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August 12, 2016

Mr. Justin Ball
New Mexico Environment Department
Ground Water Quality Bureau
Remediation Oversight Section
121 Tijeras Ave. NE, Suite 1000
Albuquerque, New Mexico 87102

Dear Mr. Ball:

On behalf of Laun-Dry Supply Company, EA Engineering, Science, and Technology, Inc., PBC is submitting the Stage 2 Abatement Plan for Laun-Dry Supply Company located at 1503 12th Street, Albuquerque, New Mexico. Please let me know if you have any questions regarding the information provided in this plan.

Sincerely,

Teri McMillan
Project Manager

Jay Snyder
Senior Hydrogeologist

Enclosure

Cc: Dan March, Laun-Dry Supply Company
Peter V. Domenici, Jr., Esquire, Domenici Law Firm
File

# STAGE 2 ABATEMENT PLAN
# LAUN-DRY SUPPLY COMPANY
# 1503 12TH STREET NW
# ALBUQUERQUE, NEW MEXICO

Prepared for:

Laun-Dry Supply Company
1503 12th Street NW
Albuquerque, New Mexico

Prepared by:

EA Engineering, Science,
and Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
Albuquerque, New Mexico 87102

August 2016

EA Project No. 1506902.01
Revision 01

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EA Project No. 1464103.0002

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# Laun-Dry Supply Company
# 1503 12th Street NW
# Albuquerque, New Mexico

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August 12, 2016
Teri McMillan
Project Manager
Date

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Senior Hydrogeologist
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# 1.0 DESCRIPTION OF CURRENT SITUATION

On behalf of Laun-Dry Supply Company (Laun-Dry), EA Engineering, Science, and Technology, Inc., PBC (EA) has prepared this Stage 2 Abatement Plan for Laun-Dry located at 1503 12th Street NW, Albuquerque, New Mexico.
This plan is organized with the following New Mexico Administrative Code (NMAC) 20.6.2.4106.E and contains the following Sections:

- Section Description of Current Situation
- Assessment of Abatement Option
- Description of Preferred Abatement Option
- Modification of Monitoring Plan
- Reporting and Performance Assessment
- Site Maintenance Activities After Termination of Abatement Activities
- Schedule
- Public Notification; and References.

## 1.1 SITE BACKGROUND

The Laun-Dry facility is located on the northwest corner of 12th Street NW and Aspen Avenue NW in Albuquerque, New Mexico (Figure 1). The Laun-Dry property is approximately 0.5 acre with one building. A railroad spur forms the northwest boundary of the property. The property was developed in approximately 1959 and has been used as a laundry and dry cleaning supply distribution facility. In 1981 an addition was added to the northern portion of the building. There were two above ground storage tanks (ASTs), one 3,500 gallon and one 500 gallon, at Laun-Dry that had contained tetrachloroethene (PCE) (Kleinfelder 2003a). The 3,500 gallon AST was located on the loading dock on the west side of the property and used until late 2002. The location of the 500 gallon AST when it was in use is unknown.

## 1.2 REGULATORY HISTORY

In the 1990's three leaking underground storage tank (LUST) sites were being investigated in the general area of 4th Street and Haines Avenue NW in Albuquerque, New Mexico, approximately 4,000 feet east of Laun-Dry. The three sites were the City of Albuquerque 4th Street Yard located at 4th Street and Aspen, Brewer Oil Gascard Facility located at 306 Haines Street, and Creamland Dairies located at 1911 2nd Street. During the investigation activities at the LUST sites, chlorinated solvents were detected in groundwater. As a result, in 2000, a Preliminary Assessment was conducted by the NMED Ground Water Quality Bureau (GWQB) Superfund Oversight Section to determine the source(s) of the chlorinated solvents. As part of the Assessment, NMED conducted a subsurface soil vapor survey, installed six monitoring wells, and sampled existing monitoring wells within the area of 4th Street and Haines Ave. The Preliminary Assessment did not determine the source(s) of the chlorinated solvents (NMED 2001).

In December 2002, the NMED GWQB installed a soil vapor probe adjacent to the western loading dock at Laun-Dry (Kleinfelder 2003a). Analytical results from the soil vapor probe indicated that elevated concentrations of PCE and trichloroethene (TCE) were present. As a result, Kleinfelder performed a Phase II Limited Site Assessment at Laun-Dry and three

monitoring wells were installed (Kleinfelder 2003b). Analytical results from the subsurface investigation indicated that elevated concentrations of PCE and TCE were present in soil and groundwater. Groundwater concentrations were above the New Mexico Water Quality Control Commission (NMWQCC) standards. As a result of this investigation, in February 2004, the NMED requested that Laun-Dry complete a Stage 1 Abatement Plan to define the extent of groundwater contamination.

Assessment conducted under Stage 1 Abatement began in 2004 and consisted of several phases of investigations at and around Laun-Dry to delineate the extent of the contamination. These investigations included the following:

- Installation of 29 monitoring/observation wells to delineate the extent of groundwater contamination, 3 monitoring/vapor wells and 3 soil vapor extraction (SVE) wells for groundwater sampling and vapor extraction (Figure 2).

- Semi-annual sampling of 44 monitoring wells, 3 soil vapor extraction (SVE) wells, 3 observation wells, and 2 irrigation wells (Table 1).

- Two passive soil gas surveys. One that was completed at Laun-dry and an additional survey completed along the railroad spur, Haines Avenue and 5$^{th}$ Street and select locations along 1$^{st}$ and 2$^{nd}$ Street.

- Direct push boring survey to delineate soil contamination.

- Direct push soil vapor survey.

- Groundwater pumping tests to determine aquifer characteristics.

- SVE pilot test that began in December 2013 with the operation of four SVE wells to remediate soil and solute contamination. The SVE pilot test is presently ongoing with the system operating intermittently to allow for contaminant rebound.

- In-situ bioremediation (ISB) pilot test of three different amendments (lactate, EHC-L, and powdered activated carbon).

- The vapor intrusion (VI) assessment to assess the vapor intrusion pathway at residential properties located east of Laun-Dry in the vicinity of 8$^{th}$ Street, 7$^{th}$ Street, Hannett Avenue, and Aspen Avenue.

A summary of investigation activities, abatement plans, and reports for Laun-Dry that comprise Stage 1 Abatement Plan is provided below.

CHRONOLOGY OF INVESTIGATION ACTIVITIES

| Date | Event |
|---|---|
| July 2003 | Phase I Environmental Site Assessment |
| November 2003 | Phase II Limited Subsurface Site Assessment - Three monitoring wells (MW-1 through MW-3) were installed. |
| September 2004 | GORE™ Soil Gas Survey for Site Assessment and Monitoring Final Report – Fifteen GORE-SORBERS™ were installed at and in the near vicinity of the site. |
| August 2005 | Phase 2, Stage 1 Abatement Plan Investigation – Three wells (MW-4 through MW-6) were installed. |
| May 2006 | Stage 1 Abatement Plan |
| June 2006 | Revised Stage 1 Abatement Plan |
| September 2006 | Stage 1 Abatement Plan Semi - Annual Groundwater Monitoring Report for Wells Sampled 8/21/06 |
| September 2006 | Stage 1 Abatement Plan Vadose Zone Investigation - Six direct push borings (GP-1 through GP-6) were advanced at the Laun-Dry site soil samples, vapor samples and grab groundwater samples were collected. |
| June 2007 | Phase 2, Stage 1Abatement Plan Investigation and Semi-Annual Groundwater Monitoring Report - Eight water table monitoring wells (MW-8 through MW-15) and two deep monitoring wells (MW-14D and MW-15D) were installed. |
| February 2008 | Phase 2, Stage 1 Abatement Plan Semi-Annual Groundwater Monitoring Report |
| September 2008 | Phase 2, Stage 1 Abatement Plan Semi-Annual Groundwater Monitoring Report |
| April 2009 | Phase 2, Stage 1 Abatement Plan Semi-Annual Groundwater Monitoring Report |
| October 2009 | Phase 2, Stage 1 Abatement Plan Semi-Annual Groundwater Monitoring Report |
| June 2010 | Laun-Dry Stage 1 Abatement Plan Phase 6 Quality Assurance Project Plan |
| December 2010 (Revised February 2011 and June 2011) | Phase 6, Stage 1 Abatement Plan Investigation Report Geoprobe Soil Vapor Survey – Twenty direct push borings (G1 through G20) were advanced within the plume area at off-site locations. Soil was field screened and grab groundwater samples were collected. |
| May 2011 | Phase II Stage I Abatement Plan Semi -Annual Groundwater Monitoring |
| June 2011 (Revised September 2011) | Phase 6, Stage 1 Abatement Plan Proposed Task 2 Work Plan |
| June 2012 | Phase 6, Stage 1 Abatement Plan Final Investigation Report Task 2 Monitoring Well Installation and Semi-Annual Groundwater Sampling - Eight water table monitoring wells (MW-6A through MW-6HS) and one deep well (MW-6HD) were installed. |
| December 2012 | Semi -Annual Groundwater Monitoring Report |
| June 2013 | Semi -Annual Groundwater Monitoring Report |

CHRONOLOGY OF INVESTIGATION ACTIVITIES

| Date | Event |
|---|---|
| December 2013 | Final Site Investigation Report - Summarizing current and past activities. Installation of soil vapor extraction wells, completing pump tests, water well inventory and well survey. SVE system started. |
| June 2014 | Additional Site Investigation Work Plan |
| July 2014 | Semi -Annual Groundwater Monitoring Report |
| June 2015 | Additional Site Investigation and Semi-Annual Monitoring Report - Plume delineation with the installation of wells MW-16 through MW-19 and injection associated with *in-situ* groundwater treatment pilot test. |
| September 2015 | Semi -Annual Groundwater Monitoring Report |
| October 2015 | Passive Soil Gas Survey Report |
| November 2015 | Work Plan and Addendum of Sampling and Analysis Plan for Vapor Intrusion and Indoor Air Assessment |
| February 2016 | Vapor Intrusion Assessment |
| March 2016 | *In-Situ* Groundwater Treatment Pilot Test 1-Year Results Report |
| March 2016 | Supplemental Final Site Investigation Report and Semi-Annual Groundwater Monitoring Report (contained herein) |

## 1.3 GEOLOGY AND HYDROLOGY

### 1.3.1 Regional Geology

The physiography of the Albuquerque area is controlled by the Rio Grande rift. Most of Albuquerque area lies on an apron of material eroded from the mountains surrounding the rift axis and deposited within it. Thousands of feet of sediment have consolidated to form a porous zone that stores large quantities of water in the Albuquerque Basin.

According to the United States Geological Service (USGS) (Bartolino and Cole 2002), the major groundwater resource in the Albuquerque, New Mexico, area is the Santa Fe Group Aquifer. The Santa Fe Group aquifer system is divided into three parts: the upper (from less than 1,000 to 1,500 feet thick), middle (from 250 to 9,000 feet thick), and lower (from less than 1,000 to 3,500 feet thick). Much of the lower part has low permeability and poor water quality; thus, groundwater is mostly withdrawn from the upper and middle parts of the aquifer. Only the upper 2,000 feet of the aquifer is typically used for groundwater withdrawal. Groundwater from the Santa Fe Group aquifer system is currently a major source of water for municipal supply, domestic, commercial, and industrial use in the middle Rio Grande Basin.

### 1.3.2 Site Geology

The geology beneath the site consists of unconsolidated sediments grouped into a shallow zone (0 to 50 feet below ground surface [bgs]) and a deep zone beneath the shallow zone. From the ground surface to approximately 50 feet bgs is fine to coarse grained light yellowish brown sand with up to 20% gravel. Interbedded within the sand are thin (generally less than or equal to 5 feet thick) clay, silty clay, and sandy clay intervals. In the medial to distal portion of the plume (in the area of 6th Street and Haines) sand with gravel and cobbles is present at approximately 35 feet bgs. Beneath the shallow zone sand and sand with gravel is fine grained silty sand that is

present to a total depth of 88 feet bgs. Cross-sections depicting the subsurface lithology are included as Figures 3, 4 and 5 (Geologic Cross-section Transects). The location of the transects is shown on Figure 2. Boring Logs are provided in Appendix A.

