	Hg	30.10	30.10	30.10	30.09	30.09	30.10
	Absolute Pressure	"Hg	26.09	26.09	26.09	26.08	26.08	26.09
MONITOR WELL VACUUM	(16.2) W-2	"H_2O	0	.07	.86	.88	.92	.88
	(25.8) W-1	"H_2O	0	.05	.31	.37	.38	.36
	(38.3) W-3	"H_2O	0	.02	.13	.17	.20	.17
		"H_2O						
		"H_2O						
		"H_2O	Static					
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	NAPL %	Vol Gals	—	—	180/189	9.5/10	5.5/5.8	40/42
	Data Logger / Probe	ft	7.5	20	20	20	20	20
	Depth of GW Depression	ft	0	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well	DTNAPL	57.40					
	Extraction Well	DTGW	64.08					

( ) Indicates Well Pressure

6.68

SG = .74 HE = 59.14

OPERATING DATA - MDP PILOT TEST # 1 PAGE # 1 ACUVAC MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66 Lovington, NM							Project Managers: Sadler/Faucher
Date 7-12-15	-	-					
Time	0800	0900					
TEST Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
TEST Well No.	A-1	A-1					
VAPOR/INFLUENT HC ppmv	76,990	74,020					
VAPOR/INFLUENT CO_2 %	4.72	5.12					
VAPOR/INFLUENT CO %	3.82	3.09					
VAPOR/INFLUENT O_2 %	6.8	6.1					
VAPOR/INFLUENT H_2S %	0	0					

0600	Arrived @ location - Positioned MDP System near well A-1 as
	the extraction well. Mobilized equipment - Opened selected wells - recorded
	distances gauged wells - Install total fluid pump and probe in EW. Plugged outer
	observation wells - Connected LNAPL/GW discharge line to volume meter
	and standby tanks-trucks - Safety checks - all ok - calibrated instruments
0725	Recorded static (baseline) data - all outer wells @ 0" H_2O - Pump inlet @ 65.0' BTOC
0730	START MDP-1 - Initial EW induced vacuum = 40" H_2O, WVF = 12.14 scfm
	GW pump rate = 3.5 gpm - All outer wells recorded slight increased vacuum levels
0800	Recorded data: BP - All outer wells on increasing vacuum trend. GWR
	= 3.5 gpm · GWD = -5.5 ft - (Heavy LNAPL recovery) Propane @ 0 cfh
	HORIBA DATA: TOH = HC = 76,990 ppmv, CO_2 = 4.72% · CO = 3.82% · O_2 = 6.8%
0830	Recorded data: BP ↓ Outer wells continue on a slight increasing trend
	GWR = 3.5 gpm LNAPL recovery (liquid) @ 5.5% = 5.8 gals
0900	HORIBA DATA: HC = 74,020 ppmv ↓ CO_2 = 5.12% ↑, CO = 3.09% ↓, O_2 = 6.1% ↓
	Recorded data BP - All outer wells continue on an increasing vacuum
	trend - GWR = 3.5 gpm · GWD = -5.5 ft - Liquid LNAPL @ 4%
0930	Recorded data: BP ↑ Outer wells recording a slight decreasing vacuum
	trend - LNAPL @ 3% · GWR = 3.5 gpm · Well vacuum and WVF steady
	INCREASED EW induced = 60" H_2O, WVF = 19.88 scfm. GWR:
	4.3 gpm - Pump rate increase necessary to maintain GWD @ 5.5 ft

OPERATING DATA - PILOT TEST # 1 PAGE # 2

ACUVAC
MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

		Date:	7-12-15	-	-	-	-	-
Parameters			Time 1000	Time 1030	Time 1100	Time 1130	Time 1200	Time 1230
	Well # A-1		Hr Meter 7282.5	Hr Meter 7283.0	Hr Meter 7283.5	Hr Meter 7284.0	Hr Meter 7284.5	Hr Meter 7285.0
ENGINE/BLOWER	R.P.M.		2300	2300	2300	2300	2300	2300
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	165	165	170	170	170	170
	Volts		14.0	14.0	14.0	14.0	14.6	14.0
	Intake Vacuum	"Hg	17	17	17	17	17	17
	Gas Flow Fuel/Propane	cfh	0	0	0	0	0	0
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	ON	ON	ON	ON
	Extraction Well Flow	scfm	19.88	19.88	19.88	19.88	19.88	19.88
	Extraction Well Vac.	"H_2O	60	60	60	60	60	60
	Pump Rate	gals/min	4.30	4.30	4.30	4.30	4.30	430
	Total Volume	gals	549	678	807	936	1065	1194
	Influent Vapor Temp.	°F	70	70	70	71	71	71
	Air Temp	°F	81.3	82.7	84.0	84.6	87.7	90.6
	Barometric Pressure	Hg	30.09	30.09	30.09	30.09	30.08	30.08
	Absolute Pressure	"Hg	26.08	26.08	26.08	26.08	26.07	26.08
MONITOR WELL VACUUM	W-2	"H_2O	1.07	1.09	1.14	1.13	1.12	1.13
	W-1	"H_2O	.38	.42	.42	.41	.42	.43
	W-3	"H_2O	.14	.16	.16	.15	.14	.15
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	NAPL %	Vol Gals	3.0/3.2	1.5/2.0	1.0/1.3	1.5/2.0	1.5/2.0	1.5/1.9
	Data Logger / Probe	ft	2.0	2.0	2.0	2.0	2.0	2.0
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well	DTNAPL						
	Extraction Well	DTGW						

( ) Indicates Well Pressure

Location: Walstadd 66 Lovington, NM						Project Managers: Sadler/Faucher	
Date 7-12-15	-	-					
Time	1000	1100					
TEST Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
TEST Well No.	A-1	A-1					
VAPOR/INFLUENT HC ppmv	71,750	68,490					
VAPOR/INFLUENT CO_2 %	4.60	5.24					
VAPOR/INFLUENT CO %	2.37	2.55					
VAPOR/INFLUENT O_2 %	5.8	6.4					
VAPOR/INFLUENT H_2S %	0	0					

1000	HORIBA DATA HC = 71,750 ppmv ↓, CO_2 = 4.60% ↑, CO = 2.37% ↓, O_2 = 5.8% ↓
	Recorded data: BP ↓ Outer well W-2, recording an increased vacuum
	level in response to the EW ↑, other wells, most steady - GWR = 4.3
	gpm - EW vacuum @ 60 "H_2O, WVF = 19.88 scfm - LNAPL @ 1.5%
1030	Gauged all wells - IHC on slight decreasing trend
	Recorded data: BP — Outer wells continue on an increasing
	vacuum trend. GWR steady @ 4.3 gpm - LNAPL @ 1.0%
1100	Recorded data: BP — Outer well W-2, slight increase, the two
	wells, steady - NOTE - LNAPL @ 1.5% of volume
	HORIBA DATA: HC = 68,490 ppmv ↓, CO_2 = 5.24% ↑, CO = 2.55% ↑, O_2 = 6.48 ↑
1130	Recorded data: BP ↓ Outer wells mostly steady, but developing a
	slight decreasing vacuum trend. GWR - 4.3 gpm. LNAPL @ 1.5%
1200	Recorded data: BP ↓ - Outer wells mostly steady, slight increase/
	decreases. GWR steady @ 4.3 gpm. LNPL steady @ 1.5% - GWD = -5.5'
1230	Recorded data: BP — Outer wells mostly steady with slight
	increases - GWR = 4.3 gpm LNAPL = 1.5% GWD = 5.5 ft

OPERATING DATA - PILOT TEST # 1 PAGE # 3

ACUVAC
MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

		Date:	7-12-15	-	-	-	-	-
Parameters			Time 1300	Time 1330	Time 1400	Time 1430	Time 1500	Time 1530
	Well # A-1		Hr Meter 7285.5	Hr Meter 7286.0	Hr Meter 7286.5	Hr Meter 7287.0	Hr Meter 7287.5	Hr Meter 7288.0
ENGINE/BLOWER	R.P.M.		2300	2400	2400	2400	2400	2400
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	175	175	175	175	175	175
	Volts		14.0	14.0	14.0	14.0	14.0	14.0
	Intake Vacuum	"Hg	17	17	17	17	17	16
	Gas Flow Fuel/Propane	cfh	0	0	0	0	0	0
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	ON	ON	ON	ON
	Extraction Well Flow	scfm	19.88	21.34	21.34	21.34	27.95	27.95
	Extraction Well Vac.	"H_2O	60	75	75	75	90	90
	Pump Rate	gals/min	4.30	4.60	4.60	4.60	5.20	5.20
	Total Volume	gals	1323	1460	1598	1736	1892	2048
	Influent Vapor Temp.	°F	71	71	71	71	71	72
	Air Temp	°F	91.8	93.0	94.6	95.3	95.8	96.1
	Barometric Pressure	Hg	30.07	30.06	30.06	30.04	30.02	30.02
	Absolute Pressure	"Hg	26.07	26.06	26.05	26.04	26.02	26.02
MONITOR WELL VACUUM	W-2	"H_2O	1.10	1.14	1.14	1.10	1.23	1.54
	W-1	"H_2O	.38	.43	.43	.37	.43	.60
	W-3	"H_2O	.12	.14	.14	.09	.15	.20
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	NAPL %	Vol Gals	1.5/2.0	1.5/2.1	2.0/2.7	2.0/2.8	2.0/3.1	2.0/3.1
	Data Logger	ft	2.0	2.0	2.0	2.0	2.0	2.0
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well	DTNAPL						61.61
	Extraction Well	DTGW						6165

( ) Indicates Well Pressure

7FORMS/TestForms/1210010

LNAPL = 0.04'
HE = 61.64'

Location:	Walstadd 66 Lovington, NM					Project Managers: Sadler/Faucher	
Date	7-12-15	-	-				
Time		1300	1500				
TEST Instrument		HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA
TEST Well No.		A-1	A-1				
VAPOR/INFLUENT HC	ppmv	61,880	61,720				
VAPOR/INFLUENT CO_2	%	5.12	5.20				
VAPOR/INFLUENT CO	%	1.88	1.75				
VAPOR/INFLUENT O_2	%	8.3	8.7				
VAPOR/INFLUENT H_2S	%	0	0				

1300	HORIBA DATA: HC = 61,880 ppmv ↓, CO_2 = 5.12% ↓ CO = 1.88% ↓ O_2 = 8.3% ↑
	Recorded data: BP ↓ All outer wells recording a decreasing
	vacuum trend due to BP ↓ - LNAPL = 1.5% - GWD = -5.5 ft
	INCREASED EW induced vacuum = 75" H_2O, WUF = 21.34 scfm
	GWR = 4.6 gpm - LNAPL = 1.5%
1330	Recorded data: BP ↓ Outer well recording increased vacuum levels
	in response to the EW increase. GWR = 4.6 gpm - LNAPL = 2%
	Gauged outer wells - Note increase in the IHC
1400	Recorded data: BP ↓ Outer well steady - No change
	GWR = 4.6 gpm - LNAPL steady @ 2% - GWD = 5.5 ft
1430	Recorded data: BP ↓↓ - Outer wells recording a decreasing
	vacuum trend due to BP ↓ - GWR = 4.6 gpm - LNAPL = 2%
1430	INCREASED EW induced vacuum = 90" H_2O, WUF = 27.95 scfm
	GWR = 5.2 gpm LNAPL = 2.0 %
1500	HORIBA DATA: HC = 61,720 ppmv ↓, CO_2 = 5.20% ↑, CO = 1.75% ↓, O_2 = 8.7% ↑
1500	Recorded data: BP ↓↓ - Outer wells recorded increasing vacuum trend
	in response to EW vacuum increase - GWR = 5.2 gpm - LNAPL = 2%
1530	Recorded data: BP - All wells recorded increased vacuum levels
	in response to A-1 @ 90" H_2O - GWR = 5.2 gpm LNAPL = 2.0%
	Gauged wells -
1535	Discontinued EW pumping and induced vacuum to allow time
	for outer wells to adjust to atmospheric changes

OPERATING DATA - PILOT TEST # 1 PAGE # 4

ACUVAC
MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66, Lovington, NM

Project Managers: Sadler/Faucher

	Date:	7-12-15						
Parameters		Time 1600	Time	Time	Time	Time	Time	
	Well #	Hr Meter 7288.3	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	
ENGINE/BLOWER	R.P.M.	1000						
	Oil Pressure psi	50						
	Water Temp °F	165						
	Volts	14.0						
	Intake Vacuum "Hg	19						
	Gas Flow Fuel/Propane cfh	90						
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump ON/OFF	OFF						
	Extraction Well Flow scfm	OFF						
	Extraction Well Vac. "H_2O	OFF						
	Pump Rate gals/min	OFF						
	Total Volume gals	2048						
	Influent Vapor Temp. °F	N/A						
	Air Temp °F	95.1						
	Barometric Pressure Hg	30.02						
	Absolute Pressure "Hg	26.02						
MONITOR WELL VACUUM	W-2 "H_2O	(.19)						
	W-1 "H_2O	(.15)						
	W-3 "H_2O	(.17)						
	"H_2O							
	"H_2O							
	"H_2O							
	"H_2O	STATIC						
	"H_2O							
	"H_2O							
	"H_2O							
MANIFOLD	NAPL % Vol / Gals	—						
	Data Logger ft	—						
	Depth of GW Depression ft	—						
	Extraction Well DTNAPL	—						
	Extraction Well DTGW	—						

( ) Indicates Well Pressure

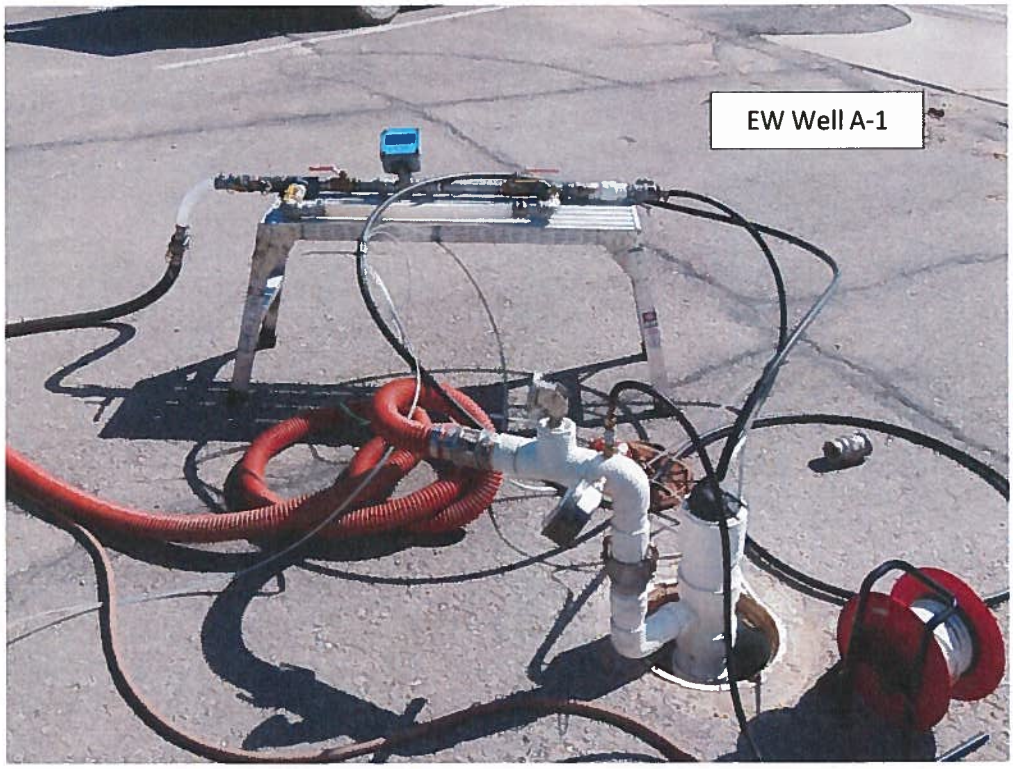
OPERATING DATA - MDP PILOT TEST # 1 PAGE # 4 ACUVAC MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66 Lovington, NM						Project Managers: Sadler/Faucher	
Date 7-11-15							
Time							
TEST Instrument	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	HORIBA	
TEST Well No.							
VAPOR/INFLUENT HC ppmv							
VAPOR/INFLUENT CO_2 %							
VAPOR/INFLUENT CO %							
VAPOR/INFLUENT O_2 %							
VAPOR/INFLUENT H_2S %							

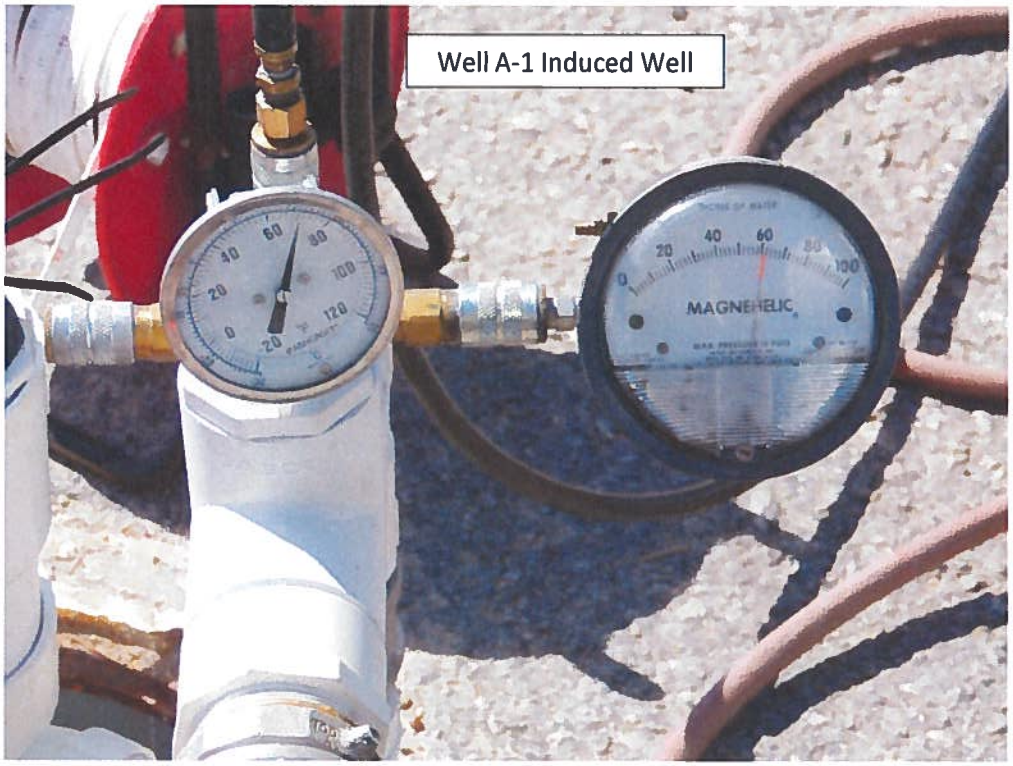
1600	Recorded static data: DP steady - All wells recording well pressure due to decreased barometric pressure on the GW
	TEST MDP-1 completed - NOTE Total Liquid Volume = 2048 gals
1635	Secured all wells - departed site

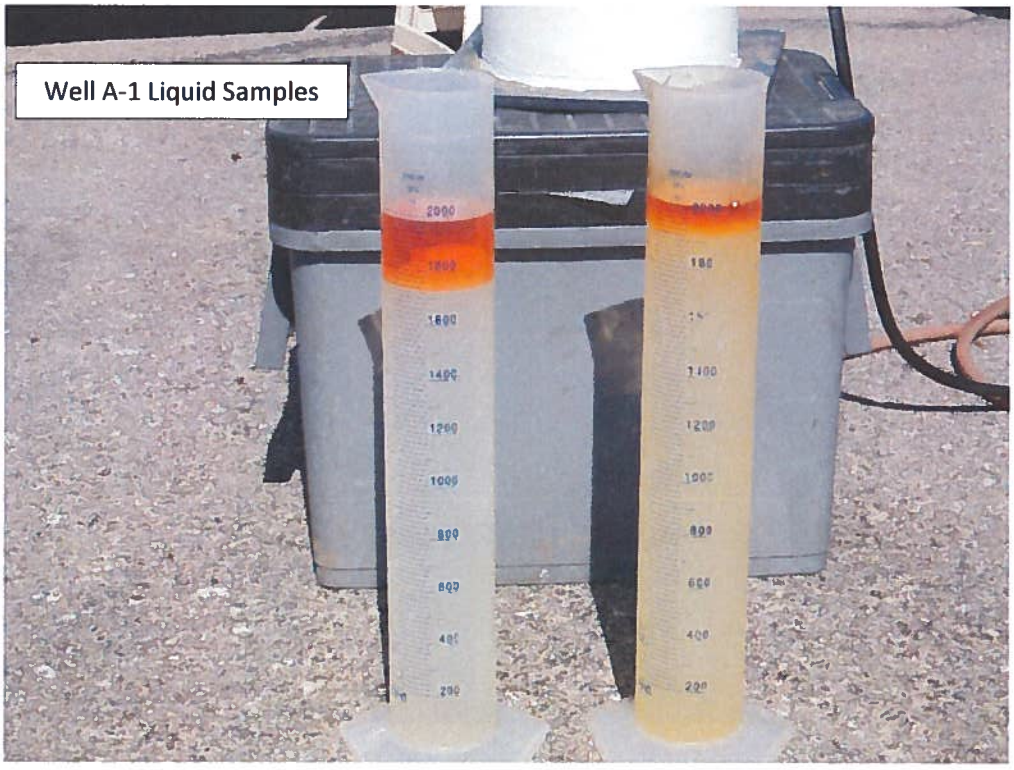
WALSTADD 66
LOVINGTON, NM

WALSTADD 66
LOVINGTON, NM



WALSTADD 66
LOVINGTON, NM





AcuVac Remediation, LLC

1656-H Townhurst • Houston, Texas 77043
713 468 6688 • acuvac.com

July 15, 2015

Mr. Clay Kilmer
Senior Hydrogeologist
Golder Associates, Inc.
5200 Pasadena Avenue, N.E. Suite C
Albuquerque, NM 87113

Dear Clay:

Re: Walstadd 66, Lovington, NM

At your request, we performed two 1-hour (Wells W-1 and W-2), and one 6.0-hour (Well A-1) Mobile Dual Phase (MDP) Events at the above referenced location on July 13, 2015. Following is the Report and a copy of the Operating Data collected during Event #1 at the above referenced location. Table #1A is the Well Summary Information and Table #1B is the Recovery Summary Information on wells W-2 (Event #1A), W-1 (Event #1B), and Well A-1 (Event #1C). PSH is referred to as LNAPL in this report. GW samples are taken in a 2,000 ml beaker to determine the average LNAPL percentage and volume.