### 1.3.3 Site Hydrology

Groundwater is present beneath the Site at a depth of approximately 28 feet below ground surface, and the depth to groundwater increases east of the Site as the ground surface elevation increases. Water levels over the course of abatement are provided in Table 2. Hydrographs are provided in Appendix B. Potentiometric surface maps have been completed for the Site throughout the implementation of the Stage 1 Abatement Plan. Figure 6 shows the most recent potentiometric surface map, and the generally east direction of groundwater flow. The hydraulic gradient is approximately 0.005 ft/ft.

Based on single well recovery tests completed at the site, the hydraulic conductivity of the shallow zone of the aquifer beneath the site ranged from a low of 19 feet per day (ft/day) in well MW-4H-06 to a high of 317 ft/day in MW-1. The arithmetic mean hydraulic conductivity for the shallow zone is 138 ft/day, and the geometric mean is 97 ft/day. The hydraulic conductivity in the less permeable deep zone unit that underlies the water table aquifer was 1.7 ft/day in well MW-14D. The calculated groundwater seepage velocity is 1.3 feet per day.

Water levels across the area have been steadily increased by 5 to 6 feet since September 2009. This rising trend is expected to continue as water levels rebound in Albuquerque in response to reduced groundwater withdrawal for water supply.

## 1.4 DISCUSSION OF CONTAMINATION

### 1.4.1 Sources of Contamination

Both soil vapor and soil samples collected at Laun-Dry indicate that sources of contamination are present in the area west of the Laun-Dry building, and in and along the railroad spur or west of the railroad spur. Release mechanisms are believed to include possible drum and aboveground storage tank leaks and known spills during solvent handling, and releases from rail car unloading hoses.

### 1.4.2 Summary of Groundwater Data

PCE and daughter products TCE, cis1,2-dichloroethene (cis1,2-DCE), trans1,2-dichloroethene (trans 1,2-DCE) are present in groundwater at the Site. Groundwater analytical data have been collected from monitoring wells at the site and other nearby sites in the area from 2003 through 2016. The January 2016 PCE, TCE, cis1,2-DCE and trans 1,2-DCE groundwater concentration maps are provided as Figures 7, 8, 9 and 10, respectively. Field measurements of pH, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP), and temperature are provided in Table 3. A summary of historic groundwater analytical results is provided in Table 4. Concentration trend graphs are provided in Appendix C.

#### *1.4.2.1 PCE*

Wells that exceeded the NMWQCC PCE groundwater standard of 20 µg/L are located at Laun-Dry and extend downgradient (easterly) approximately 1,100 feet past well MW-5. January 2016 PCE concentrations across the site range from <1.0 µg/L in up and cross-gradient delineating wells to 190 µg/L in well SVE-1 north of the Laun-Dry building (Figure 7). The upgradient extent of the PCE plume is defined by well MW-16 (<1.0 µg/L).

In general, PCE concentrations continue to decline in the wells located at the Laun-Dry facility at wells that are in close proximity to the SVE system and in areas where the in-situ groundwater treatment pilot test was conducted (e.g. wells MW-1, MW-2, MW-3, MW-4, MW-6A, MW-6B, MW-6C and MW-14.). Current concentrations in well MW-6B are much lower than historic levels.

Laun-Dry area PCE concentration trends appear variable in most wells, but from the start of the SVE system, concentrations have decreased as shown on the trend graph (Appendix C). In the medial portion of the plume, PCE concentrations appear to be relatively stable with the exception of well MW-5, which appears variable. The PCE concentrations within the distal portion of the plume are all below the NMWQCC standard with fluctuating concentrations through time. Concentration trend plots were prepared for PCE for select wells within the Laun-Dry area, medial, and distal portions of the plume, and are provided in Appendix C.

#### *1.4.2.2 TCE*

Wells that exceeded the NMWQCC TCE standard of 100 µg/L are located to the northeast of the Laun-Dry facility, on the Rak's Building Supply (Rak's) property, and further east to well MW-17. The January 2016 TCE concentrations across the site ranged from <1.0 µg/L in up and cross-gradient delineating wells to 1,500 µg/L in well MW-5 located on the east end of the Rak's property. The January 2016 TCE concentrations are depicted on Figure 8. A TCE plume is present from the north-eastern portion of Laun-Dry to well MW-17, where the TCE concentration was 240 µg/L in January 2016. TCE appears persistent, with concentrations in the range of 700 µg/L in groundwater at RayMar-E and RayMar-W, located some 3,000 feet downgradient from the Laun-Dry facility. Site data and past evaluations by NMED indicate that RayMar is the location of another possible source.

Laun-Dry area TCE concentration trends (Appendix C) indicate that TCE concentrations in groundwater are decreasing to stable except in well MW-6A, which has been variable; however, since the in-situ groundwater treatment pilot test, concentrations have been consistently low. Concentrations have been generally decreasing since June 2013 within the medial portion of the TCE plume, except for well MW-6G, which has been relatively stable. TCE concentrations in the distal portion of the plume (MW-17) have been generally increasing; however, concentrations in wells RayMar-E and RayMar-W have been variable and persistently high, providing supporting evidence that an additional source may be present in this area.

#### *1.4.2.3 DCE*

The only other daughter products of PCE that are present in groundwater east of Laun-Dry are cis 1,2-DCE and trans 1,2- DCE. The NMWQCC has no groundwater standards for cis

1,2-DCE or trans 1,2- DCE. Overall, cis 1,2-DCE and trans 1,2- DCE concentrations have remained fairly consistent and are depicted on Figures 9 and 10, respectively. The suspected source of DCE is the dechlorination of TCE; however, the mechanism of dechlorination is not understood at present.

#### *1.4.2.4 Vertical Delineation*

Four deep wells (MW-14D, MW-15D, MW-6H-D and MW-18D) have been installed to delineate the vertical extent of contamination. These wells are located east of Laun-Dry with MW-14D and MW-15D located just downgradient from Laun-Dry east of 12th Street. Well MW-6H-D is located within the medial portion of the plume, and well MW-18D is located in the distal portion of the plume near Broadway Avenue. The groundwater results from these wells are below the NMWQCC standards for PCE and TCE (20 µg/L and 100 µg/L, respectively) with the exception of well MW-6H-D which had a TCE concentration of 110 µg/L during the January 2016 sampling event. MW-6H-D is the shallowest of the vertical delineation wells and reflects concentrations more accurately of the water table wells.

### 1.4.3 Contaminant Fate and Transport

The groundwater plume includes impacts by PCE, TCE and cis 1,2-DCE. This is a well understood PCE degradation pathway via a process known as reductive dechlorination (RDC), which often occurs naturally (i.e. intrinsically) and is capable of being enhanced by injecting various amendments into the groundwater. In the area between 12$^{th}$ Street and 8$^{th}$ Street, significant RDC of PCE to TCE, and in turn TCE to cis 1,2-DCE is occurring. Downgradient of 8$^{th}$ Street, TCE and cis 1,2-DCE seem to be persistent. A possible second release site near the intersection of 4$^{th}$ Street and Haines Avenue NW complicates the interpretation of the TCE distribution in groundwater. Groundwater data, operational history, and the results of the passive soil gas (PSG) survey in 2015 support the theory of a second source of TCE in this area, and it warrants further investigation.

The mass fraction of organic carbon in the aquifer matrix is low, <0.001 (EA 2013), and sorption and retardation of the groundwater contaminants are therefore limited. This along with the possible presence of an additional source(s) would contribute to the apparent significant plume length.

Consideration of such fate and transport characteristics is important in formulating an effective Stage 2 Abatement strategy. Based on the observed intrinsic RDC and the limited sorption and retardation capacity of the aquifer matrix, an abatement approach that retards plume expansion and enhances RDC is desirable.

### 1.4.4 ISB Pilot Test

In January 2015, an ISB pilot test was performed by the injecting three different amendments into the aquifer in January 2015. The following amendments were injected:

- Injection Location 1 - JRW Bioremediation LLC's Wilclear Plus (consisting primarily of sodium lactate that rapidly promotes anaerobic conditions and serves as a source of electron donor needed for RDC)

- Injection Location 2 - PeroxyChem EHC-L, a lecithin-based food grade substrate with organic carbon and organic iron components that promotes both biotic and abiotic (i.e., direct chemical reduction) RDC of chlorinated solvents

- Injection Location 3 - Powdered activated carbon (PAC) was injected in concert with EHC-L to act as a plume retardant via sorption, and to provide surface for bacterial growth to enhance the biotic RDC.

Results of the ISB pilot test are summarized as follows:

- Injection Location 1 - Based on the analytical laboratory concentrations and the field measurements over the course of 1 year, it appears that RDC has occurred as a result of the injection of Wilclear Plus® lactate with Accelerite®. However, RDC was not sustained over the 1 year monitoring period.

- Injection Location 2 - Based on the DO and ORP measurements and the increase in total organic carbon observed in observation wells, Injection Location 2 had favorable conditions for RDC. However, at the 6-month sampling event, PCE had shown an increase from baseline concentrations. This may have occurred because chlorinated ethane reducing bacteria (Dehalococcoides [DHC]) are not abundant. After 1-year PCE and TCE concentrations showed a decrease. The low to slightly moderate level of chlorinated ethene reducing bacteria DHC may indicate why more significant RDC has not occurred.

- Injection Location 3 - It appears the chlorinated ethenes are reducing at Injection Location 3 as a result of the powder activated carbon (PAC) that was injected and not as a result of the EHC-L® since there was no increase in the TOC or any other evidence of RDC. Chlorinated ethenes are reducing due to sorption and retardation as a result of the PAC.

A summary of the ISB pilot test results is provided in the ISB Groundwater Treatment Pilot Test Results 1Year that is provided as Appendix D.

### 1.4.5 Stage 2 Abatement Plan Area Defined

Based on the extent of PCE and TCE in groundwater, the abatement plan area (APA) is significant. The Stage 2 Abatement Plan (S2AP) area extends from 12$^{th}$ Street to Calvary and Sunset Memorial cemeteries to the east (Figure 2). However, evidence of a contributing TCE source near 4$^{th}$ Street and Haines Avenue warrants further subsurface investigation. Such an investigation would better characterize the plume east of 4$^{th}$ Street. Based on the results of the 4$^{th}$ Street and Haines Avenue investigation the S2AP area may change.

### 1.4.6 Groundwater Cleanup Goals

The primary organic compound released was PCE. However, as discussed above, PCE can degrade in the subsurface, whether by natural processes or by an engineered approach such as ISB, to a number of daughter products. These include the following pathways:

- PCE degrades to TCE
- TCE can degrade to cis 1,2-DCE and trans 1,2-DCE
- TCE can degrade to 1,1-DCE
- DCE (all isomers) to vinyl chloride (VC)
- VC to inert compounds (e.g., ethane, methane, carbon dioxide)

PCE, TCE, 1,1-DCE and VC all have 20.6.2.3103 NMAC standards (*Human Health Standards*), and the cleanup goals for these compounds will be as specified in 20.6.2.4103.B.2 NMAC (*Abatement Standards and Requirements*). *Cis* and *trans* 1,2-DCE are listed as *Toxic Pollutants* under (20.6.2.7.WW.49 and 50 NMAC) and shall be cleaned up by 20.6.2.4103.B.1 NMAC. Since no numerical standard is promulgated under Section 3103, cis and trans 1,2-DCE will be cleaned up to respective Tap Water Screening Levels listed in Table A-1 of *New Mexico Environment Department Risk Assessment Guidance for Site Investigations and Remediation* (NMED 2015).

# 2.0 ASSESSMENT OF ABATEMENT OPTIONS

There are various abatement options for chlorinated ethenes groundwater contamination. A discussion of the abatement options, technology and process, effectiveness, implementability, and cost effectiveness are discussed below and summarized in Table 7.

## 2.1 SOURCE AREA SOIL CONTAMINATION ABATEMENT OPTIONS

A soil vapor extraction (SVE) pilot test was conducted at Laun-Dry from December 2013 to present. SVE for volatile organic compounds such as PCE is a presumptive cleanup technology as per EPA (1996). The results of the SVE pilot test have been provided in monitoring reports and in the Supplemental Final Site Investigation Report (FSIR, EA 2016). The SVE pilot test has resulted in substantial soil cleanup in the Laun-Dry source area, and reduction in groundwater concentrations by over 100-fold at several wells. As a result, mitigation of the Laun-Dry source is nearing completion. The performance of SVE pilot test is provided in Table 5. Mass of PCE and TCE removed by the pilot test is provided in Table 6. The SVE pilot test will continue intermittently until groundwater concentrations in the Laun-Dry source area reach NMWQCC standards or a point of diminishing return.