OBJECTIVES

The Objectives of an MDP Event are to:

- Evaluate the potential for removing liquid and vapor phase LNAPL (PSH) from the groundwater (GW) and soils in the subsurface formations.
- Expose the capillary fringe area and below to the Extraction Well (EW) induced vacuums.
- Increase the GW and contaminant specific yields with high induced vacuums.
- Provide an induced hydraulic gradient (IHG) to gain hydraulic control of the area during the Event period.
- Select the GW depression and pump rates to accomplish the above objectives.

METHODS AND EQUIPMENT

The tests were conducted using AcuVac's I-6 System, with Roots RAI-33 and RAI-22 blowers, various instrumentation, including the HORIBA® Analyzer, Solinst Interface Probes, Lumidor O_2 Meter, flow gauges, a sensitive instrument to determine barometric pressure, V-1 vacuum box to capture non-diluted vapor samples, Redi-Flo 2 total fluids pump and other special equipment.

The vacuum extraction portion of the AcuVac System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes light hydrocarbons in the soil and on the GW to volatilize and flow through a moisture knockout tank to the vacuum pump and the IC Engine where they are burned as part of the normal combustion process. Propane is used as auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

The AcuVac IC Engine is fully loaded for the maximum power necessary to achieve and maintain high induced vacuums and/or high well vapor flows required to maximize the vacuum Radius of Influence (ROI) for Pilot Tests and short term Event remediation.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the AcuVac System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

The GW Extraction is provided by an in-well, Redi-Flo 2 total fluids pump that has the discharge line connected to a total volume meter. The discharge line from the volume meter is then connected to the stand-by tank truck. The electrical power for the GW pump was supplied from a 120v Honda generator. The GW flow rate can be adjusted to maintain a target level. Interface meters are used to measure all DTGW/DTLNAPL.

The design of the AcuVac System enables complete independent control of both the Induced Well Vacuum and the GW pumping functions such that the AcuVac team can control the IHG to expose the maximum amount of the formation to SVE. The ability to separate the vacuum and liquid flows within the Extraction Well improves the LNAPL recovery rates, and enables the AcuVac team to record data specific to each.

SUMMARY OF MDP EVENT #1A- WELL W-2

- The total Event time was 1.0 hour. The Event was conducted on July 13, 2015. There is no comparative data.
- The total liquid volume recovered was 192 gals, of which 13.50% or 25.92 gals were liquid LNAPL.
- Total vapor LNAPL burned as IC engine fuel was 1.97 gals, **for a total liquid and vapor LNAPL recovery of 27.89 gals.**
- Average HORIBA® Analytical Data from the influent vapor samples was: HC = 95,790 ppmv, CO_2 = 3.46%, CO = 7.46%, O_2 = 8.6% and H_2S = 0 ppm.
- The maximum HORIBA® Analytical Data from the influent vapor samples for TPH was 95,790 ppmv.
- The Average Induced Vacuum was 60"H_2O with a maximum vacuum of 60.00"H_2O.
- The average EW well vapor flow was 9.51 scfm with a maximum well vapor flow of 9.51 scfm.
- The GW pump inlet was set at 65.0 ft BTOC. The average GW pump rate was 3.20 gpm, and the maximum GW pump rate was 3.20 gpm.
- The average GW depression, based on the positioning of the GW pump, was 5.50 ft below static level.
- An LNAPL thickness of 6.54 ft was recorded prior to the start of Event #1A and no LNAPL thickness was recorded at the conclusion of the Event.

The total LNAPL removed, including liquid and vapor, during the 1.0 hour Event #1A, Well W-2, was 27.89 gals.

ADDITIONAL INFORMATION

- The higher percentage of the LNAPL volume, 25.92 gals or 92.94%, was recovered as liquid due to the high level of free phase LNAPL at the start of the Event.
- A minimal percentage of the LNAPL, 1.97 gals or 7.06%, was burned as IC engine fuel as a result of the short duration of the Event period.
- The high HC (TPH) levels indicate contaminant in the gasoline range.
- The relatively low O_2 levels in the influent vapors indicate SVE short circuiting from the ground surface most likely did not occur.
- Well W-2 was gauged at the conclusion of Event #1C (1445 hrs) and an LNAPL thickness of 4.40 ft was recorded indicating a rebound of 67.28%.

SUMMARY OF MDP EVENT #1B- WELL W-1

- The total Event time was 1.0 hour. The Event was conducted on July 13, 2015. There is no comparative data.
- The total liquid volume recovered was 201 gals, of which 23.69% or 47.61 gals were liquid LNAPL.
- Total vapor LNAPL burned as IC engine fuel was 1.84 gals, **for a total liquid and vapor LNAPL recovery of 49.45 gals.**
- Average HORIBA® Analytical Data from the influent vapor samples was: HC = 89,750 ppmv, CO_2 = 3.52%, CO = 5.74%, O_2 = 8.6% and H_2S = 0 ppm.
- The maximum HORIBA® Analytical Data from the influent vapor samples for TPH was 89,750 ppmv.
- The Average Induced Vacuum was 60"H_2O with a maximum vacuum of 60.00"H_2O.
- The average EW well vapor flow was 9.51 scfm with a maximum well vapor flow of 9.51 scfm.
- The GW pump inlet was set at 65.0 ft BTOC. The average GW pump rate was 3.47 gpm, and the maximum GW pump rate was 3.70 gpm.
- The average GW depression, based on the positioning of the GW pump, was 5.50 ft below static level.
- An LNAPL thickness of 6.84 ft was recorded prior to the start of Event #1B and an LNAPL thickness of 0.04 ft was recorded at the conclusion of the Event.

The total LNAPL removed, including liquid and vapor, during the 1.0 hour Event #1B, Well W-1, was 49.45 gals.

ADDITIONAL INFORMATION

- The higher percentage of the LNAPL volume of 47.61 gals or 96.27%, was recovered as liquid.
- A minimal amount of LNAPL, 1.84 gals or 3.73%, was burned as IC engine fuel as a result of the short duration of the Event period.

- The high HC (TPH) levels indicate contaminant in the gasoline range.
- The relatively low O_2 levels in the influent vapors indicate SVE short circuiting from the ground surface most likely did not occur.
- Well W-1 was gauged at the conclusion of Event #1C (1445 hrs) and an LNAPL thickness of 1.01 ft of was recorded indicating a rebound of 14.77%.
- A thickness of biomass was initially observed on the collected GW/LNAPL sample.

SUMMARY OF MDP EVENT #1C- WELL A-1

- The total Event time was 6.0 hours. The Event was conducted on July 13, 2015. The data is compared to Pilot Test #1 conducted on July 12, 2015 which had a total Test time of 8.0 hours.
- The total liquid volume recovered was 1,553 gals, of which 2.35% or 36.53 gals were liquid LNAPL.
- Total vapor LNAPL burned as IC engine fuel was 29.36 gals, **for a total liquid and vapor LNAPL recovery of 65.88 gals. This equates to an average of 10.98 gals/hr.**
- Average HORIBA® Analytical Data from the influent vapor samples was: HC = 59,027 ppmv, CO_2 = 5.61%, CO = 1.73%, O_2 = 7.1% and H_2S = 0 ppm.
- Compared with MDP Pilot Test #1 data, the average TPH levels decreased 10,115 ppmv, CO_2 increased 0.61%, CO decreased 0.85%, O_2 increased 0.1% and H_2S was steady at 0 ppm.
- The maximum HORIBA® Analytical Data from the influent vapor samples for TPH was 64,480 ppmv. Compared with MDP Pilot Test #1 data, the maximum TPH levels decreased 12,510 ppmv.
- The Average Induced Vacuum was 68.46"H_2O with a maximum vacuum of 70.00"H_2O. Compared with Pilot Test #1 data, the average induced vacuum increased 8.17"H_2O and the maximum induced vacuum decreased 20.00"H_2O.
- The average EW well vapor flow was 23.01 scfm with a maximum well vapor flow of 23.34 scfm. Compared with MDP Pilot Test #1 data, the average EW well vapor flow increased 4.18 scfm, and the maximum well flow decreased 4.61 scfm.
- The GW pump inlet was set at 65.0 ft BTOC. The average GW pump rate was 4.35 gpm, and the maximum GW pump rate was 4.50 gpm.
- The average GW depression, based on the positioning of the GW pump, was 5.50 ft below static level.
- An LNAPL thickness of 5.52 ft was recorded prior to the start of Event #1C and a LNAPL thickness of 0.13 ft was recorded at the conclusion of the Event.

The total LNAPL removed, including liquid and vapor, during the 6.0 hour Event #1C, Well A-1, was 65.88 gals.

ADDITIONAL INFORMATION

- The higher percentage of the LNAPL volume, 36.53 gals or 55.44%, was recovered as liquid.
- Of the total LNAPL volume recovered, 29.36 gals or 44.56%, was burned as IC engine fuel during the Event period as a result of the high TPH and Well Vapor Flow.
- The high HC (TPH) levels indicate contaminant in the gasoline range.
- The HC (TPH) recorded a decreasing trend throughout the Event period.
- The relatively low O_2 levels in the influent vapors indicate SVE short circuiting from the ground surface most likely did not occur.

TOTAL RECOVERY EVENT #1

The total LNAPL removed, including liquid and vapor, during the 8.0 hour Event #1, Wells W-1, W-2, and A-1, was 143.22 gals. This equates to 17.90 gal/hr.

RECOMMENDATION

The Events proved to be an extremely effective method of decreasing the liquid LNAPL thickness in these wells. An Event program should be considered to quickly reduce the LNAPL thickness before considering a CAP which includes an on-site recovery system. In many cases the Event program has initially been more cost effective.

METHOD OF CALIBRATION AND CALCULATIONS

The HORIBA® Analytical instrument is calibrated with Hexane, CO and CO_2.

The formula used to calculate the emission rate is:

$$ER = HC\ (ppmv) \times MW\ (Hexane) \times Flow\ Rate\ (scfm) \times 1.58E^{-7} \frac{(min)(lb\ mole)}{(hr)(ppmv)(ft^3)} = lbs/hr$$

INFORMATION INCLUDED WITH REPORT

- Table #1A Summary Well Data
- Table #1B Summary Recovery Data
- Recorded Data
- Photographs of the MDP System and Wells A-1, W-1 and W-2.

After you have reviewed the report and if you have any questions, please contact me. We appreciate you selecting AcuVac to provide this service.