## 2.2 SOLUTE PLUME ABATEMENT OPTIONS

A number of abatement options are suitable to control the plume migration and reduce contaminant concentrations in groundwater. The fact that the contamination in the Laun-Dry area has been substantially abated allows a number of options to be feasible in various portions of the plume. Based on the contaminant fate and transport as discussed in Section 1.4.3 above, the goals of the selected abatement option(s) include:

- Prevent ingestion of groundwater in the APA while the S2AP is being implemented;
- Mitigate plume migration via increased retardation capacity of the aquifer matrix;
- Reduce contaminant mass via reductive dechlorination in high mass portions of the solute plume (i.e., areas several-fold greater than applicable standards); and
- Conduct long-term monitoring in areas of low contaminant mass to ensure plume stability and protectiveness of abatement option.

To achieve these goals, a number of options are appropriate for all or parts of the plume, and these options have been evaluated as shown in Table 7. Advantages and disadvantages of each are discussed below.

### 2.2.1 No Further Action

No further action would require that no action be taken for the solute plume. No further action requires no active remediation and no monitoring of groundwater. No action is not protective, is not in accordance with abatement requirements, and is therefore rejected.

### 2.2.2 Limited Action

Limited action includes institutional controls, engineering controls and long term monitoring. Limited action options are implementable, and two limited actions are selected in the proposed S2AP: (1) New Mexico Office of the State Engineer (OSE) Order proscribing drilling new wells in the solute plume and (2) long term monitoring (LTM).

Engineering controls were not selected principally because they are not necessary. No uncontrolled waste materials exist on site, so restrictions to site entry are not necessary. Soil contamination on the Laun-Dry site has been substantially remediated, so there is no need to isolate waste or prevent infiltration via impermeable cap that must be maintained. Finally, there are currently no known exposures to the solute plume, so point-of-use treatment is not required. Notwithstanding these points, the results of the ongoing vapor intrusion study may require abatement of indoor air (vapor intrusion) pathway, which is typically addressed with an engineered control.

### 2.2.3 Containment

Containment is typically facilitated with vertical barriers which physically restrict groundwater movement, and hydraulically which contains groundwater via pumping and capture. These options are discussed below.

#### *2.2.3.1 Vertical Barriers*

Vertical barriers include slurry walls, sheet piling, and grout curtains. These physical barriers are used to limit and/or eliminate the migration of contaminants in groundwater. However, they are used to isolate source waste areas, not large solute plumes. And because the Laun-Dry source has been substantially abated by the SVE pilot test, the need to isolate source area waste via a vertical barrier is unnecessary. Moreover, the substantial depth to groundwater and the relatively high seepage velocity of the aquifer (1.4 feet per day) render physical barriers expensive and of questionable effectiveness.

#### *2.2.3.2 Hydraulic Containment*

Hydraulic control is viable for containment of large solute plumes, and is typically used where an actual point of exposure (e.g, water supply well, surface water body, etc.) is threatened. Hydraulic containment is achieved by pumping a sufficient rate of well (or wells) discharge to create a capture zone that contains the width of the solute plume. Pumping the groundwater to provide containment is rather straightforward; however, the attendant conveyance of the pumped water, the treatment thereof, and the final discharge of treated groundwater to surface water or returned to the aquifer via injection, is operation and maintenance and energy intensive, and accordingly expensive. In concert, these aggregate activities constitute “pump and treat.”

An inherent problem of pump and treat is design based on capture versus design based on cleanup. Capture, or hydraulic containment, does not necessarily optimize pore volume flushing and plume cleanup. Cleanup designs typically require far more wells, conveyance piping, utility distribution, and higher capacity treatment plants, all with the intent of pumping more pore volumes of affected groundwater in a given time frame. More wells, more conveyance, and

larger treatment plant all exacerbate the expense of hydraulic containment/pump and treat remedies. For these reasons, pump and treat has gained disfavor. And since there are no actual threatened points of exposure at present, hydraulic containment/pump and treat is not selected.

### 2.2.4 Treatment

Treatment of contaminated groundwater can be addressed in situ (in place) or ex situ (typically above grade). In situ treatment typically involves either injection of fluids or gases to facilitate microbially facilitated reactions, or oxidants (i.e., ozone, permanganate, percarbonate, etc.) to directly chemically oxidize contaminants upon contact to less toxic substances. Ex situ treatment, as applied to ground water, involves treating ground water once removed or pumped from the aquifer, so that it is suitable for beneficial reuse, discharge to surface water, or injection back into the aquifer to offset consumptive use from and appropriation perspective.

#### *2.2.4.1 In Situ Treatment*

Over the past two decades, in situ treatment has gained considerable attention and researchers have advanced several remedial technologies and the means of measuring their performance with respect to contaminant destruction. During the latter half of this period, advances in carbon isotope geochemistry and polymerase chain reaction (e.g., DNA testing of bacteria) have provided implicit means of evaluating in situ destruction and availability of suitable bacteria that facilitate the desired contaminant destruction process. In situ approaches can be passive, such as monitored natural attenuation (MNA), where intrinsic processes are occurring which result in contaminant destruction, and active, such as enhanced RDC where groundwater amendments (edible vegetable oil, sodium lactate etc.) and possibly contaminant degrading bacteria (e.g., bioaugmentation) are injected into the treatment zone. The means of measuring performance of either passive or active approaches are similar in many ways (USEPA 1998; USEPA 2000); however, active remediation allows suitable conditions for desired reactions to be manipulated, resulting in enhanced degradation rates and performance.

MNA is the process that includes a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater (USEPA 1999). Within the Laun-Dry solute plume, it is clear that PCE substantially degrades to TCE, as most of the PCE mass is converted to TCE by the time the plume migrates to 8$^{th}$ Street. Additionally, TCE was found to be degrading to cis 1,2-DCE, a favored degradation pathway during RDC (Vogel, et. al., 1987). Therefore, contaminant destruction is naturally occurring. However, the fate of cis-1, 2-DCE is not clear as its dechlorination by-product, vinyl chloride, was largely not detected, and cis-1, 2-DCE concentrations were not accumulating (i. e., no stalling). It is not certain whether abiotic dechlorination plays a role, which directly converts TCE and cis-1, 2-DCE to ethene, by-passing vinyl chloride formation. Thus, the exact mechanisms for this natural RDC in the solute plume are not well understood. Regardless, in areas of lower solute concentrations, LTM and MNA will provide a means of monitoring plume stability, contaminant destruction and dispersion toward attainment of cleanup goals, and ensuring the protectiveness of the proposed abatement option.

In situ treatment can be enhanced by the addition of an electron donor. RDC can be enhanced by injection (via wells or drive points) or placement (in trenched reactive barrier) of electron donor

to lower redox potential and dissolved oxygen, thereby promoting natural biological dechlorination. Bacteria that can reductively dechlorinate PCE, TCE and DCE can be added to the treatment zone once anaerobic conditions have been established in the aquifer.

In addition to the addition of an electron donor, active in situ treatment can be enhanced by addition of activated carbon to the subsurface. Activated carbon can be added by injection of powdered activated carbon that has been impregnated with an electron donor as a slurry such as BOS 100™ (Remediation Products, Inc.), Chemically Oxidized Granular Activated Carbon (COGAC™ – Remington Technologies), or liquid activated carbon such as Plume Stop™ (Regenesis). The goal of activated carbon addition is to increase the fraction of organic carbon of the aquifer matrix, and thereby increase the contaminant retardation coefficient. The injected activated carbon adds growth substrate to facilitate bacterial growth to the aquifer matrix in the case of BOS 100™ and Plume Stop™, and trapping and chemical oxidation of contaminants in the case of COGAC™. The injection of activated carbon retards or stops the plume migration, which in turn can render less aggressive cleanup technologies such as MNA suitable for areas downgradient and peripheral to the PRB and still protective of potential receptors.

Based on the observations of the long-term monitoring and ISB pilot test conducted at the site, activated carbon injection, enhanced RDC, bioaugmentation, and MNA are all selected for inclusion in the preferred abatement option.

#### *2.2.4.2 Ex Situ Treatment*

For groundwater solute plumes, ex situ treatment is required of extracted (pumped) groundwater prior to discharge to surface or groundwater. PCE, TCE and DCE are all sufficiently volatile to air strip or to filter by carbon absorption. Because these technologies are used in concert with pump-and-treat, which is not a selected abatement option, they are not selected and not considered further herein.

# 3.0 DESCRIPTION OF PREFERRED ABATEMENT OPTION

The preferred abatement option for the Laun-Dry solute plume includes the following options:

- Institutional control in the form of an OSE order to prohibit new well installation within the APA;
- Permeable reactive barriers, emplaced via injection of fluids and/or slurries which may include:
    - Activated carbon addition for plume sequestration
    - A groundwater amendments to enhance RDC; and
    - Bioaugmentation as needed to increase dechlorination bacteria populations and enhance RDC.
- Long-term monitoring in all portions of the APA;
- MNA in areas of low solute concentrations but above groundwater standards.

The preceding abatement options are briefly discussed in the following sections.

## 3.1 INSTITUTIONAL CONTROL

Laun-Dry will request NMED GWQB to petition the OSE to draft a State Engineer Order to prohibit construction of a well in the affected water bearing zone. The order will be established in accordance with 19.27.5.13.A. NMAC Rejection of Application, which states:

> *"The state engineer may reject an application for a 72-12-1.1 domestic well permit when the proposed 72-12-1.1 domestic well is to be located in an area where a restriction on the use of water or the drilling of new wells has been imposed by a court. The state engineer may reject an application for a 72-12-1.1 domestic well permit when the proposed 72-12-1.1 domestic well is to be located in an area of water quality concern where a prohibition on or a recommendation against the drilling of new wells has been established by a government entity."*

In this matter, the "area where a restriction on the use of water or the drilling of new wells" shall be the APA as defined in Section 1.3.5. The government entity establishing the prohibition is NMED. Laun-Dry will provide NMED the necessary documents to support the prohibition.

## 3.2 PERMEABLE REACTIVE BARRIER

Permeable reactive barriers (PRBs) can be designed in several ways as described in the Interstate Technology & Research Council's "Permeable Reactive Barrier: Technology Update" document (ITRC 2011). Where groundwater is shallow, they can be excavated with a tracked excavator and reactive materials placed in the trench. "Funnel and gate" reactive barriers are trenched variants that consist of slurry walls that direct groundwater through reactive "gates" that allow reactive material to be removed when spent and replaced. They can also be emplaced with a continuous "one-pass" deep trencher. PRBs can also be emplaced hydraulically, either through

permanent injection wells or by direct push rods with perforated injection tools. The depth to groundwater dictates feasibility of the direct push technique.

The depth to groundwater at the Site is such that trenching technology is infeasible. Therefore, the amendment would have to be placed hydraulically. The previous pilot test injections at the site were facilitated using direct push methods and have therefore been demonstrated to be feasible. Wells are also feasible and provide a means for subsequent injections as needed. Several possible reactants to retard the plume, enhance RDC, and provide suitable bacteria may be injected as discussed below. However, because research continues in the area of donor carbon and activated carbon, the final specification for the amendment will be finalized in the ISB PRB work plan and the Class V Injection Well permit that will be submitted to the NMED GWQB.

### 3.2.1 Activated Carbon Addition

One amendment that may be selected in the PRB is activated carbon. If activated carbon is selected as one of the amendments it will be injected into the groundwater to retard and sequester the solute plume, and to form substrate for microbial growth to facilitate RDC via ISB within the PRB. The activated carbon will provide substrate (i.e. surface area for attachment) for bacterial growth in an aquifer that otherwise is low in natural organic carbon (fraction of organic carbon was <0.001) as measured during S1AP implementation (EA 2013). The high seepage velocities (1.36 feet per day) calculated from pumping test data and hydraulic gradients (EA 2013) across the site also support the concept of "slowing" or sequestering the plume to mitigate expansion.

Powdered activated carbon (PAC) was successfully injected during the ISB pilot test, and is an acceptable candidate as an activated carbon source. It is likely that PAC, if used, would be injected by direct push technology, likely 10-feet on-center (O.C.). A plume transect could require on the order of 20 to 40 direct push points depending upon the alignment. The PAC would be injected through a 3 to 4 foot long injection tool using the top-down technique. The top-down technique using a 4-foot injection tool would consist of advancing the tool to 1 to 5 feet below the water table and injecting the prescribed dose, advancing and injecting 6-10 feet below the groundwater elevation, and so forth until plume thickness is spanned. As the direct push technique is a one-time event, if subsequent injections are needed additional direct push boreholes will be required.