Sincerely,
ACUVAC REMEDIATION, LLC

Paul D. Faucher
Vice President, Operations

Summary Well Data
Table #1A

Event		1A	1B	1C
WELL NO.		W-2	W-1	A-1
Total Event Hours		1.0	1.0	6.0
TD	ft	75.0	80.0	75.0
Well Screen	ft	45.0 to 75.0	50 to 70	50 to 70
Well Size	in	4.0	4.0	4.0
Well Data				
DTGW - Static - Start Event	ft	64.67	63.96	63.55
DTLNAPL - Static - Start Event	ft	58.13	57.12	58.03
LNAPL	ft	6.54	6.84	5.52
Hydro-Equivalent- Beginning	ft	59.83	58.90	59.47
DTGW - End Event	ft	57.76	59.21	60.01
DTLNAPL - End Event	ft	0	59.17	59.88
LNAPL	ft	0	0.04	0.13
Hydro-Equivalent - Ending	ft	57.76	59.18	59.91
Extraction Data				
Maximum Extraction Well Vacuum	"H_2O	60.00	60.00	70.00
Average Extraction Well Vacuum	"H_2O	60.00	60.00	68.46
Maximum Extraction Well Vapor Flow	scfm	9.51	9.51	23.34
Average Extraction Well Vapor Flow	scfm	9.51	9.51	23.01
Maximum GW/ LNAPL Pump Rate	gpm	3.20	3.70	4.50
Average GW/ LNAPL Pump Rate	gpm	3.20	3.47	4.35
Influent Data				
Maximum TPH	ppmv	95,790	89,750	64,480
Average TPH	ppmv	95,790	89,750	59,027
Average CO_2	%	3.46	3.52	5.61
Average CO	%	7.46	5.74	1.73
Average O_2	%	8.6	8.6	7.1
Average H_2S	ppm	0	0	0

Summary Recovery Data
Table #1B

Event		1A	1B	1C
WELL NO.		W-2	W-1	A-1
Recovery Data- Current Event				
Total Liquid Volume Recovered	gals	192	201	1,553
Total Liquid LNAPL Recovered	gals	25.92	47.61	36.53
Total Liquid LNAPL Recovered / Total Liquid	%	13.50	23.69	2.35
Total Liquid LNAPL Recovered / Total LNAPL	%	92.94	96.27	55.44
Total Vapor LNAPL Recovered	gals	1.97	1.84	29.36
Total Vapor LNAPL Recovered / Total LNAPL	%	7.06	3.73	44.56
Total Vapor and Liquid LNAPL Recovered	gals	27.89	49.45	65.88
Average LNAPL Recovery	gals/hr	27.89	49.45	10.98
Total LNAPL Recovered	lbs	195	346	461
Total Volume of Well Vapors	cu. ft	571	571	8,284
Recovery Data- Cumulative				
Total Liquid Volume Recovered	gals	192	201	3,601
Total Liquid LNAPL Recovered	gals	25.92	47.61	100.16
Total Vapor LNAPL Recovered	gals	1.97	1.84	51.87
Total Vapor and Liquid LNAPL Recovered	gals	27.89	49.45	152.03
Average LNAPL Recovery	gals/hr	27.89	49.45	10.86
Total LNAPL Recovered	lbs	195	346	1,064
Total Volume of Well Vapors	cu. ft	571	571	17,322

OPERATING DATA - EVENT #1A **PAGE # 1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

Date: 7/13/15

	Parameters		Time 0615	Time 0645	Time 0715	Time	Time	Time
	WELL # W-1		Hr Meter 7288.5	Hr Meter 7289.0	Hr Meter 7289.5	Hr Meter	Hr Meter	Hr Meter
ENGINE/BLOWER	R.P.M.		2206	2200	2200			
	Oil Pressure	psi	50	50	50			
	Water Temp	°F	130	140	150			
	Volts		14	14	14			
	Intake Vacuum	"Hg	19	19	19			
	Gas Flow Fuel/Propane	cfh	0	0	0			
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	OFF			
	Extraction Well Flow	scfm	9.51	9.51	9.51			
	Extraction Well Vacuum	"H_2O	60	60	60			
	Pump Rate	gals/min	3.2	3.2	3.2			
	Total Volume	gals	–	96	192			
	Influent Vapor Temp.	°F	68	68	68			
	Air Temperature	°F	66.7	69.1	69.8			
	Barometric Pressure	"Hg	30.03	30.02	30.01			
VAPOR /INFLUENT	HC	ppmv	–	95760	–			
	CO_2	%	–	3.42	–			
	CO	%	–	7.46	–			
	O_2	%	–	8.6	–			
	H_2S	ppm	–	0	–			

NOTES

ARRIVED ON SITE AT 0545 HRS. POSITIONED THE ACUVAC SYSTEM NEAR WELL W-1. GAUGED THE WELL AND MOBILIZED ALL EQUIPMENT. PLACED THE IN WELL PUMP AT 67.0 FT BTOC. EVENT STARTED AT 0615 HRS. INITIAL WELL VAC SET AT 60" H_2O RESULTING IN WVF OF 9.50 SCFM. INFLUENT VAPOR SAMPLE INDICATES HIGH CONCENTRATION OF HYDROCARBONS IN THE 95,000 + PPMV RANGE. LIQUID SAMPLE TAKEN AT APPROX 0630 INDICATES 15 % OF LNAPL PRESENT IN THE LIQUID. INDUCED WELL VAC REDUCED AT 0705 HRS GW PUMPING STOPPED AT 0715. EVENT CONCLUDED AT 0715

MANIFOLD								
	LNAPL % Vol / Gals	-/-	15/14.40	12/11.52			
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	1445		
	Extraction Well DTLNAPL	ft	58.13		–	59.00		
	Extraction Well DTGW	ft	64.67		57.76	63.40		

( ) Indicates Well Pressure

LNAPL 6.54
HE 59.83

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4.40
HE 60.14

7FORMS/TestForms/1210017B

OPERATING DATA - EVENT #1 B **PAGE #1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

	Date:	7/13/15					
	Parameters	Time 0730	Time 0800	Time 0830	Time	Time	Time
	WELL # W-2	Hr Meter 7289.5	Hr Meter 7290.0	Hr Meter 7290.5	Hr Meter	Hr Meter	Hr Meter
ENGINE/BLOWER	R.P.M.	2200	2200	2200			
	Oil Pressure psi	50	50	50			
	Water Temp °F	150	150	150			
	Volts	14	14	14			
	Intake Vacuum "Hg	19	19	19			
	Gas Flow Fuel/Propane cfh	0	0	0			
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump ON/OFF	ON	ON	OFF			
	Extraction Well Flow scfm	9.51	9.51	9.51			
	Extraction Well Vacuum "H_2O	60	60	60			
	Pump Rate gals/min	3.0	3.70	3.70			
	Total Volume gals	-	90	201			
	Influent Vapor Temp. °F	68	68	68			
	Air Temperature °F	70.4	71.7	72.5			
	Barometric Pressure "Hg	30.01	30.01	30.01			
VAPOR /INFLUENT	HC ppmv	—	89,750	—			
	CO_2 %	-	3.52	-			
	CO %	-	5.74	-			
	O_2 %	-	8.6	-			
	H_2S ppm	-	0	-			
NOTES	RELOCATED THE AcuVac SYSTEM NEAR WELL W-2. GAUGED THE WELL PLACED THE D-WELL PUMP AT 67.0 FT BTOC. INITIAL WELL VAC SET AT 60 "H_2O RESULTING IN A WVF OF 9.50 SCFM.						
MANIFOLD	LNAPL % Vol / Gals	-/-	27/24.3	21/23.31			
	Depth of GW Depression ft	-5.5	-5.5	-5.5		1445	
	Extraction Well DTLNAPL ft	59.12		59.17		59.12	
	Extraction Well DTGW ft	63.96		59.21		60.13	

( ) Indicates Well Pressure

LNAPL 6.84 HE 58.80 .04 HE 59.18 1.01 HE 59.38

OPERATING DATA - EVENT #1 C **PAGE # 1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

	Date:	7/13/15					
	Parameters	Time 0845	Time 0915	Time 0945	Time 1015	Time 1045	Time 1115
	WELL # A-1	Hr Meter 7290.5	Hr Meter 7291.0	Hr Meter 7291.5	Hr Meter 7292.0	Hr Meter 7292.5	Hr Meter 7293.0
ENGINE/BLOWER	R.P.M.	2200	2200	2300	2300	2300	2300
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	150	150	150	150	155	160
	Volts	14	14	14	14	14	14
	Intake Vacuum "Hg	16	16	16	16	16	16
	Gas Flow Fuel/Propane cfh	0	0	50	50	50	50
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump ON/OFF	ON	ON	ON	ON	ON	ON
	Extraction Well Flow scfm	23.34	23.34	22.95	22.95	22.95	22.95
	Extraction Well Vacuum "H_2O	60	60	70	70	70	70
	Pump Rate gals/min	4.2	4.2	4.4	4.5	4.5	4.5
	Total Volume gals	-	126	252	384	519	654
	Influent Vapor Temp. °F	71	71	71	72	72	72
	Air Temperature °F	74.3	77.8	84.3	86.7	88.5	89.4
	Barometric Pressure "Hg	30.01	30.01	30.00	30.00	30.00	29.99
VAPOR /INFLUENT	HC ppmv	-	-	64480	-	-	-
	CO_2 %	-	-	5.14	-	-	-
	CO %	-	-	2.09	-	-	-
	O_2 %	-	-	7.1	-	-	-
	H_2S ppm	-	-	0	-	-	-

NOTES

AT 0830 MOBILIZED THE ACUVAC EQUIPMENT ON WELL A-1. SET IN-WELL PUMP AT 67 FT BTOC. INITIAL WELL VAC SET AT 60"H_2O RESULTING IN A WVF OF 23.34 SCFM. INITIAL GW PUMP RATE SET AT 4.2 GPM.

AT 0945 INCREASED WELL VAC TO 70"H_2O RESULTING IN A WVF OF 22.95 SCFM. GW PUMP RATE INCREASED TO 4.4 GPM AND INCREASED AGAIN AT 1015 HRS TO 4.5 GPM TO COMPENSATE FOR HIGHER VACUUM. TPH VAPORS REMAIN HIGH IN THE GASOLINE RANGE

MANIFOLD	LNAPL % Vol / Gals	-/-	8/10.08	4/5.04	2/2.64	2/2.7	1.5/2.03
	Depth of GW Depression ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well DTLNAPL ft	0820 58.03	0830 57.76				
	Extraction Well DTGW ft	63.55	63.87				

( ) Indicates Well Pressure

LNAPL 5.52 6.11

HE 57.47 57.35

OPERATING DATA - EVENT #1C **PAGE #2** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

Date: 7/13/15

	Parameters		Time 1145	Time 1215	Time 1245	Time 1315	Time 1345	Time 1445
	WELL # A-1		Hr Meter 7293.5	Hr Meter 7294.0	Hr Meter 7294.5	Hr Meter 7295.0	Hr Meter 7295.5	Hr Meter 7296.5
ENGINE/BLOWER	R.P.M.		2300	2300	2300	2300	2300	2300
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	160	160	165	165	165	165
	Volts		14	14	14	14	14	14
	Intake Vacuum	"Hg	16	16	16	16	16	16
	Gas Flow Fuel/Propane	cfh	50	50	50	50	50	50
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	ON	ON	ON	OFF
	Extraction Well Flow	scfm	22.95	22.95	22.95	22.95	22.95	22.95
	Extraction Well Vacuum	"H_2O	70	70	70	70	70	70
	Pump Rate	gals/min	4.5	4.5	4.5	4.4	4.4	3.5
	Total Volume	gals	789	924	1059	1194	1326	1553
	Influent Vapor Temp.	°F	71	71	71	71	71	71
	Air Temperature	°F	91.3	95.1	97.6	99.2	99.5	98.8
	Barometric Pressure	"Hg	29.98	29.97	29.96	29.94	29.92	29.92
VAPOR /INFLUENT	HC	ppmv	56,750	-	-	-	55850	-
	CO_2	%	5.74	-	-	-	5.96	-
	CO	%	1.57	-	-	-	1.52	-
	O_2	%	7.0	-	-	-	7.2	-
	H_2S	ppm	0	-	-	-	0	-
NOTES	WELL VAC AND WELL FLOW STEADY DURING PERIOD. TPH VAPORS MOSTLY STEADY DURING THE PERIOD. AT 1445 EVENT CONCLUDED. ALL WELL GAUGED. WELL W-1 AND W-2 WERE GAUGED TO DETERMINE THE EXTENT OF ANY REBOUND. ACUVAC EQUIPMENT AND SYSTEM DEMOBILIZED, SITE SECURED, DEPARTED SITE.							
MANIFOLD	LNAPL	% Vol / Gals	1.5/2.03	1.5/2.03	1.5/2.03	1.5/2.03	1.5/1.98	1.5/1.98
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well DTLNAPL	ft						55.98
	Extraction Well DTGW	ft						60.01