Liquid activated carbon can be injected by direct push technology or hydraulically injected through permanent wells. If injected into wells, the liquid carbon can be hydraulically pulled (i.e., inject in one well and pump from an adjacent well) to achieve a greater effective radius and maintain alignment along the PRB with greater well spacing then otherwise required. This design would include permanent wells along transects and at added cost. However, the permanent wells would facilitate any retreatment of areas.

### 3.2.2 Groundwater Amendment to Enhance Reductive Dechlorination

A variety of carbon donor amendments exist that can be injected into the aquifer to enhance RDC. Most of them provide a form of fermentable organic carbon in a liquid or emulsion. The EHC-L used in the ISB pilot test at Laun-Dry is lecithin-based organic carbon. Lecithin is a group of fatty substances occurring in animal and plant tissues that attract both water and fatty

substances. Other products use emulsified food-grade soy bean oil. Lactate from dairy whey and molasses have also been used. Summaries of several injectable amendments that serve as a source of electron donor and required for RDC are widely documented (USEPA 2000; Stroo and Ward 2010, and several others). Therefore, this S2AP proposes a technology rather than a specific product so that flexibility in amendment specification is available over the course of S2AP implementation. However, specific products for the initial injection along 8$^{th}$ Street are specified. When the abatement plan is approved, an ISB PRB work plan and the Class V Injection Well permit will specify an appropriate electron donor source along with dosing if a carbon donor amendment is selected.

Injecting an organic carbon to the aquifer to be treated supports growth of indigenous bacteria in the groundwater environment. The bacteria feed on carbon, consume DO and other electron acceptors (e.g., iron, nitrate, and sulfate) and reduce the DO content and ORP of the groundwater. The fermentation of the organic carbon results in the formation of volatile fatty acids (VFAs) such as lactic acid, propionic acid and butyric acid. These VFAs serve as electron donors for chlorinated ethene degrading bacteria such as Dehalococcoides sp. (DHC). In general, sufficient organic carbon (electron donor source) must be injected into the groundwater to degrade and collapse the chlorinated ethenes plume at the Site (i.e. reduce PCE, TCE, and DCE that serve as electron acceptors).

When using a carbon donor for the PRB, upgradient groundwater must seep through the reactive zone where contaminants are expected to be dechlorinated. The longevity of organic carbon sources is typically two to three years, so a PRB transect design is based on travel time in groundwater. It is a common practice to rejuvenate the PRB with additional injections when data indicate that the PRB performance is declining due to reagent depletion or saturation. It is important to note that if a PRB is 100 percent efficient, the source of solute to continue contaminating downgradient areas has been eliminated. Typically, attenuation processes begin immediately after emplacement of PRBs. Therefore, and as mentioned above, the performance assessment regimen for the PRB and for MNA share many traits.

### 3.2.3 Bioaugmentation

Bioaugmentation consists of the addition of DHC bacteria to the subsurface groundwater to degrade PCE, TCE and DCE to innocuous by-product ethene. The ISB pilot test data suggested that the DHC population was inadequate, requiring their addition for the PRB abatement option. Typically, bioaugmentation is performed after favorable anaerobic conditions have been created in the aquifer for the bacteria to establish, grown, and flourish. Recommended groundwater conditions for DHC application are D.O. in groundwater reduced to very low levels, and strongly negative redox potential has been achieved. This may favor delivery through injection wells where organic carbon (electron donor) and DHC have been injected on separate days. However, methods for batching the DHC culture with the injection fluids and completing the process in a single step have been developed, rendering the direct push technique still feasible. The DHC culture is available commercially.

## 3.3 LONG-TERM MONITORING

Long-term monitoring will be performed on wells that are below NMWQCC standards. This will ensure the plume is stable and not expanding into areas currently below standards. The

monitoring regimen will be in accordance with Table 8. Wells will be sampled as specified in the approved Quality Assurance Project Plan for the S1AP.

If COC concentrations in well(s) specified for LTM statistically increase to above standards, then they may be moved to the MNA regimen discussed below.

## 3.4 MONITORED NATURAL ATTENUATION

Natural attenuation processes typically occur at most sites, and have been observed at Laun-Dry. PCE has naturally dechlorinated extensively to TCE, and TCE on to DCE to a lesser extent. The degree of dechlorination depends on the types and concentrations of contaminants present and the physical, chemical, and biological characteristics of the soil and groundwater. Natural attenuation processes reduce the potential risk posed by site contaminants in three ways:

- Transformation of contaminant(s) to a less toxic form through destructive processes such as RDC;
- Reduction of contaminant concentrations via dispersion whereby potential exposure levels are reduced; and
- Reduction of contaminant mobility and bioavailability through sorption onto the soil or rock matrix.

MNA is appropriate where it can be demonstrated it is capable of achieving remediation goals within a reasonable timeframe when compared to other technically appropriate alternatives, as stated by the Office of Solid Waste and Emergency Response (OSWER) Directive (USEPA 1999). Based on the OSWER Directive, MNA appears to be appropriate for certain portions of the plume that are at or slightly above standards. In these areas, PCE, TCE and DCE will be reduced through natural attenuation processes such as the RDC observed in the plume, sorption, dispersion, and diffusion.

The MNA monitoring will be performed in accordance with Table 8. Data will be evaluated annually as described under performance assessment discussed in Section 5.2 *Annual Reporting and Performance Assessment*. Approaches for evaluating natural attenuation will utilize the following lines of evidence per USEPA technical protocol (USEPA, 1998):

- Primary Line of Evidence – Involves the evaluation of temporal (i.e., VOC distribution with time) and spatial (i.e., VOC horizontal and lateral distribution) data to assess plume stability and concentration trends.
- Secondary Line of Evidence – Involves the evaluation of geochemical data to help elucidate degradation mechanisms and indirectly support the primary line of evidence for natural attenuation.
- Tertiary Line of Evidence – Involves the evaluation of microbiological, isotopic, or other laboratory data.”

## 3.5 DESIGN OF PROPOSED ABATEMENT OPTION

The design for hydraulic emplacement of the PRB described herein is intentionally flexible to facilitate injection of a variety of amendments. The proposed S2AP PRB includes injection of amendments as follows: (1) adsorption-based activated carbon-based sequestering agent, (2) destruction-based zero valent iron to destroy chlorinated solvents abiotically, (3) groundwater amendment with fermentable organic carbon as a long term electron donor source to facilitate RDC via ISB, and (4) DHC culture (for bioaugmentation to facilitate complete RDC of chlorinated ethenes). Many products are available through the vendors which facilitate these process. Therefore, injection spacing design and means of injection is provided for both direct push techniques and for permanent injection wells to add flexibility and use any suitable amendment. A general schematic of these various means of injection are provided in Figure 11.

### 3.5.1 Injection Well and Direct Push Design

Injection wells will consist of single screened intervals that span the impacted groundwater zone or nested strings that isolate the upper, middle and lower thirds of the impacted zones to control vertical distribution of dosage.

Direct push injections will include advancing narrow rods (1.25 inch) with a 3 or 4 foot long injection tool in a top-down manner that consists of advancing the injection tool (for the 4 foot tool example) from 1 to 5 feet below water table and inject prescribed dose, advance and inject 6-10 feet below water, and so forth until plume thickness is spanned. This is shown schematically in Figure 11.

### 3.5.2 Permeable Reactive Barrier Transect Design

Two PRB areas are proposed as shown in Figure 12. During Year 1 the first PRB transect will be installed along 8$^{th}$ Street and in Year 2 the second transect will be installed in the vicinity of 2$^{nd}$ Street to 5$^{th}$ Street pending outcome of 4$^{th}$ Street and Haines Avenue investigation.

### 3.5.3 Sequencing of Permeable Reactive Barriers

A schedule for implementing the S2AP for the first four years is provided as Figure 13. In Year 1, an amendment consisting of a combination of zero valent iron (ZVI), PeroxyChem's EHC™, DHC culture and Regenesis' PlumeStop™ will be injected along the 8$^{th}$ Street PRB. These amendments were chosen based on the pilot test conducted at the site. During the pilot test EHC-L™, which contains a liquid form of iron, was injected and anaerobic conditions were achieved. EHC™ with DHC was chosen for greater longevity of the ZVI and to degrade chlorinated ethenes concentrations via anaerobic bioremediation. During the pilot test PAC was injected causing the chlorinated ethene concentrations to decrease due to sorption and retardation. Based on these results, PlumeStop™ was selected for better distribution of the activated carbon over PAC. ZVI was selected to be injected as a possible additive with PlumeStop™ for additional abiotic reductive dechlorination. Included in Appendix E are product information sheets.

The EHC™ and DHC will be injected along a portion of the barrier and PlumeStop™ with or without ZVI will be injected within the other portion of the barrier. Injection spacing for the 8$^{th}$

Street PRB is 12 feet on-center as shown on Figure 12. The exact volumes will be a function of initial solvent concentrations entering the barrier at the time of barrier emplacement (i.e., after S2AP approval and Class V Injection Well approval). The data to support this injection specification will be derived from existing monitoring wells and performance assessment wells (4 total) along 8$^{th}$ Street installed as part of this Plan. The 8$^{th}$ Street PRB will be carefully assessed to select the best combination of amendments for Year 2 PRB injection.

Once the S2AP is approved performance assessment wells will be installed (Figure 12), and upgradient wells (MW-5, MW-8, and BIA-E-MW) and performance assessment wells (PA-01 through PA-04) will be sampled. Utilizing the sampling data, the PRB design and implementation will be specified that will include the injection well or direct push design, the amendment makeup, amendment dosage, mixing and injection protocol, and performance assessment monitoring. This will be presented in an ISB PRB work plan and the Class V Injection permit submitted to NMED GWQB.

After the amendment is injected in the PRB proposed for 8$^{th}$ Street a performance assessment will be completed. The progress made by the amendment(s) injected on 8$^{th}$ Street will determine if that amendment or a new amendment will be injected in the 2$^{nd}$ to 5$^{th}$ Street PRB. Subsequent line(s) of injection (i.e., additional PRBs) are optional and their timing and placement will be dependent upon:

- Contaminant reduction noted in response to the 8$^{th}$ Street PRB and the PRB placed in the vicinity of 2$^{nd}$ and 5$^{th}$ Street;
- Results of additional assessment at 5$^{th}$ and Haines near the suspected source of TCE; and
- Future location and magnitude of remaining contaminant mass.

All vendor recommendations and sequencing of products will be detailed in the ISB PRB work plan and final Class V Injection Well permit application.

This plan is specifically written to be flexible so that appropriate amendments (existing and those that will emerge), as well as means and mechanisms of emplacement, can be evaluated over the course of S2AP implementation. Performance assessment of amendments as well as contaminant concentration trends and overall reduction in plume mass is crucial in evaluating the success of amendments already in-place, as well as emerging amendments designed to address deleterious effects that may be observed such as elevated metals, stalling at a daughter compound such as DCE or VC, or inadequate or incomplete dechlorination of PCE or TCE. Regardless of the cause, any alternative amendments will be proposed in an ISB PRB work plan submitted to NMED GWQB.

## 3.6 ACCESS AND ADMINISTRATIVE REQUIREMENTS

In order to implement this plan, EA will require access from the City of Albuquerque, New Mexico Department of Transportation (NMDOT), properties in and around 4$^{th}$ Street and Haines Avenue, and select property owners along the PRB transects.

In order to inject the remediation fluids, a Class V Injection Well Permit (Discharge Plan) will be obtained from the Pollution Prevention Section. The injection points are Underground Injection Control Class V wells by definition, as described in 20.6.2.5002.A.1 NMAC and Section 5002.B.5.d.ii. The Class V Injection Well permit application will specify:

- Injection point coordinates (northings and eastings);
- Injection depth intervals in feet below ground level;
- Mix water volume per injection point; and
- Amendment volume or mass per injection point.

The SVE pilot test obtained source registration from Albuquerque-Bernalillo County Air Quality Control Board in 2014. This registration is current and is being maintained to continue the pilot test.