( ) Indicates Well Pressure

7FORMS/TestForms/1210017B

HE 55.91 LNAPL .13

OPERATING DATA - EVENT #1A **PAGE #1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

Date: 7/13/15

	Parameters		Time 0615	Time 0645	Time 0715	Time	Time	Time
	WELL # W-1		Hr Meter 7288.5	Hr Meter 7289.0	Hr Meter 7289.5	Hr Meter	Hr Meter	Hr Meter
ENGINE/BLOWER	R.P.M.		2206	2200	2200			
	Oil Pressure	psi	50	50	50			
	Water Temp	°F	130	140	150			
	Volts		14	14	14			
	Intake Vacuum	"Hg	19	19	19			
	Gas Flow Fuel/Propane	cfh	0	0	0			
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	OFF			
	Extraction Well Flow	scfm	9.51	9.51	9.51			
	Extraction Well Vacuum	"H_2O	60	60	60			
	Pump Rate	gals/min	3.2	3.2	3.2			
	Total Volume	gals	–	96	192			
	Influent Vapor Temp.	°F	68	68	68			
	Air Temperature	°F	66.7	69.1	69.8			
	Barometric Pressure	"Hg	30.03	30.02	30.01			
VAPOR /INFLUENT	HC	ppmv	–	95190	–			
	CO_2	%	–	3.42	–			
	CO	%	–	7.46	–			
	O_2	%	–	8.6	–			
	H_2S	ppm	–	0	–			

NOTES

ARRIVED ON SITE AT 0545 HRS. POSITIONED THE ACUVAC SYSTEM NEAR WELL W-1. GAUGED THE WELL AND MOBILIZED ALL EQUIPMENT. PLACED THE IN WELL PUMP AT 67.0 FT BTOC. EVENT STARTED AT 0615 HRS. INITIAL WELL VAC SET AT 60" H_2O RESULTING IN WVF OF 9.50 SCFM. INFLUENT VAPOR SAMPLE INDICATES HIGH CONCENTRATION OF HYDROCARBONS IN THE 95,000 + PPMV RANGE. LIQUID SAMPLE TAKEN AT APPROX 0630 INDICATES 15 % OF LNAPL PRESENT IN THE LIQUID. INDUCED WELL VAC REDUCED AT 0705 HRS GW PUMPING STOPPED AT 0715. EVENT CONCLUDED AT 0715

MANIFOLD								
	LNAPL % Vol / Gals	-/-	15/14.40	12/11.52			
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	1445		
	Extraction Well DTLNAPL	ft	58.13		–	59.00		
	Extraction Well DTGW	ft	64.67		57.76	63.40		

( ) Indicates Well Pressure

LNAPL 6.54 HE 59.83

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4.40 HE 60.14

7FORMS/TestForms/1210017B

OPERATING DATA - EVENT #1 B **PAGE # 1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

	Date:	7/13/15					
	Parameters	Time 0730	Time 0800	Time 0830	Time	Time	Time
	WELL # W-2	Hr Meter 7289.5	Hr Meter 7290.0	Hr Meter 7290.5	Hr Meter	Hr Meter	Hr Meter
ENGINE/BLOWER	R.P.M.	2200	2200	2200			
	Oil Pressure psi	50	50	50			
	Water Temp °F	150	150	150			
	Volts	14	14	14			
	Intake Vacuum "Hg	19	19	19			
	Gas Flow Fuel/Propane cfh	0	0	0			
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump ON/OFF	ON	ON	OFF			
	Extraction Well Flow scfm	9.51	9.51	9.51			
	Extraction Well Vacuum "H_2O	60	60	60			
	Pump Rate gals/min	3.0	3.70	3.70			
	Total Volume gals	-	90	201			
	Influent Vapor Temp. °F	68	68	68			
	Air Temperature °F	70.4	71.7	72.5			
	Barometric Pressure "Hg	30.01	30.01	30.01			
VAPOR /INFLUENT	HC ppmv	-	89,750	-			
	CO_2 %	-	3.52	-			
	CO %	-	5.74	-			
	O_2 %	-	8.6	-			
	H_2S ppm	-	0	-			

NOTES

RELOCATED THE ACUVAC SYSTEM NEAR WELL W-2. GAUGED THE WELL PLACED THE ID WELL PUMP AT 67.0 FT BTOC. INITIAL WELL VAC SET AT 60 "H_2O RESULTING IN A WVF OF 9.50 SCFM.

MANIFOLD	LNAPL % Vol / Gals	-/-	27/24.3	21/23.31			
	Depth of GW Depression ft	-5.5	-5.5	-5.5		1445	
	Extraction Well DTLNAPL ft	59.12		59.17		59.12	
	Extraction Well DTGW ft	63.96		59.21		60.13	

( ) Indicates Well Pressure

LNAPL 6.84 HE 58.80 .04 HE 59.18 1.01 HE 59.38

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OPERATING DATA - EVENT #1 C **PAGE # 1** **ACUVAC MOBILE DUAL PHASE SYSTEM**

Location: Walstadd 66, Lovington, NM **Project Managers: Sadler/Faucher**

	Date:	7/13/15					
	Parameters	Time 0845	Time 0915	Time 0945	Time 1015	Time 1045	Time 1115
	WELL # A-1	Hr Meter 7290.5	Hr Meter 7291.0	Hr Meter 7291.5	Hr Meter 7292.0	Hr Meter 7292.5	Hr Meter 7293.0
ENGINE/BLOWER	R.P.M.	2200	2200	2300	2300	2300	2300
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	150	150	150	150	155	160
	Volts	14	14	14	14	14	14
	Intake Vacuum "Hg	16	16	16	16	16	16
	Gas Flow Fuel/Propane cfh	0	0	50	50	50	50
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump ON/OFF	ON	ON	ON	ON	ON	ON
	Extraction Well Flow scfm	23.34	23.34	22.95	22.95	22.95	22.95
	Extraction Well Vacuum "H_2O	60	60	70	70	70	70
	Pump Rate gals/min	4.2	4.2	4.4	4.5	4.5	4.5
	Total Volume gals	-	126	252	384	519	654
	Influent Vapor Temp. °F	71	71	71	72	72	72
	Air Temperature °F	74.3	77.8	84.3	86.7	88.5	89.4
	Barometric Pressure "Hg	30.01	30.01	30.00	30.00	30.00	29.99
VAPOR /INFLUENT	HC ppmv	-	-	64480	-	-	-
	CO_2 %	-	-	5.14	-	-	-
	CO %	-	-	2.09	-	-	-
	O_2 %	-	-	7.1	-	-	-
	H_2S ppm	-	-	0	-	-	-

NOTES

AT 0830 MOBILIZED THE ACUVAC EQUIPMENT ON WELL A-1. SET IN-WELL PUMP AT 67 FT BTOC. INITIAL WELL VAC SET AT 60"H_2O RESULTING IN A WVF OF 23.34 SCFM. INITIAL GW PUMP RATE SET AT 4.2 GPM.
AT 0945 INCREASED WELL VAC TO 70"H_2O RESULTING IN A WVF OF 22.95 SCFM. GW PUMP RATE INCREASED TO 4.4 GPM AND INCREASED AGAIN AT 1015 HRS TO 4.5 GPM TO COMPENSATE FOR HIGHER VACUUM. TPH VAPORS REMAIN HIGH IN THE GASOLINE RANGE

MANIFOLD	LNAPL % Vol / Gals	-/-	8/10.08	4/5.04	2/2.64	2/2.7	1.5/2.03
	Depth of GW Depression ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well DTLNAPL ft	0820 58.03	0830 57.76				
	Extraction Well DTGW ft	63.55	63.87				