# 4.0 MODIFICATION OF MONITORING PLAN

The monitoring regimen specified for the S1AP will be modified to facilitate implementation of the S2AP described herein. Specifically, regimens for MNA and performance assessment monitoring near the PRBs are proposed. In addition, redundant LTM wells are proposed to be dropped, and frequency of sampling for select wells are proposed to be reduced.

## 4.1 REVISION OF SAMPLING FREQUENCY

Presently, all Laun-Dry wells and other wells specified in the S1AP sampling plan are sampled semi-annually. It is requested that the sampling frequency for several of the wells be reduced from semi-annually to annually. Table 8 provides a list of the wells and the frequency with which they will be sampled.

## 4.2 DATA GAPS

Additional information is needed within the S2AP area. In the approximate order they need to be addressed, they include:

- Assessment of potential additional source of TCE near 5$^{th}$ Street and Haines;
- Vapor intrusion (indoor air) pathway assessment at select commercial businesses along the plume center line. EA has submitted a work plan to NMED to assess the vapor intrusion pathway at commercial businesses;
- Plume delineation northeast of MW-17;
- Addition of irrigation wells downgradient of MW-17 to the monitoring regimen. These wells will be sampled semi-annually if they are in operation (during the winter months these irrigation wells are not operational).

These data gaps are identified in the Comments on the Final Site Investigation Report, included in Appendix F.

## 4.3 LONG-TERM MONITORING

Long-term monitoring will continue as presently specified in the S1AP and sampling plan. Wells subject to this sampling regimen, as well as sampling frequency, are listed in Table 8.

## 4.4 MONITORED NATURAL ATTENUATION

The objective of MNA sampling is to collect groundwater contaminant, geochemical, and microbial data to provide three lines of evidence in support of natural attenuation. The MNA regimen is specified in Table 8. MNA parameters will include pH, temperature, specific conductance, DO, and ORP measurements. MNA monitoring will be performed semi-annually.

## 4.5 PRB PERFORMANCE MONITORING

The objective of PRB performance assessment sampling is to collect groundwater contaminants, geochemical, and microbial data and evaluate PRB's COCs adsorption and biodegradation characteristics. Performance assessment of the PRB monitoring regimen is specified in Table 8, which includes the number of monitoring wells and sampling frequency. Additional analytes (i.e. dissolved metals, nitrate, sulfate, alkalinity, total organic carbon) and sampling frequency may be added as needed for the performance assessment wells (PA-01, PA-02 and PA-04) directly downgradient of the PRB depending on field parameter measurements. .

Performance assessment will rely on the mass flux technique (ITRC 2010) whereby the reduction in mass flux through a given plume transect downgradient of the PRBs will quantify plume reduction and positive performance. It is anticipated two additional monitoring wells will need to be installed downgradient of PRBs to facilitate the mass flux analysis.

# 5.0 REPORTING AND PERFORMANCE ASSESSMENT

This section provides a summary of reporting requirements and annual performance assessment of the preferred abatement option.

## 5.1 SEMI-ANNUAL MONITORING AND REPORTING

Semi-annual groundwater monitoring will be performed as discussed in Section 4.0 and Table 8 for LTM, MNA, and Performance Assessment Monitoring. The sampling protocol will be as specified in the S1AP modified to accommodate MNA and Performance Assessment as specified in this plan and the ISB PRB work plan. All wells will be gauged semi-annually so that accurate potentiometric surface maps can be prepared.

Installation of the PRB, as well as groundwater monitoring activities and results, will be provided in the first semi-annual monitoring report following PRB installation.

## 5.2 ANNUAL REPORTING AND PERFORMANCE ASSESSMENT

The performance assessment of MNA and PRBs will be reported annually. The performance assessment report will include the semi-annual data, and the following:

- Updated trend plots and summary statistics where appropriate;
- Evaluation of whether total mass of solvent is declining in the solute plume over time;
- Evaluation of trends and protectiveness at monitoring wells located at the margins of the APA;
- General discussion of whether the plan is achieving target cleanup goals through evaluation of declining trends, updated evaluation of decay rates, and estimation of cleanup times;
- Demonstrate the S2AP is performing according to expectations. This will be principally measured by (1) declining solvent plume area, (2) declining solvent mass in solute plume, (3) decreasing contaminant concentration trends for PCE, TCE and DCE, and (4) evaluation of decay rates for PCE, TCE and DCE; and
- The reduction in plume mass downgradient of PRBs will be demonstrated using the mass-flux approach (ITRC 2010) with existing and performance assessment monitoring wells.

## 5.3 CONTINGENCY MEASURES

If it appears that cleanup goals are not being achieved, or that migration of contaminants is adversely impacting receptors, then modification of the abatement plan under 20.6.2.4111 NMAC may be required in areas that are problematic. Laun-Dry may request a modification of the plan under Section 4111.A, or the Secretary may request a modification under Section 4111.B, which states:

> *"If data submitted pursuant to any monitoring requirements specified in the approved abatement plan or other information available to the secretary indicates that the abatement action is ineffective, or is creating unreasonable injury to or interference with health, welfare, environment or property, the secretary may require a responsible person to modify an abatement plan within the shortest reasonable time so as to effectively abate water pollution which exceeds the standards and requirements set forth in Section 20.6.2.4103 NMAC, and to abate and prevent unreasonable injury to or interference with health, welfare, environment or property".*

If it appears overall that the S2AP is not protective or is not achieving cleanup goals, then modification of the abatement plan may be required. However, as long as the PRBs are demonstrated to be effective, the plan as written is flexible and provides the means and methods to apply the concept along additional transects or in problematic areas where decay and attenuation of concentrations may be limited. This flexibility allows these actions to be taken without modification of the plan.

# 6.0 SITE MAINTENANCE ACTIVITIES AFTER TERMINATION OF ABATEMENT ACTIVITIES

Once the Stage 2 Abatement activities have concluded (including successful LTM), all Laun-Dry remediation and monitoring wells will be plugged and abandoned as required by the New Mexico Office of the State Engineer. The SVE system will be dismantled and conveyance lines removed or grouted in-place.

# 7.0 SCHEDULE

Key deliverables and activities for implementing this Stage 2 Abatement Plan are provided in the schedule shown as Figure 3. The schedule provides abatement and reporting activities for ten years.

# 8.0 PUBLIC NOTIFICATION

Within 30 days of submittal of Revision 01 of this Stage 2 Abatement Plan, EA, on behalf of Laun-Dry EA will submit proof to NMED that all applicable provisions of the public notice requirements of NMAC 20.6.2.4108. B NMAC, have been met. This includes the following:

1. Publication of a notice in a newspaper of general circulation in the area of the site (Albuquerque Journal). The notice will be in English and Spanish.

2. The notice will be mailed to persons who have requested notifications as identified by NMED.

3. The notice will be mailed to a bilingual radio station (KANW) serving the Albuquerque area with a request that it be aired as a public service announcement.

4. Notification will been sent by certified mail to the New Mexico Office of the Natural Resources Trustee and the local state, and federal government as identified by NMED.

5. Notification will be provided by mailing the written notice to owners and residents of surface property located within one (1) mile of the perimeter of the sites where ground water standards are exceeded. The notification will be in English and Spanish.

6. Notification by mail to the Governor or President of each Indian Tribe, Pueblo or Nation within the state of New Mexico.

Public notice plan for the Site and the written notices are provided in Appendix G.

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# TABLES

# TABLE 1. WELL CONSTRUCTION DETAILS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well | Date Installed | Type | Site | Northing[1] | Easting[1] | Casing Diameter (inches) | Top of Casing (feet amsl) | Total Depth (feet bgs) | Screen Interval (feet bgs) |
|---|---|---|---|---|---|---|---|---|---|
| Laun-Dry Monitoring Wells | | | | | | | | | |
| MW-1 | 9/24/2003 | Water Table Well | Laun-Dry | 1492872.54 | 1518256.58 | 2 | 4962.52 | 45.5 | 30 - 45 |
| MW-2 | 9/24/2003 | Water Table Well | Laun-Dry | 1492895.82 | 1518416.13 | 2 | 4962.03 | 45.5 | 30 - 45 |
| MW-3 | 9/25/2003 | Water Table Well | Laun-Dry | 1492988.82 | 1518388.45 | 2 | 4963.10 | 43 | 28 - 43 |
| MW-4 | 6/20/2005 | Water Table Well | Laun-Dry | 1492991.23 | 1518598.49 | 2 | 4961.27 | 43 | 28 - 43 |
| MW-5 | 6/20/2005 | Water Table Well | Laun-Dry | 1493006.21 | 1519335.79 | 2 | 4961.54 | 43 | 28 - 43 |
| MW-6 | 6/20/2005 | Water Table Well | Laun-Dry | 1492872.54 | 1518443.59 | 2 | 4962.75 | 43 | 28 - 43 |
| MW-6A | 3/19/2012 | Water Table/Vapor Well | Laun-Dry | 1492965.59 | 1518408.39 | 4 | 4962.65 | 48 | 10 - 30 and 43 - 48 |
| MW-6B | 3/20/2012 | Water Table/Vapor Well | Laun-Dry | 1492985.87 | 1518344.45 | 4 | 4961.48 | 48 | 10 - 30 and 43 - 48 |
| MW-6C | 3/21/2012 | Water Table/Vapor Well | Laun-Dry | 1493011.46 | 1518549.65 | 4 | 4960.78 | 45 | 8 - 28 and 40 - 45 |
| MW-6D | 3/26/2012 | Water Table Well | Laun-Dry | 1493220.50 | 1519327.32 | 2 | 4961.68 | 43 | 23-43 |
| MW-6E | 3/23/2012 | Water Table Well | Laun-Dry | 1493215.95 | 1519719.48 | 2 | 4963.54 | 45 | 30-45 |
| MW-6F | 3/23/2012 | Water Table Well | Laun-Dry | 1493428.38 | 1519879.10 | 2 | 4963.27 | 45 | 25-45 |
| MW-6G | 3/26/2012 | Water Table Well | Laun-Dry | 1492938.36 | 1520252.21 | 2 | 4963.65 | 43 | 23-43 |
| MW-6HS | 3/22/2012 | Nested Water Table Well | Laun-Dry | 1492889.50 | 1520897.30 | 2 | 4961.95 | 44 | 29-44 |
| MW-6HD | 3/22/2012 | Nested Deep Well | Laun-Dry | 1492889.50 | 1520897.30 | 2 | 4962.23 | 54 | 49-54 |
| MW-8 | 5/9/2007 | Water Table Well | Laun-Dry | 1493135.09 | 1519404.72 | 2 | 4962.84 | 51 | 31 - 46 |
| MW-9 | 5/9/2007 | Water Table Well | Laun-Dry | 1493231.12 | 158598.22 | 2 | 4965.01 | 51 | 31 - 46 |
| MW-10 | 4/23/2007 | Water Table Well | Laun-Dry | 1492504.37 | 1518895.37 | 2 | 4962.11 | 48 | 33 - 48 |
| MW-11 | 4/16/2007 | Water Table Well | Laun-Dry | 1492736.75 | 1518512.71 | 2 | 4961.56 | 45 | 30 - 45 |
| MW-12 | 4/23/2007 | Water Table Well | Laun-Dry | 1493206.94 | 1518734.96 | 2 | 4964.89 | 53 | 33 - 48 |
| MW-14S | 4/19/2007 | Water Table Well | Laun-Dry | 1492976.53 | 1518700.04 | 2 | 4960.57 | 48 | 33 - 45 |
| MW-14D | 4/19/2007 | Deep Well | Laun-Dry | 1492983.41 | 1518679.64 | 2 | 4960.71 | 88 | 78 - 83 |
| MW-15S | 4/24/2007 | Water Table Well | Laun-Dry | 1492936.04 | 1518860.35 | 2 | 4961.34 | 48 | 33 - 45 |
| MW-15D | 5/8/2007 | Deep Well | Laun-Dry | 1492941.22 | 1518850.93 | 2 | 4960.90 | 78 | 68 -73 |
| MW-16 | 12/11/2014 | Water Table Well | Laun-Dry | 1492861.47 | 1518127.50 | 2 | 4961.54 | 43 | 23 -43 |
| MW-17 | 12/9/2014 | Water Table Well | Laun-Dry | 1493517.82 | 1523062.79 | 2 | 4968.84 | 70 | 50 -70 |
| MW-18S | 12/16/2014 | Water Table Well | Laun-Dry | 1492985.72 | 1523191.98 | 2 | 4971.29 | 72 | 52 -72 |
| MW-18D | 1/16/2015 | Deep Well | Laun-Dry | 14929885.17 | 1523201.02 | 4 | 4971.13 | 187.5 | 180-185 |
| MW-19 | 12/11/2014 | Water Table Well | Laun-Dry | 1492086.91 | 1522968.77 | 2 | 4963.78 | 65 | 45 -65 |
| OB-1 | 12/17/2014 | Observation Well | Laun-Dry | 1493034.23 | 1518416.61 | 2 | 4963.52 | 49 | 29 -49 |

# TABLE 1. WELL CONSTRUCTION DETAILS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well | Date Installed | Type | Site | Northing[1] | Easting[1] | Casing Diameter (inches) | Top of Casing (feet amsl) | Total Depth (feet bgs) | Screen Interval (feet bgs) |
|---|---|---|---|---|---|---|---|---|---|
| OB-2 | 12/17/2014 | Observation Well | Laun-Dry | 1493010.03 | 1518559.68 | 2 | 4961.92 | 49 | 29 -49 |
| OB-3 | 1/27/2015 | Observation Well | Laun-Dry | 1492974.24 | 1518709.47 | 2 | 4961.07 | 49 | 29 - 49 |
| SVE-1 | 9/4/2013 | Vapor Extraction Well | Laun-Dry | 1492963.47 | 1518419.42 | 2 | 4962.95 | 40 | 10 - 40 |
| SVE-2 | 9/6/2013 | Vapor Extraction Well | Laun-Dry | 1493032.97 | 1518426.49 | 2 | 4963.25 | 39 | 9 - 39 |
| SVE-3 | 9/4/2013 | Vapor Extraction Well | Laun-Dry | 1492929.44 | 1518287.81 | 2 | 4961.91 | 40 | 10 - 40 |
| Various Other Site Monitoring Wells | | | | | | | | | |
| BIA-MW-1 | 6/17/1999 | Water Table Well | BIA SPA Maintenance Yard | 1493278.79 | 1519248.30 | 3/4 | 4961.82 | 45 | Unknown |
| BIA-MW-3 | 6/17/1999 | Water Table Well | BIA SPA Maintenance Yard | 1493411.10 | 1519100.76 | 2 | 4964.28 | 45 | Unknown |
| New BIA-E-MW | Unknown | Unknown | BIA SPA Maintenance Yard | 1493196.02 | 1519433.06 | 2 | 4962.98 | ? | Unknown |
| BG-BMW-1 | 11/4/1992 | Water Table Well | PSTB State Lead | Destroyed | | 2 | | 47 | 37 - 47 |
| BG-BMW-8 | 7/28/1993 | Water Table Well | PSTB State Lead | 1492831.97 | 1521600.76 | 2 | 4960.97 | 47 | 37 - 47 |
| BG-BMW-9 | 7/29/1993 | Plugged and Abandoned | PSTB State Lead | NA | NA | NA | NA | 47 | 37 - 47 |
| BG-BMW-12 | 8/3/1993 | Water Table Well | PSTB State Lead | 1492946.04 | 152191.41 | 2 | 4961.89 | 47 | 37 - 47 |
| Catholic Cemetery Well North | 2/7/2003 | Irrigation Well | Catholic Cemetary Association | NM | NM | 12 | Unknown | 290 | 230 - 270 |
| Catholic Cemetery Well South | 2/7/2003 | Irrigation Well | Catholic Cemetary Association | NM | NM | 12 | Unknown | 290 | 230 - 270 |
| CHMW- E | 10/1/1997 | Water Table Well | Childers Manufacturing Facility | 1493521.74 | 1520938.70 | 2 | 4962.33 | 53 | 38 - 53 |
| NI-MW-2 | Unknown | Unknown | Haines and 7th Street | 1493125.60 | 1520049.81 | 2 | 4962.74 | 43.6 | Unknown |
| RayMar-W | Unknown | Unknown | Ray's Automotive and Machine Shop | 1493133.53 | 1521195.91 | 2 | 4962.78 | 58.4 | Unknown |
| RayMar-E | Unknown | Unknown | Ray's Automotive and Machine Shop | 1493130.46 | 1521306.83 | 2 | 4962.94 | 51.6 | Unknown |
| CA-FSY-14 | Unknown | Water Table Well | City of Albuquerque 4th Street Yard | 1492635.52 | 1520970.42 | 2 | 4962.78 | 48 | Unknown |
| MW-4H-01 | 6/28/2000 | Water Table Well | NMED Superfund | 1492661.55 | 1520401.76 | 2 | 4962.90 | 56 | 36 - 56 |
| MW-4H-02 | 6/26/2000 | Water Table Well | NMED Superfund | 1492458.91 | 1520137.72 | 2 | 4962.73 | 56 | 36 - 56 |
| MW-4H-03 | 6/26/2000 | Water Table Well | NMED Superfund | Destroyed | | | | 56 | 36 - 56 |
| MW-4H-04 | 6/27/2000 | Water Table Well | NMED Superfund | 1493078.70 | 1519875.46 | 2 | 4963.00 | 55 | 35 - 55 |
| MW-4H-06 | 6/28/2000 | Water Table Well | NMED Superfund | 1493016.51 | 1521058.02 | 2 | 4961.16 | 58 | 38 - 58 |
| SBM-1 | 1991 | Deep Well | City of Albuquerque | 1492887.91 | 1524401.46 | 4 | 4995.03 | 150 | 135 - 145 |
| SBM-2 | 1991 | Water Table Well | City of Albuquerque | 1492885.10 | 1524417.29 | 4 | 4995.61 | 96 | 71 - 91 |

# TABLE 1. WELL CONSTRUCTION DETAILS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well | Date Installed | Type | Site | Northing[1] | Easting[1] | Casing Diameter (inches) | Top of Casing (feet amsl) | Total Depth (feet bgs) | Screen Interval (feet bgs) |
|---|---|---|---|---|---|---|---|---|---|
| Menaul School | Unknown | Irrigation Well | Menaul School | NM | NM | Unkown | Unknown | Unknown | Unknown |
| Sunset Memorial Cemetery - Hand Pump Well | Unknown | Irrigation Well | Sunset Memorial Cemetery | NM | NM | Unkown | Unknown | Unknown | Unknown |
| Sunset Memorial Cemetery[2] | 1980 | Irrigation Well | Sunset Memorial Cemetery | NM | NM | 12 | NM | 284 | 207 - 247 & 246 - 268 |
| Sunset Memorial Cemetery[2] | 1990 | Irrigation Well | Sunset Memorial Cemetery | NM | NM | 10 | NM | 325? | 220 - 260 & 300 - 320 |

NOTES:

[1] = NM State Plane Coordinates (NAD 83/ NAVD 88). Nested wells MW-6HD and MW-6HS were not distinguished in the survey data.

Screen interals for MW-1, MW-4H-01, and MW-4H-06 were estimated based on the total depth measured during pump test activities.

2 = These two Sunset Memorial Cemetery Wells are tied together.