( ) Indicates Well Pressure

LNAPL 5.52 6.11

HE 59.47 59.35

7FORMS/TestForms/1210017B

OPERATING DATA - EVENT #1C PAGE #2 ACUVAC MOBILE DUAL PHASE SYSTEM

Location: Walstadd 66, Lovington, NM **Project Managers:** Sadler/Faucher

Date: 7/13/15

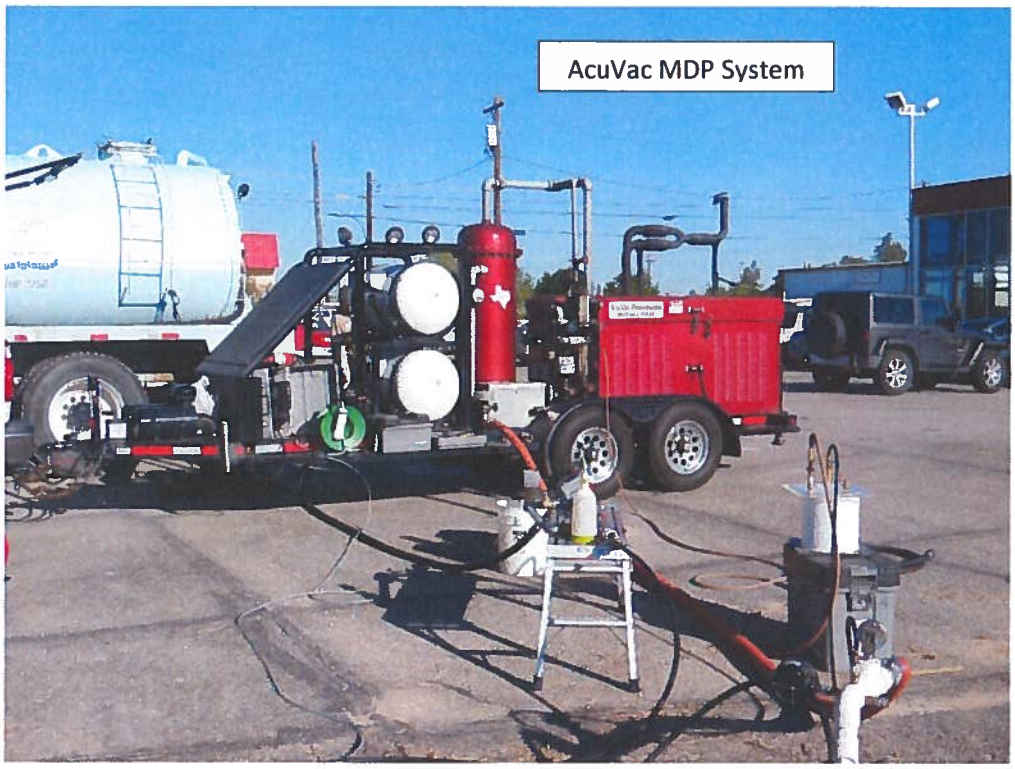
	Parameters		Time 1145	Time 1215	Time 1245	Time 1315	Time 1345	Time 1445
	WELL # A-1		Hr Meter 7253.5	Hr Meter 7254.0	Hr Meter 7254.5	Hr Meter 7255.0	Hr Meter 7255.5	Hr Meter 7256.5
ENGINE/BLOWER	R.P.M.		2300	2300	2300	2300	2300	2300
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	160	160	165	165	165	165
	Volts		14	14	14	14	14	14
	Intake Vacuum	"Hg	16	16	16	16	16	16
	Gas Flow Fuel/Propane	cfh	50	50	50	50	50	50
ATMOSPHERE/VACUUM/AIR PUMP/VOLUME	GW Pump	ON/OFF	ON	ON	ON	ON	ON	OFF
	Extraction Well Flow	scfm	22.95	22.95	22.95	22.95	22.95	2295
	Extraction Well Vacuum	"H_2O	70	70	70	70	70	70
	Pump Rate	gals/min	4.5	4.5	4.5	4.4	4.4	3.5
	Total Volume	gals	789	924	1059	1194	1326	1553
	Influent Vapor Temp.	°F	71	71	71	71	71	71
	Air Temperature	°F	91.3	95.1	97.6	99.2	99.5	99.8
	Barometric Pressure	"Hg	29.98	29.97	29.96	29.94	29.92	2992
VAPOR /INFLUENT	HC	ppmv	56,750	-	-	-	55850	-
	CO_2	%	5.74	-	-	-	5.96	-
	CO	%	1.57	-	-	-	1.52	-
	O_2	%	7.0	-	-	-	7.2	-
	H_2S	ppm	0	-	-	-	0	-
NOTES	WELL VAC AND WELL FLOW STEADY DURING PERIOD. TPH VAPORS MOSTLY STEADY DURING THE PERIOD. AT 1445 EVENT CONCLUDED. ALL WELL GAUGED. WELL W-1 AND W-2 WERE GAUGED TO DETERMINE THE EXTENT OF ANY REBOUND. ACUVAC EQUIPMENT AND SYSTEM DEMOBILIZED, SITE SECURED, DEPARTED SITE.							
MANIFOLD	LNAPL % Vol / Gals		1.5/2.03	1.5/2.03	1.5/2.03	1.5/2.03	1.5/1.98	1.5/1.98
	Depth of GW Depression	ft	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
	Extraction Well DTLNAPL	ft						55.98
	Extraction Well DTGW	ft						60.01

( ) Indicates Well Pressure

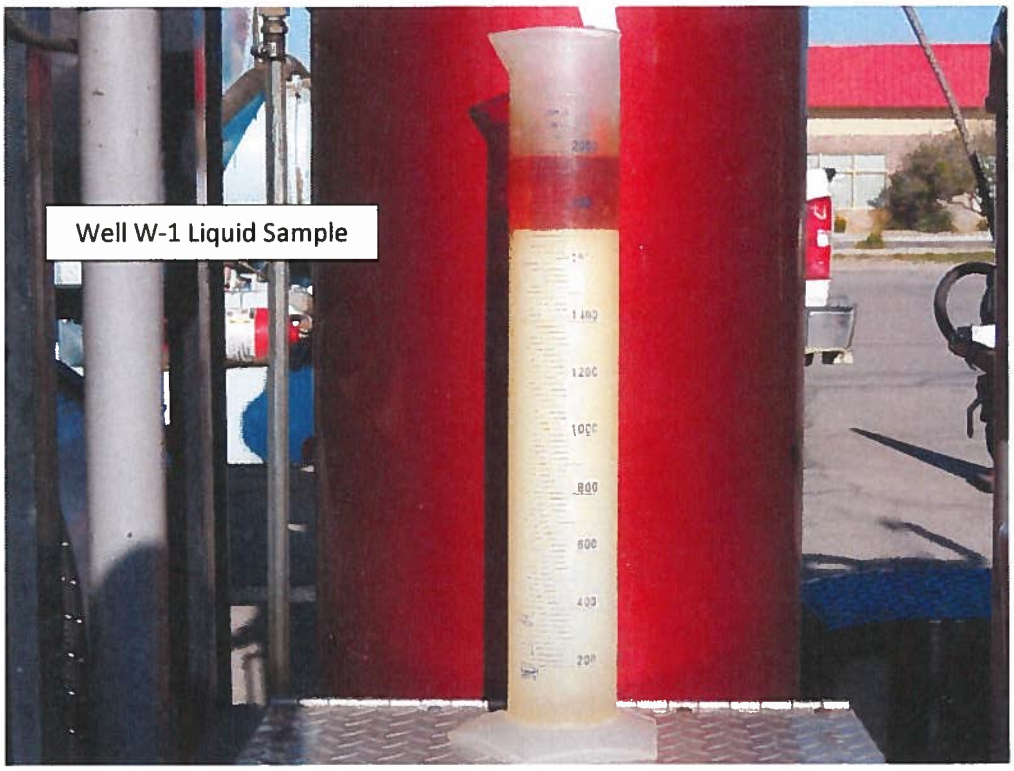
7FORMS/TestForms/1210017B

HE 55.91 LNAPL .13

WALSTADD 66
LOVINGTON, NM



WALSTADD 66
LOVINGTON, NM



Dual-Phase Extraction Pilot Test Field Data (SVE Component)
Lovington 66, PSTB Facility #1489
Lovington, New Mexico

DPE-1							
Time	Wellhead Vacuum (in H_20)	Influent Flow Rate (cfm)	PID Response (ppmv)	Influent Temperature (°F)	W-1 (in H_20)	W-2 (in H_20)	W-3 (in H_20)
7:25	OFF	OFF	OFF	OFF	0.00	0.00	0.00
7:30	40	12.19	--	69	0.05	0.07	0.02
8:00	40	12.19	76,990	69	0.31	0.86	0.13
8:30	40	12.19	--	69	0.37	0.88	0.17
9:00	40	12.19	74,020	69	0.38	0.92	0.20
9:30	40	12.19	--	70	0.36	0.88	0.17
10:00	60	19.88	71,750	70	0.38	1.07	0.14
10:30	60	19.88	--	70	0.42	1.09	0.16
11:00	60	19.88	68,490	70	0.42	1.14	0.16
11:30	60	19.88	--	71	0.41	1.13	0.15
12:00	60	19.88	--	71	0.42	1.12	0.14
12:30	60	19.88	--	71	0.43	1.13	0.15
13:00	60	19.88	61,880	71	0.38	1.10	0.12
13:30	75	21.34	--	71	0.43	1.14	0.14
14:00	75	21.34	--	71	0.43	1.14	0.14
14:30	75	21.34	--	71	0.37	1.10	0.09
15:00	90	27.95	61,720	71	0.43	1.23	0.15
15:30	90	27.95	--	72	0.60	1.54	0.20
Average	**60.3**	**18.83**	**69,142**	**70**	**0.37**	**0.97**	**0.14**

Notes:
in H_20 = inches of water
cfm = cubic feet per minute
ppmv = parts per million volume
°F = degrees Fahrenheit
-- = Not measured/monitored

Prepared by: MCC
Reviewed by: LCK

Golder Associates

Dual-Phase Extraction Pilot Test Field Data
Induced Hydraulic Gradient Data
Lovington 66, PSTB Facility #1489
Lovington, New Mexico

Time	DPE-1 Vacuum (in H_20)	DPE -1 Pumping Rate (gpm)	Total Volume (gal)	DPE-1 (feet)	W-1 (feet)	W-2 (feet)	W-3 (feet)
7:30	0	0	0	0.00	0.00	0.00	0.00
10:30	60	4.30	678	5.50	0.07	0.11	0.03
13:30	75	4.60	1,460	5.50	0.32	0.59	0.20
15:30	90	5.20	2,048	5.50	0.37	0.66	0.24
	Distance from DPE-1 (feet):			0.0	25.8	16.2	38.3

Notes:
gpm = gallons per minute
gal = gallons
ppmv = parts per million volume
-- = Not measured/monitored

Prepared by: MCC
Reviewed by: LCK

Golder Associates

APPENDIX J-3

Calculation Sheet
ESTIMATED SVE RADIUS OF INFLUENCE

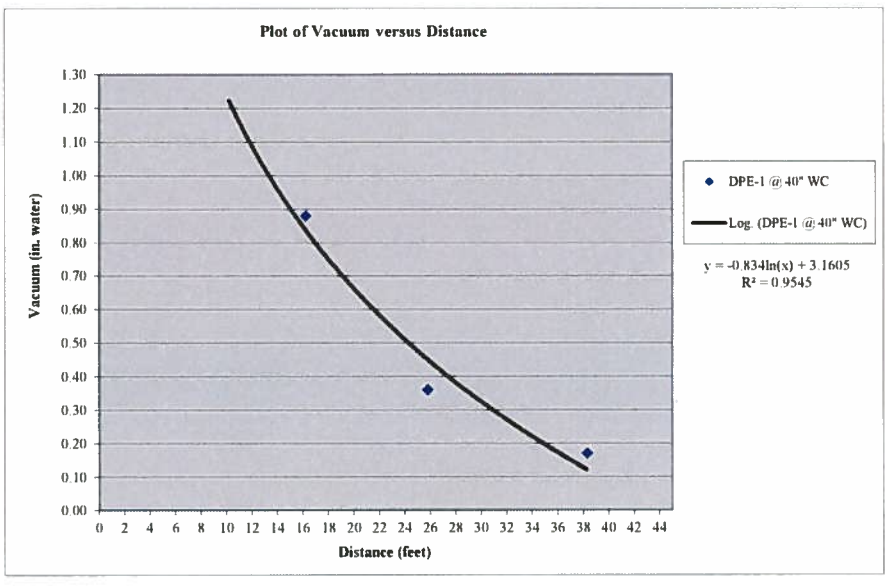
Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project Number:	1404221

DPE-1 @ 40" WC	Pressure (in. water)	Distance (feet)
Extraction wellhead	40	0
W-1	0.36	25.8
W-2	0.88	16.2
W-3	0.17	38.3

FROM PLOT (EPA)	(1"wc)
slope =	-0.834
intercept =	3.1605
ESTIMATED FIELD ROI =	13.3

FROM PLOT (NMED 3%)	(1.2"wc)
slope =	-0.834
intercept =	3.1605
ESTIMATED FIELD ROI =	10.5