amsl = above mean sea level

bgs = below ground surface

BIA = Bureau of Indian Affairs

NA = not applicable

NM = Not Measured

NMED = New Mexico Environment Department

PSTB = Petroleum Storage Tank Bureau

SPA = Southern Pueblos Agency

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| Laun-Dry Monitoring Wells | | | | | | |
| MW-1 | 1/13/2016 | 1492872.54 | 1518256.58 | 4962.52 | 27.22 | 4935.30 |
| | 6/29/2015 | | | | 27.89 | 4934.63 |
| | 12/29/2014 | | | | 28.36 | 4934.16 |
| | 6/17/2014 | | | | 28.65 | 4933.87 |
| | 12/17/2013 | | | | 29.01 | 4933.51 |
| | 6/5/2013 | | | | 29.32 | 4933.20 |
| | 12/5/2012 | | | | 29.73 | 4932.79 |
| | 4/5/2012 | | | | 29.93 | 4932.59 |
| | 4/1/2011 | | | | 30.77 | 4931.75 |
| | 9/2/2009 | | | | 32.67 | 4929.85 |
| | 1/27/2009 | | | | 32.39 | 4930.13 |
| | 7/1/2008 | | | | 32.34 | 4930.18 |
| | 12/19/2007 | | | | 32.02 | 4930.50 |
| | 5/17/2007 | | | | 31.78 | 4930.74 |
| | 2/3/2006 | | | | 31.73 | 4930.79 |
| | 6/23/2005 | | | | 31.07 | 4931.45 |
| MW-2 | 1/13/2016 | 1492895.82 | 1518416.13 | 4962.03 | 27.16 | 4934.87 |
| | 6/29/2015 | | | | 27.83 | 4934.20 |
| | 12/29/2014 | | | | 28.30 | 4933.73 |
| | 6/17/2014 | | | | 28.60 | 4933.43 |
| | 12/17/2013 | | | | 28.96 | 4933.07 |
| | 6/5/2013 | | | | 29.28 | 4932.75 |
| | 12/5/2012 | | | | 29.70 | 4932.33 |
| | 4/5/2012 | | | | 29.90 | 4932.13 |
| | 4/1/2011 | | | | 30.73 | 4931.30 |
| | 9/2/2009 | | | | 32.63 | 4929.40 |
| | 1/27/2009 | | | | 32.33 | 4929.70 |
| | 7/1/2008 | | | | 32.33 | 4929.70 |
| | 12/19/2007 | | | | 31.99 | 4930.04 |
| | 5/17/2007 | | | | 31.68 | 4930.35 |
| | 2/3/2006 | | | | 31.70 | 4930.33 |
| | 6/23/2005 | | | | 31.08 | 4930.95 |
| MW-3 | 1/13/2016 | 1492988.11 | 1518388.45 | 4963.10 | 28.18 | 4934.92 |
| | 6/29/2015 | | | | 28.82 | 4934.28 |
| | 12/29/2014 | | | | 29.32 | 4933.78 |
| | 6/17/2014 | | | | 29.60 | 4933.50 |
| | 12/17/2013 | | | | 29.98 | 4933.12 |
| | 6/5/2013 | | | | 30.30 | 4932.80 |
| | 12/5/2012 | | | | 30.71 | 4932.39 |
| | 4/5/2012 | | | | 30.91 | 4932.19 |
| | 4/1/2011 | | | | 31.78 | 4931.32 |
| | 9/2/2009 | | | | 33.68 | 4929.42 |
| | 1/27/2009 | | | | 33.20 | 4929.90 |
| | 7/1/2008 | | | | 33.24 | 4929.86 |
| | 12/19/2007 | | | | 33.02 | 4930.08 |
| | 5/17/2007 | | | | 32.70 | 4930.40 |
| | 2/3/2006 | | | | 32.73 | 4930.37 |
| | 6/23/2005 | | | | 32.10 | 4931.00 |
| MW-4 | 1/13/2016 | 1492991.23 | 1518598.49 | 4961.27 | 26.90 | 4934.37 |
| | 6/29/2015 | | | | 27.58 | 4933.69 |
| | 12/29/2014 | | | | 28.07 | 4933.20 |
| | 6/17/2014 | | | | 28.40 | 4932.87 |
| | 12/17/2013 | | | | 28.80 | 4932.47 |
| | 6/5/2013 | | | | 29.13 | 4932.14 |
| | 12/5/2012 | | | | 29.59 | 4931.68 |
| | 4/5/2012 | | | | 29.81 | 4931.46 |
| | 4/1/2011 | | | | 30.42 | 4930.85 |
| | 9/2/2009 | | | | 32.76 | 4928.51 |
| | 1/27/2009 | | | | 32.43 | 4928.84 |
| | 7/1/2008 | | | | 32.47 | 4928.80 |
| | 12/19/2007 | | | | 32.90 | 4928.37 |
| | 5/17/2007 | | | | 31.74 | 4929.53 |
| | 2/3/2006 | | | | 31.76 | 4929.51 |
| | 6/23/2005 | | | | 31.15 | 4930.12 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-5 | 1/13/2016 | 1493006.21 | 1519335.79 | 4961.54 | 28.84 | 4932.70 |
| | 6/29/2015 | | | | 29.58 | 4931.96 |
| | 12/29/2014 | | | | 30.12 | 4931.42 |
| | 6/17/2014 | | | | 30.56 | 4930.98 |
| | 12/17/2013 | | | | 31.05 | 4930.49 |
| | 6/5/2013 | | | | 31.40 | 4930.14 |
| | 12/5/2012 | | | | 31.90 | 4929.64 |
| | 4/3/2012 | | | | 32.20 | 4929.34 |
| | 3/31/2011 | | | | 33.05 | 4928.49 |
| | 9/2/2009 | | | | 35.18 | 4926.36 |
| | 1/27/2009 | | | | Damaged. Not Measured | |
| | 7/1/2008 | | | | Damaged. Not Measured | |
| | 12/19/2007 | | | | Damaged. Not Measured | |
| | 5/17/2007 | | | | 33.74 | 4927.80 |
| | 2/3/2006 | | | | 33.77 | 4927.77 |
| | 6/23/2005 | | | | 33.29 | 4928.25 |
| MW-6 | 1/13/2016 | 1493050.00 | 1518443.59 | 4962.75 | 27.86 | 4934.89 |
| | 6/29/2015 | | | | 28.53 | 4934.22 |
| | 12/29/2014 | | | | 29.02 | 4933.73 |
| | 6/17/2014 | | | | 29.35 | 4933.40 |
| | 12/17/2013 | | | | 29.71 | 4933.04 |
| | 6/5/2013 | | | | 30.05 | 4932.70 |
| | 12/5/2012 | | | | 30.46 | 4932.29 |
| | 4/5/2012 | | | | 30.68 | 4932.07 |
| | 4/1/2011 | | | | 31.54 | 4931.21 |
| | 9/2/2009 | | | | 33.49 | 4929.26 |
| | 1/27/2009 | | | | 33.20 | 4929.55 |
| | 7/1/2008 | | | | 33.16 | 4929.59 |
| | 12/19/2007 | | | | 32.81 | 4929.94 |
| | 5/17/2007 | | | | 32.51 | 4930.24 |
| | 2/3/2006 | | | | 32.53 | 4930.22 |
| | 6/23/2005 | | | | 31.89 | 4930.86 |
| MW-6A | 1/13/2016 | 1492965.59 | 1518408.29 | 4962.65 | 27.75 | 4934.90 |
| | 6/29/2015 | | | | 28.40 | 4934.25 |
| | 12/29/2014 | | | | 28.90 | 4933.75 |
| | 6/17/2014 | | | | 29.18 | 4933.47 |
| | 12/17/2013 | | | | 29.54 | 4933.11 |
| | 6/5/2013 | | | | 29.88 | 4932.77 |
| | 12/5/2012 | | | | 30.29 | 4932.36 |
| | 4/5/2012 | | | | 30.47 | 4932.18 |
| MW-6B | 1/13/2016 | 1492985.86 | 1518344.45 | 4961.48 | 26.35 | 4935.13 |
| | 6/29/2015 | | | | 27.02 | 4934.46 |
| | 12/29/2014 | | | | 27.50 | 4933.98 |
| | 6/17/2014 | | | | 27.79 | 4933.69 |
| | 12/17/2013 | | | | 28.17 | 4933.31 |
| | 6/5/2013 | | | | 28.50 | 4932.98 |
| | 12/5/2012 | | | | 28.91 | 4932.57 |
| | 4/5/2012 | | | | 29.12 | 4932.36 |
| MW-6C | 1/13/2016 | 1493011.46 | 1518549.65 | 4960.78 | 26.23 | 4934.55 |
| | 6/29/2015 | | | | 26.90 | 4933.88 |
| | 12/29/2014 | | | | 27.40 | 4933.38 |
| | 6/17/2014 | | | | 27.72 | 4933.06 |
| | 12/17/2013 | | | | 28.12 | 4932.66 |
| | 6/5/2013 | | | | 28.44 | 4932.34 |
| | 12/5/2012 | | | | 28.89 | 4931.89 |
| | 4/5/2012 | | | | 29.13 | 4931.65 |
| MW-6D | 1/13/2016 | 1493220.50 | 1519327.32 | 4961.68 | 29.06 | 4932.62 |
| | 6/29/2015 | | | | 29.81 | 4931.87 |
| | 12/29/2014 | | | | 30.41 | 4931.27 |
| | 6/17/2014 | | | | 30.84 | 4930.84 |
| | 12/17/2013 | | | | 31.31 | 4930.37 |
| | 6/5/2013 | | | | 31.65 | 4930.03 |
| | 12/5/2012 | | | | 32.20 | 4929.48 |
| | 4/4/2012 | | | | 32.44 | 4929.24 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-6E | 1/13/2016 | 1493215.95 | 1519879.10 | 4963.54 | 32.22 | 4931.32 |
| | 6/29/2015 | | | | 32.98 | 4930.56 |
| | 12/29/2014 | | | | 33.57 | 4929.97 |
| | 6/17/2014 | | | | 34.08 | 4929.46 |
| | 12/17/2013 | | | | 34.60 | 4928.94 |
| | 6/5/2013 | | | | 34.95 | 4928.59 |
| | 12/5/2012 | | | | 35.50 | 4928.04 |
| | 4/4/2012 | | | | 35.80 | 4927.74 |
| MW-6F | 1/13/2016 | 1493428.38 | 1519879.10 | 4963.27 | 32.49 | 4930.78 |
| | 6/29/2015 | | | | 33.27 | 4930.00 |
| | 12/29/2014 | | | | 33.85 | 4929.42 |
| | 6/17/2014 | | | | 34.36 | 4928.91 |
| | 12/17/2013 | | | | 34.87 | 4928.40 |
| | 6/5/2013 | | | | 35.18 | 4928.09 |
| | 12/5/2012 | | | | 35.75 | 4927.52 |
| | 4/3/2012 | | | | 36.05 | 4927.22 |
| MW-6G | 1/15/2016 | 1492938.36 | 1520252.21 | 4963.65 | 34.07 | 4929.58 |
| | 6/29/2015 | | | | Inaccessable. Not Measured | |
| | 12/29/2014 | | | | 35.57 | 4928.08 |
| | 6/19/2014 | | | | 36.41 | 4927.24 |
| | 12/17/2013 | | | | Inaccessable. Not Measured | |
| | 6/5/2013 | | | | 36.95 | 4926.70 |
| | 12/5/2012 | | | | Inaccessable. Not Measured | |
| | 4/4/2012 | | | | 37.83 | 4925.82 |
| MW-6H-S | 1/13/2016 | 1492889.50 | 1520897.30 | 4961.95 | 34.87 | 4927.08 |
| | 6/29/2015 | | | | 35.67 | 4926.28 |
| | 12/29/2014 | | | | 36.44 | 4925.51 |
| | 6/17/2014 | | | | 36.90 | 4925.05 |
| | 12/17/2013 | | | | 37.68 | 4924.27 |
| | 6/5/2013 | | | | 37.85 | 4924.10 |
| | 12/5/2012 | | | | 38.69 | 4923.26 |
| | 4/3/2012 | | | | 38.88 | 4923.07 |
| MW-6H-D | 1/13/2016 | 1492889.50 | 1520897.30 | 4962.23 | 35.20 | 4927.03 |
| | 6/29/2015 | | | | 36.00 | 4926.23 |
| | 12/29/2014 | | | | 36.77 | 4925.46 |
| | 6/17/2014 | | | | 37.22 | 4925.01 |
| | 12/17/2013 | | | | 38.02 | 4924.21 |
| | 6/5/2013 | | | | 38.19 | 4924.04 |
| | 12/5/2012 | | | | 39.00 | 4923.23 |
| | 4/3/2012 | | | | 39.18 | 4923.05 |
| MW-8 | 1/13/2016 | 1493135.09 | 1519404.72 | 4962.84 | 29.95 | 4932.89 |
| | 6/29/2015 | | | | 30.66 | 4932.18 |
| | 12/29/2014 | | | | 31.24 | 4931.60 |
| | 6/17/2014 | | | | 31.70 | 4931.14 |
| | 12/17/2013 | | | | 32.16 | 4930.68 |
| | 6/5/2013 | | | | 32.53 | 4930.31 |
| | 12/5/2012 | | | | 33.04 | 4929.80 |
| | 4/4/2012 | | | | 33.32 | 4929.52 |
| | 3/31/2011 | | | | 34.23 | 4928.61 |
| | 9/2/2009 | | | | 36.35 | 4926.49 |
| | 1/27/2009 | | | | 35.98 | 4926.86 |
| | 7/1/2008 | | | | 35.93 | 4926.91 |
| | 12/19/2007 | | | | 35.73 | 4927.11 |
| | 5/17/2007 | | | | 36.43 | 4926.41 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-9 | 1/13/2016 | 1493231.12 | 1518598.22 | 4965.01 | 30.60 | 4934.41 |
| | 6/29/2015 | | | | 31.30 | 4933.71 |
| | 12/29/2014 | | | | 31.81 | 4933.20 |
| | 6/17/2014 | | | | 32.17 | 4932.84 |
| | 12/17/2013 | | | | 32.58 | 4932.43 |
| | 6/5/2013 | | | | 32.60 | 4932.41 |
| | 12/5/2012 | | | | 33.35 | 4931.66 |
| | 4/4/2012 | | | | 33.62 | 4931.39 |
| | 3/31/2011 | | | | 34.51 | 4930.50 |
| | 9/2/2009 | | | | 36.58 | 4928.43 |
| | 1/27/2009 | | | | 36.25 | 4928.76 |
| | 7/1/2008 | | | | 36.27 | 4928.74 |
| | 12/19/2007 | | | | 35.86 | 4929.15 |
| | 5/17/2007 | | | | 35.55 | 4929.46 |
| MW-10 | 1/13/2016 | 1492504.37 | 1518895.37 | 4962.11 | 28.34 | 4933.77 |