FROM PLOT	(0.1"wc)
slope =	-0.834
intercept =	3.1605
ESTIMATED FIELD ROI =	39.2

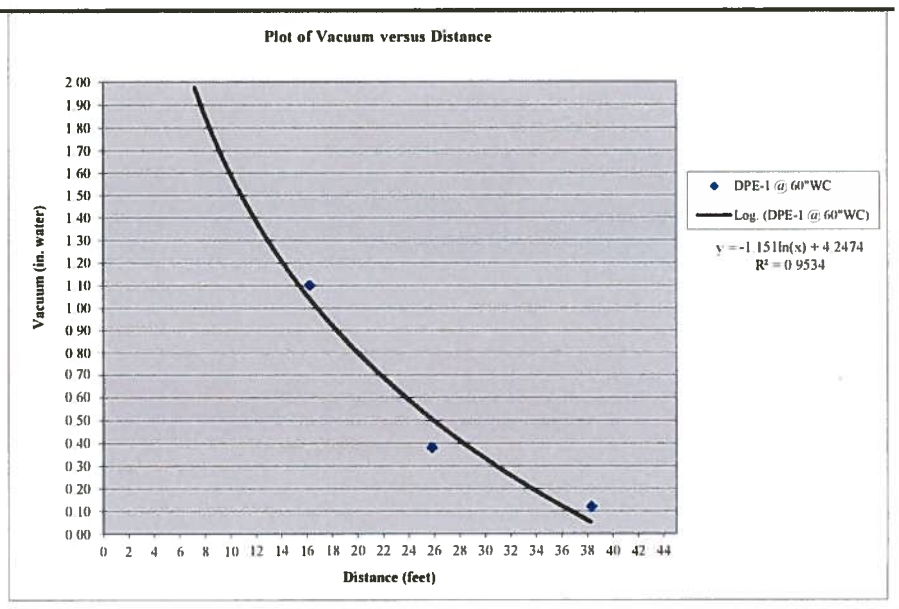


DPE-1 @ 60"WC	Pressure (in. water)	Distance (feet)
Extraction wellhead	60	0
W-1	0.38	25.8
W-2	1.10	16.2
W-3	0.12	38.3

FROM PLOT (EPA)	(1"wc)
slope =	-1.151
intercept =	4.2474
ESTIMATED FIELD ROI =	16.8

FROM PLOT (NMED 3%)	(1.8"wc)
slope =	-1.151
intercept =	4.2474
ESTIMATED FIELD ROI =	8.4

FROM PLOT	(0.1"wc)
slope =	-1.151
intercept =	4.2474
ESTIMATED FIELD ROI =	36.7

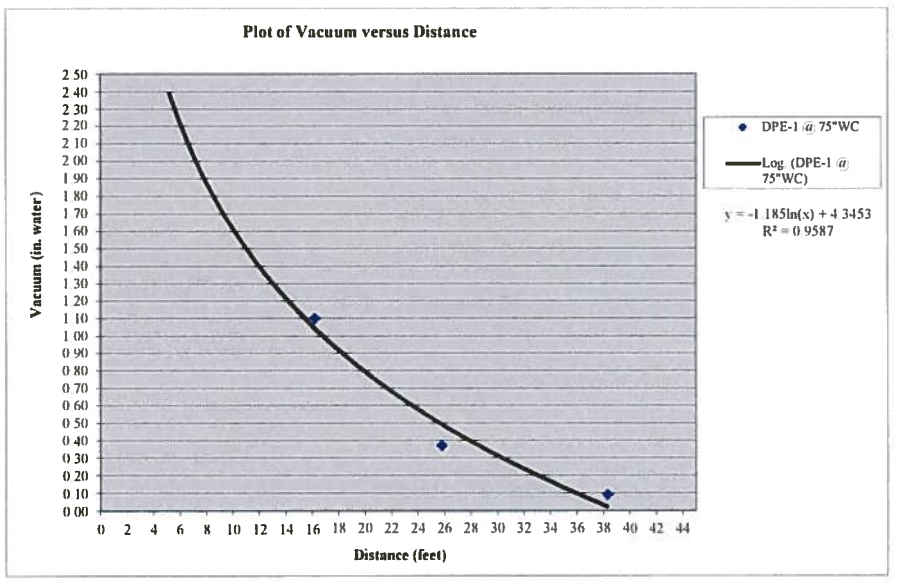


DPE-1 @ 75"WC	Pressure (in. water)	Distance (feet)
Extraction wellhead	75	0
W-1	0.37	25.8
W-2	1.10	16.2
W-3	0.09	38.3

FROM PLOT (EPA)	(1"wc)
slope =	-1.185
intercept =	4.3453
ESTIMATED FIELD ROI =	16.8

FROM PLOT (NMED 3%)	(2.25"wc)
slope =	-1.185
intercept =	4.3453
ESTIMATED FIELD ROI =	5.9

FROM PLOT	(0.1"wc)
slope =	-1.185
intercept =	4.3453
ESTIMATED FIELD ROI =	36.0

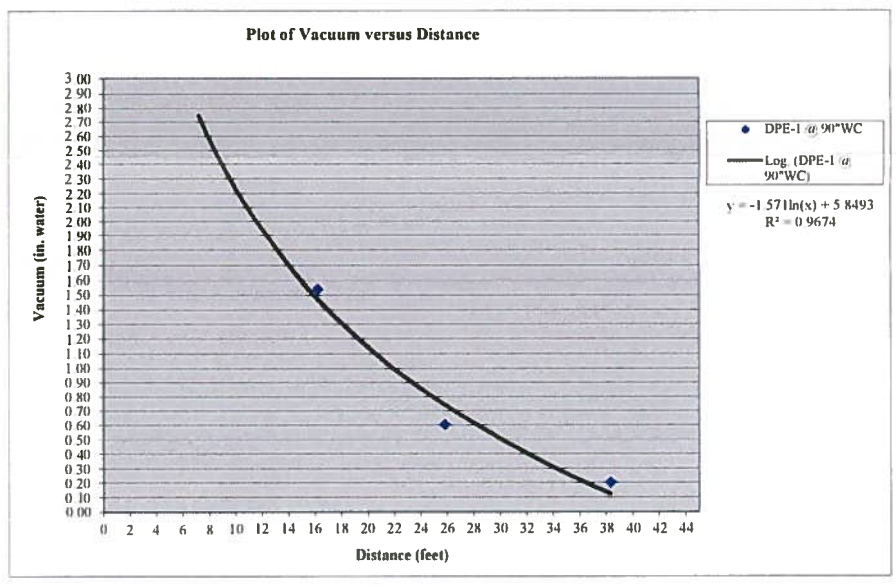


DPE-1 @ 90"WC	Pressure (in. water)	Distance (feet)
Extraction wellhead	90	0
W-1	0.60	25.8
W-2	1.54	16.2
W-3	0.20	38.3

FROM PLOT (EPA)	(1"wc)
slope =	-1.571
intercept =	5.8493
ESTIMATED FIELD ROI =	21.9

FROM PLOT (NMED 3%)	(2.7"wc)
slope =	-1.571
intercept =	5.8493
ESTIMATED FIELD ROI =	7.4

FROM PLOT	(0.1"wc)
slope =	-1.571
intercept =	5.8493
ESTIMATED FIELD ROI =	38.8

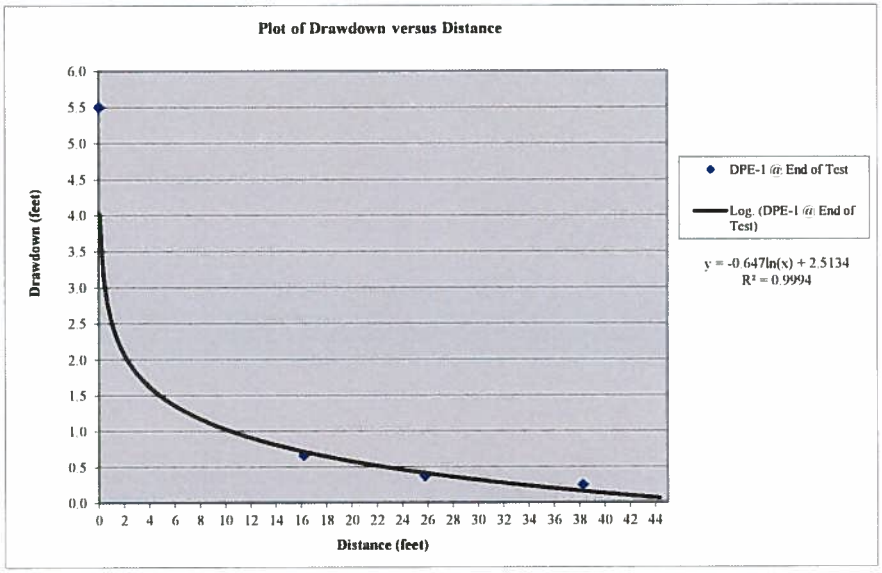


Calculation Sheet
ESTIMATED DRAWDOWN RADIUS OF INFLUENCE

Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project Number:	1404221

DPE-1 @ End of Test	Drawdown (feet)	Distance (feet)
Extraction wellhead	5.5	0
W-1	0.37	25.8
W-2	0.66	16.2
W-3	0.24	38.3

Radial Distance (feet)	Drawdown (feet)
0.1	4.00
0.5	2.96
1	2.51
2	2.06
3	1.80
4	1.62
5	1.47
6	1.35
7	1.25
8	1.17
9	1.09
10	1.02
11	0.96
12	0.91
13	0.85
14	0.81
15	0.76
20	0.58
25	0.43
30	0.31
35	0.21
40	0.13



Calculation Sheet
Soil Permeability (k) Calculations

Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project No:	1404221

	Value entered
	Calculated value
1.01E-02	*Constant*

Test: DPE-1 at 40 inches of water

Extraction Well: (DPE-1, 4" dia, 75 feet total depth, 30-foot screen, pump set at 65 feet BTOC)

Flow Rate =	12.19	scfm	=	5750	cm^3/sec	
Wellhead Vacuum =	40	inches H_2O	=	2.9412	inches Hg	0.9017 atm (absolute)
Well Radius =	2	inches	=	5.08	cm	
Exposed Screen Length =	19.64	feet	=	599	cm	
Atmospheric Pressure =	30.10	inches Hg		1.01	atm	

$$k = \frac{Q_W}{H}\left(\frac{\mu \cdot \ln(R_W/R_I)}{\pi \cdot P_W \cdot (1-(P_{RI}/P_W)^2)}\right)$$

(ref.: from USA Corps of Eng., June 2002)

k = Soil permeability [$cm^2 = 10^8$ Darcys]
Q_W = Extraction well flowrate [cm^3/sec]
H = Extraction well screen length [cm]
μ = Viscosity of air = 0.018 cp (centipoise)
Π = 3.1415 [dimensionless]
P_W = Pressure at extraction well [atm, absolute]
R_W = Radius of extraction well [cm]
R_I = Distance to monitoring well [cm]
P_{RI} = Pressure at monitoring well [atm, absolute]

Well	Screened Interval (ft)	Vacuum at Well (inches H_2O)	Pressure at Well (atm abs)	Distance to Well (ft)	Distance to Well (cm)	Permeability k (Darcys)	Permeability k (cm^2)
W-1	50 - 70	0.36	1.0051	25.8	786	1.26	1.26E-08
W-2	50 - 70	0.88	1.0039	16.2	494	1.16	1.16E-08
W-3	50 - 70	0.17	1.0056	38.3	1167	1.36	1.36E-08

Average Soil Permeability = 1.26 Darcys = 1.26E-08 cm^2

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Calculation Sheet
Soil Permeability (k) Calculations

Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project No:	1404221

	Value entered
	Calculated value
1.01E-02	*Constant*

Test: DPE-1 at 60 inches of water

Extraction Well: (DPE-1, 4" dia, 75 feet total depth, 30-foot screen, pump set at 65 feet BTOC)

Flow Rate =	19.88	scfm	=	9380	cm^3/sec	0.8525	atm (absolute)
Wellhead Vacuum =	60	inches H_2O	=	4.4118	inches Hg		
Well Radius =	2	inches	=	5.08	cm		
Exposed Screen Length =	19.64	feet	=	599	cm		
Atmospheric Pressure =	30.08	inches Hg		1.01	atm		

$$k = \frac{Q_W}{H}\left(\frac{\mu \cdot \ln(R_W/R_I)}{\pi \cdot P_W(1-(P_{RI}/P_W)^2)}\right)$$

(ref.: from USA Corps of Eng., June 2002)

k = Soil permeability [$cm^2 = 10^8$ Darcys]
Q_W = Extraction well flowrate [cm^3/sec]
H = Extraction well screen length [cm]
μ = Viscosity of air = 0.018 cp (centipoise)
Π = 3.1415 [dimensionless]
P_W = Pressure at extraction well [atm, absolute]
R_W = Radius of extraction well [cm]
R_I = Distance to monitoring well [cm]
P_{RI} = Pressure at monitoring well [atm, absolute]

Well	Screened Interval (ft)	Vacuum at Well (inches H_2O)	Pressure at Well (atm abs)	Distance to Well (ft)	Distance to Well (cm)	Permeability k (Darcys)	Permeability k (cm^2)
W-1	50 - 70	0.38	1.0044	25.8	786	1.36	1.36E-08
W-2	50 - 70	1.10	1.0026	16.2	494	1.25	1.25E-08
W-3	50 - 70	0.12	1.0051	38.3	1167	1.46	1.46E-08

Average Soil Permeability = 1.36 Darcys = 1.36E-08 cm^2

Calculation Sheet
Soil Permeability (k) Calculations

Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project No:	1404221

	Value entered
	Calculated value
1.01E-02	*Constant*

Test: DPE-1 at 75 inches of water

Extraction Well: (DPE-1, 4" dia, 75 feet total depth, 30-foot screen, pump set at 65 feet BTOC)

Flow Rate =	21.34	scfm	=	10070	cm^3/sec	
Wellhead Vacuum =	75	inches H_2O	=	5.5147	inches Hg	0.8156 atm (absolute)
Well Radius =	2	inches	=	5.08	cm	
Exposed Screen Length =	19.64	feet	=	599	cm	
Atmospheric Pressure =	30.04	inches Hg		1.00	atm	

$$k = \frac{Q_W}{H}\left(\frac{\mu \cdot \ln(R_W/R_I)}{\pi \cdot P_W \cdot (1-(P_{RI}/P_W)^2)}\right)$$

(ref. from USA Corps of Eng., June 2002)

k = Soil permeability [$cm^2 = 10^8$ Darcys]
Q_W = Extraction well flowrate [cm^3/sec]
H = Extraction well screen length [cm]
μ = Viscosity of air = 0.018 cp (centipoise)
Π = 3.1415 [dimensionless]
P_W = Pressure at extraction well [atm, absolute]
R_W = Radius of extraction well [cm]
R_I = Distance to monitoring well [cm]
P_{RI} = Pressure at monitoring well [atm, absolute]

Well	Screened Interval (ft)	Vacuum at Well (inches H_2O)	Pressure at Well (atm abs)	Distance to Well (ft)	Distance to Well (cm)	Permeability k (Darcys)	Permeability k (cm^2)
W-1	50 - 70	0.37	1.0031	25.8	786	1.16	1.16E-08
W-2	50 - 70	1.10	1.0013	16.2	494	1.06	1.06E-08
W-3	50 - 70	0.09	1.0038	38.3	1167	1.24	1.24E-08

Average Soil Permeability = 1.16 Darcys = 1.16E-08 cm^2

Calculation Sheet
Soil Permeability (k) Calculations

Site Name:	Lovington 66	Designed by:	Matthew C. Crews, PE
Facility ID:	1489	Reviewed by:	Clay Kilmer
Date:	11/3/2015	Project No:	1404221

	Value entered
	Calculated value
1.01E-02	*Constant*

Test: DPE-1 at 90 inches of water

Extraction Well: (DPE-1, 4" dia, 75 feet total depth, 30-foot screen, pump set at 65 feet BTOC)

Flow Rate =	27.95	scfm	=	13190	cm^3/sec	
Wellhead Vacuum =	90	inches H_2O	=	6.6176	inches Hg	0.7788 atm (absolute)
Well Radius =	2	inches	=	5.08	cm	
Exposed Screen Length =	19.64	feet	=	599	cm	
Atmospheric Pressure =	30.02	inches Hg		1.00	atm	

$$k = \frac{Q_W}{H}\left(\frac{\mu \cdot \ln(R_W/R_I)}{\pi \cdot P_W \cdot (1-(P_{RI}/P_W)^2)}\right)$$

(ref.: from USA Corps of Eng., June 2002)

k = Soil permeability [$cm^2 = 10^8$ Darcys]
Q_W = Extraction well flowrate [cm^3/sec]
H = Extraction well screen length [cm]
μ = Viscosity of air = 0.018 cp (centipoise)
Π = 3.1415 [dimensionless]
P_W = Pressure at extraction well [atm, absolute]
R_W = Radius of extraction well [cm]
R_I = Distance to monitoring well [cm]
P_{RI} = Pressure at monitoring well [atm, absolute]

Well	Screened Interval	Vacuum at Well	Pressure at Well	Distance to Well		Permeability k	Permeability k
	(ft)	(inches H_2O)	(atm abs)	(ft)	(cm)	(Darcys)	(cm^2)
W-1	50 - 70	0.60	1.0019	25.8	786	1.24	1.24E-08
W-2	50 - 70	1.54	0.9996	16.2	494	1.14	1.14E-08
W-3	50 - 70	0.20	1.0029	38.3	1167	1.33	1.33E-08

Average Soil Permeability = 1.24 Darcys = 1.24E-08 cm^2

Calculation Sheet
Pilot Study - Flow Rates

Facility Name: Lovington 66	Designed by: Matthew C. Crews, P.E.
Facility ID No.: 1489	Reviewed by: Clay Kilmer
Date: 11/3/2015	Project Number: 1404221

$$\frac{Q}{H} = \pi \frac{k}{\mu} P_w \frac{\left[1-(P_{RI}/P_w)^2\right]}{\ln(R_w/R_I)}$$

(ref.: from USA Corps of Eng., June 2002)

Value entered
Calculated value
1.01E-02 *Constant*

DPE Wells:

		Metric Units		English Units	
K	Hydraulic conductivity	1.200E-03	cm/s	3.4	ft/d
μ_w	Water viscosity	1.01E-02	g/cm-s	0.0101	cp
ρ_w	Water density (at 20C)	9.79E-01	g/cm3		
g	Gravitational acceleration	9.81E+02	cm/s2		
k	Soil intrinsic permeability ($k=K\mu_w/g\rho_w$)	1.26E-08	cm2	1.26	darcy
μ_a	Air viscosity	1.80E-04	g/cm-s	0.018	cp
P_{atm}	Atmospheric pressure ≈ 12.23 psi at 5,000 ft elevation	1.0234E+06	g/cm-s2	1.01	atm
P	Pressure (suction) at the extraction well	112090	g/cm-s2	0.1106	atm
P_w	Absolute pressure in extraction well (Pw=Patm-P)	9.11E+05	g/cm-s2	0.90	atm
P_x	Pressure at radius of influence	3363	g/cm-s2	0.0033	atm
P_{RI}	Absolute pressure at radius of influence (P_{RI} =Patm-Px)	1.0200E+06	g/cm-s2	1.0067	atm
b	Vadose zone thickness	1798.3	cm	59.0	ft
R_I	Radius of influence	304.8	cm	10.0	ft
H'	Unit of length screened	30.5	cm	1.0	ft
H	Total screened length/well	598.6	cm	19.6	ft
R_w	Radius of extraction well	5.08	cm	2.0	in

	in of H_2O	*PSI*	*Kpa*	*in of Hg*	*Atm*	*mmHg*
P_{atm}	410.9	14.8	102.338	30.22	1.010	767.6
P	45.0	1.6	11.209	3.31	0.111	84.1
P_w	365.9	13.2	91.129	26.91	0.899	683.5
P_x	1.35	0.05	0.336	0.10	0.0033	2.5
P_{RI}	409.50	14.79	102.00	30.12	1.0067	765.08

Q/H	Flow rate/unit of length screened		12.34	cm3/s /H'	0.80	cfm / H'
Q	Total flow rate / well		7387	cm3/s	**16**	scfm
		No of wells 1				
Q_{T-th}	Total flow rate		7387	cm3/s	**16**	scfm
		Safety factor 1.25				

Q_{T-sf}	**Total system design flow rate**	*9234*	cm3/s	**20**	**scfm**
		798	m3/d		

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Calculation Sheet
Pilot Study - Flow Rates

Facility Name: Lovington 66	Designed by: Matthew C. Crews, P.E.
Facility ID No.: 1489	Reviewed by: Clay Kilmer
Date: 11/3/2015	Project Number: 1404221

$$\frac{Q}{H} = \pi \frac{k}{\mu} P_w \frac{\left[1-(P_{RI}/P_w)^2\right]}{\ln(R_w/R_I)}$$

(ref.: from USA Corps of Eng., June 2002)

Value entered
Calculated value
1.01E-02 *Constant*

DPE Wells:

		Metric Units		English Units	
K	Hydraulic conductivity	1.200E-03	cm/s	3.4	ft/d
μ_w	Water viscosity	1.01E-02	g/cm-s	0.0101	cp
ρ_w	Water density (at 20C)	9.79E-01	g/cm3		
g	Gravitational acceleration	9.81E+02	cm/s2		
k	Soil intrinsic permeability ($k=K\mu_w/g\rho_w$)	1.26E-08	cm2	1.26	darcy
μ_a	Air viscosity	1.80E-04	g/cm-s	0.018	cp
P_{atm}	Atmospheric pressure ≈ 12.23 psi at 5,000 ft elevation	1.0234E+06	g/cm-s2	1.01	atm
P	Pressure (suction) at the extraction well	112090	g/cm-s2	0.1106	atm
P_w	Absolute pressure in extraction well (Pw=Patm-P)	9.11E+05	g/cm-s2	0.90	atm
P_x	Pressure at radius of influence	3363	g/cm-s2	0.0033	atm
P_{RI}	Absolute pressure at radius of influence (P_{RI} =Patm-Px)	1.0200E+06	g/cm-s2	1.0067	atm
b	Vadose zone thickness	1798.3	cm	59.0	ft
R_I	Radius of influence	457.2	cm	15.0	ft
H'	Unit of length screened	30.5	cm	1.0	ft
H	Total screened length/well	598.6	cm	19.6	ft
R_w	Radius of extraction well	5.08	cm	2.0	in

	in of H_2O	*PSI*	*Kpa*	*in of Hg*	*Atm*	*mmHg*
P_{atm}	410.9	14.8	102.338	30.22	1.010	767.6
P	45.0	1.6	11.209	3.31	0.111	84.1
P_w	365.9	13.2	91.129	26.91	0.899	683.5
P_x	1.35	0.05	0.336	0.10	0.0033	2.5
P_{RI}	409.50	14.79	102.00	30.12	1.0067	765.08

Q/H	Flow rate/unit of length screened		11.23	cm3/s /H'	0.73	cfm / H'
Q	Total flow rate / well		6721	cm3/s	14	scfm
		No of wells 1				
Q_{T-th}	Total flow rate		6721	cm3/s	14	scfm
		Safety factor 1.25				

Q_{T-sf}	**Total system design flow rate**	*8402*	cm3/s	18	**scfm**
		726	m3/d		

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