| | 6/29/2015 | | | | 29.02 | 4933.09 |
| | 12/29/2014 | | | | 29.52 | 4932.59 |
| | 6/17/2014 | | | | 29.82 | 4932.29 |
| | 12/17/2013 | | | | 30.23 | 4931.88 |
| | 6/5/2013 | | | | 30.53 | 4931.58 |
| | 12/5/2012 | | | | 31.00 | 4931.11 |
| | 4/4/2012 | | | | 31.21 | 4930.90 |
| | 3/31/2011 | | | | 32.07 | 4930.04 |
| | 9/2/2009 | | | | 34.04 | 4928.07 |
| | 1/27/2009 | | | | 33.71 | 4928.40 |
| | 7/1/2008 | | | | 33.43 | 4928.68 |
| | 12/19/2007 | | | | 33.23 | 4928.88 |
| | 5/17/2007 | | | | 33.03 | 4929.08 |
| MW-11 | 1/13/2016 | 1492736.75 | 1518512.71 | 4961.56 | 26.83 | 4934.73 |
| | 6/29/2015 | | | | 27.53 | 4934.03 |
| | 12/29/2014 | | | | 27.99 | 4933.57 |
| | 6/17/2014 | | | | 28.29 | 4933.27 |
| | 12/17/2013 | | | | 28.67 | 4932.89 |
| | 6/5/2013 | | | | 29.01 | 4932.55 |
| | 12/5/2012 | | | | 29.41 | 4932.15 |
| | 4/4/2012 | | | | 29.61 | 4931.95 |
| | 4/1/2011 | | | | 30.43 | 4931.13 |
| | 9/2/2009 | | | | 32.32 | 4929.24 |
| | 1/27/2009 | | | | 32.02 | 4929.54 |
| | 7/1/2008 | | | | 31.99 | 4929.57 |
| | 12/19/2007 | | | | 31.69 | 4929.87 |
| | 5/17/2007 | | | | 31.38 | 4930.18 |
| MW-12 | 1/13/2016 | 1493206.94 | 1518734.96 | 4964.89 | 30.83 | 4934.06 |
| | 6/29/2015 | | | | 31.55 | 4933.34 |
| | 12/29/2014 | | | | 32.07 | 4932.82 |
| | 6/17/2014 | | | | 32.44 | 4932.45 |
| | 12/17/2013 | | | | 32.86 | 4932.03 |
| | 6/5/2013 | | | | 33.20 | 4931.69 |
| | 12/5/2012 | | | | 33.65 | 4931.24 |
| | 4/4/2012 | | | | 33.94 | 4930.95 |
| | 3/31/2011 | | | | 34.85 | 4930.04 |
| | 9/2/2009 | | | | 36.91 | 4927.98 |
| | 1/27/2009 | | | | 36.57 | 4928.32 |
| | 7/1/2008 | | | | 36.62 | 4928.27 |
| | 12/19/2007 | | | | 36.21 | 4928.68 |
| | 5/17/2007 | | | | 35.88 | 4929.01 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-14S | 1/13/2016 | 1492976.53 | 1518700.04 | 4960.57 | 24.94 | 4935.63 |
| | 6/29/2015 | | | | 27.13 | 4933.44 |
| | 12/29/2014 | | | | 27.60 | 4932.97 |
| | 6/17/2014 | | | | 27.99 | 4932.58 |
| | 12/17/2013 | | | | 28.21 | 4932.36 |
| | 6/5/2013 | | | | 29.74 | 4930.83 |
| | 12/5/2012 | | | | 29.23 | 4931.34 |
| | 4/5/2012 | | | | 29.45 | 4931.12 |
| | 4/1/2011 | | | | 30.36 | 4930.21 |
| | 9/2/2009 | | | | 32.35 | 4928.22 |
| | 1/27/2009 | | | | 32.04 | 4928.53 |
| | 7/1/2008 | | | | 32.09 | 4928.48 |
| | 12/19/2007 | | | | 31.71 | 4928.86 |
| | 5/17/2007 | | | | 31.37 | 4929.20 |
| MW-14D | 1/13/2016 | 1492982.41 | 1518679.64 | 4960.71 | 26.15 | 4934.56 |
| | 6/29/2015 | | | | 27.53 | 4933.18 |
| | 12/29/2014 | | | | 27.54 | 4933.17 |
| | 6/17/2014 | | | | 28.10 | 4932.61 |
| | 12/17/2013 | | | | 28.23 | 4932.48 |
| | 6/5/2013 | | | | 28.87 | 4931.84 |
| | 12/5/2012 | | | | 29.29 | 4931.42 |
| | 4/5/2012 | | | | 29.52 | 4931.19 |
| | 4/1/2011 | | | | 30.40 | 4930.31 |
| | 9/2/2009 | | | | 32.47 | 4928.24 |
| | 1/27/2009 | | | | 32.08 | 4928.63 |
| | 7/1/2008 | | | | 32.15 | 4928.56 |
| | 12/19/2007 | | | | 31.68 | 4929.03 |
| | 5/17/2007 | | | | 31.61 | 4929.10 |
| MW-15S | 1/13/2016 | 1492936.04 | 1518860.35 | 4961.34 | 27.67 | 4933.67 |
| | 6/29/2015 | | | | 28.38 | 4932.96 |
| | 12/29/2014 | | | | 28.89 | 4932.45 |
| | 6/17/2014 | | | | 29.27 | 4932.07 |
| | 12/17/2013 | | | | 29.69 | 4931.65 |
| | 6/5/2013 | | | | 30.02 | 4931.32 |
| | 12/5/2012 | | | | 29.51 | 4931.83 |
| | 4/5/2012 | | | | 30.75 | 4930.59 |
| | 4/1/2011 | | | | 31.67 | 4929.67 |
| | 9/2/2009 | | | | 33.69 | 4927.65 |
| | 1/27/2009 | | | | 33.34 | 4928.00 |
| | 7/1/2008 | | | | 33.45 | 4927.89 |
| | 12/19/2007 | | | | 33.05 | 4928.29 |
| | 5/17/2007 | | | | 32.71 | 4928.63 |
| MW-15D | 1/13/2016 | 1492941.22 | 1518850.93 | 4960.90 | 27.23 | 4933.67 |
| | 6/29/2015 | | | | 27.94 | 4932.96 |
| | 12/29/2014 | | | | 28.45 | 4932.45 |
| | 6/17/2014 | | | | 28.84 | 4932.06 |
| | 12/17/2013 | | | | 29.27 | 4931.63 |
| | 6/5/2013 | | | | 29.60 | 4931.30 |
| | 12/5/2012 | | | | 29.10 | 4931.80 |
| | 4/4/2012 | | | | 30.30 | 4930.60 |
| | 4/1/2011 | | | | 31.19 | 4929.71 |
| | 9/2/2009 | | | | 33.27 | 4927.63 |
| | 1/27/2009 | | | | 32.89 | 4928.01 |
| | 7/1/2008 | | | | 33.07 | 4927.83 |
| | 12/19/2007 | | | | 32.60 | 4928.30 |
| | 5/17/2007 | | | | 32.39 | 4928.51 |
| MW-16 | 1/13/2016 | 1492861.47 | 1518127.50 | 4961.54 | 25.99 | 4935.55 |
| | 6/29/2015 | | | | 26.64 | 4934.90 |
| | 12/29/2014 | | | | 27.11 | 4934.43 |
| MW-17 | 1/13/2016 | 1493517.82 | 1523062.79 | 4968.84 | 51.49 | 4917.35 |
| | 6/29/2015 | | | | 53.20 | 4915.64 |
| | 12/29/2014 | | | | 54.64 | 4914.20 |
| MW-18S | 1/13/2016 | 1492985.72 | 1523191.98 | 4971.29 | 53.85 | 4917.44 |
| | 6/29/2015 | | | | 55.02 | 4916.27 |
| | 12/29/2014 | | | | 56.28 | 4915.01 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-18D | 1/13/2016 | 14929885.17 | 1523201.02 | 4971.13 | 53.34 | 4917.79 |
| | 6/29/2015 | | | | 54.69 | 4916.44 |
| | 1/16/2015 | | | | 56.15 | 4914.98 |
| MW-19 | 1/13/2016 | 1492086.91 | 1522968.77 | 4963.78 | 46.01 | 4917.77 |
| | 6/29/2015 | | | | 47.11 | 4916.67 |
| | 12/29/2014 | | | | 48.48 | 4915.30 |
| OB-1 | 1/13/2016 | 1493034.23 | 1518416.61 | 4963.52 | 28.51 | 4935.01 |
| | 6/29/2015 | | | | 29.18 | 4934.34 |
| | 12/29/2014 | | | | 29.64 | 4933.88 |
| OB-2 | 1/13/2016 | 1493010.03 | 1518559.68 | 4961.92 | 27.31 | 4934.61 |
| | 6/29/2015 | | | | 28.00 | 4933.92 |
| | 12/29/2014 | | | | 28.49 | 4933.43 |
| OB-3 | 1/13/2016 | 1492974.24 | 1518709.47 | 4961.07 | 26.89 | 4934.18 |
| | 6/29/2015 | | | | 27.59 | 4933.48 |
| | 2/25/2015 | | | | 27.91 | 4933.16 |
| SVE-1 | 1/13/2016 | 1492963.47 | 1518419.42 | 4962.95 | 27.98 | 4934.97 |
| | 6/29/2015 | | | | 28.64 | 4934.31 |
| | 12/29/2014 | | | | 29.12 | 4933.83 |
| | 6/17/2014 | | | | 29.43 | 4933.52 |
| SVE-2 | 1/13/2016 | 1493032.97 | 1518426.49 | 4963.25 | 28.32 | 4934.93 |
| | 6/29/2015 | | | | 28.98 | 4934.27 |
| | 12/29/2014 | | | | 29.45 | 4933.80 |
| | 6/17/2014 | | | | 29.78 | 4933.47 |
| SVE-3 | 1/13/2016 | 1492929.44 | 1518287.81 | 4961.91 | 26.60 | 4935.31 |
| | 6/29/2015 | | | | 27.24 | 4934.67 |
| | 12/29/2014 | | | | 27.72 | 4934.19 |
| | 6/17/2014 | | | | 28.02 | 4933.89 |
| Various Other Site Monitoring Wells | | | | | | |
| BIA-MW-1 | 6/29/2015 | 1493278.79 | 1519248.30 | 4959.25 | 29.84 | 4929.41 |
| | 12/29/2014 | | | | 30.41 | 4928.84 |
| | 6/17/2014 | | | | Not Measured | |
| | 12/17/2013 | | | | 31.31 | 4927.94 |
| | 6/5/2013 | | | | Not Measured | |
| | 12/5/2012 | | | | Not Measured | |
| | 4/4/2012 | | | | Not Measured | |
| | 3/31/2011 | | | | 30.77 | 4928.48 |
| | Recovered | | | | Not Measured | |
| | 9/2/2009 | | | | 33.34 | 4926.35 |
| | 1/28/2009 | | | | Not Measured | |
| | 7/1/2008 | | | | Not Measured | |
| | 12/19/2007 | | | | 35.47 | 4923.78 |
| | 5/17/2007 | | | | 34.55 | 4924.70 |
| BIA-MW-3 | 1/13/2016 | 1493411.10 | 1519100.76 | 4964.28 | 31.16 | 4933.12 |
| | 6/29/2015 | | | | 31.89 | 4932.39 |
| | 12/29/2014 | | | | 32.45 | 4931.83 |
| | 6/17/2014 | | | | 32.84 | 4931.44 |
| | 12/17/2013 | | | | 33.31 | 4930.97 |
| | 6/5/2013 | | | | 33.65 | 4930.63 |
| | 12/5/2012 | | | | 34.18 | 4930.10 |
| | 4/4/2012 | | | | 34.44 | 4929.84 |
| | 3/31/2011 | | | | 35.38 | 4928.90 |
| | 9/2/2009 | | | | 37.51 | 4926.77 |
| | 1/28/2009 | | | | 36.65 | 4927.63 |
| | 7/1/2008 | | | | 37.05 | 4927.23 |
| | 12/19/2007 | | | | 36.84 | 4927.44 |
| | 5/17/2007 | | | | 36.55 | 4927.73 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| New BIA-E MW | 1/13/2016 | 1493196.02 | 1519433.06 | 4962.98 | 30.59 | 4932.39 |
| | 6/29/2015 | | | | 31.32 | 4931.66 |
| | 12/29/2014 | | | | 31.90 | 4931.08 |
| | 6/17/2014 | | | | 32.38 | 4930.60 |
| | 12/17/2013 | | | | 32.85 | 4930.13 |
| | 6/5/2013 | | | | 33.22 | 4929.76 |
| | 12/5/2012 | | | | 33.73 | 4929.25 |
| | 4/4/2012 | | | | 34.01 | 4928.97 |
| | 5/31/2011 | | | | 34.92 | 4928.06 |
| | 9/2/2009 | | | | 37.05 | 4925.93 |
| | 1/28/2009 | | | | 36.65 | 4926.33 |
| | 7/1/2008 | | | | 36.41 | 4926.57 |
| | 12/19/2007 | | | | Not Measured | |
| BG-BMW-1 | 6/17/2014 | | | 4959.99 | Well Destroyed | |
| | 12/17/2013 | | | | Could Not Locate | |
| | 6/5/2013 | | | | 40.90 | 4919.09 |
| | 12/5/2012 | | | | 41.90 | 4918.09 |
| | 4/3/2012 | | | | Not Measured | |
| | 4/1/2011 | | | | 42.96 | 4917.03 |
| | 9/2/2009 | | | | 45.49 | 4915.55 |
| | 1/28/2009 | | | | 44.00 | 4915.99 |
| | 7/1/2008 | | | | 44.47 | 4915.52 |
| | 12/19/2007 | | | | 44.05 | 4915.94 |
| | 5/17/2007 | | | | 44.64 | 4915.35 |
| BG-BMW-8 | 1/13/2016 | 1492831.97 | 1521600.758 | 4960.97 | 36.88 | 4924.09 |
| | 6/29/2015 | | | | 37.74 | 4923.23 |
| | 12/29/2014 | | | | 38.68 | 4922.29 |
| | 6/17/2014 | | | | 39.16 | 4921.81 |
| | 12/17/2013 | | | | 40.15 | 4920.82 |
| BG-BMW-12 | 1/13/2016 | 1492946.04 | 1521291.41 | 4961.89 | 36.57 | 4925.32 |
| | 6/29/2015 | | | | 37.45 | 4924.44 |
| | 12/29/2014 | | | | 38.33 | 4923.56 |
| | 6/17/2014 | | | | 38.81 | 4923.08 |
| | 12/17/2013 | | | | 39.69 | 4922.20 |
| | 6/5/2013 | | | | 39.85 | 4922.04 |
| | 12/5/2012 | | | | 40.82 | 4921.07 |
| | 4/3/2012 | | | | 40.94 | 4920.95 |
| | 4/1/2011 | | | | 41.97 | 4919.92 |
| | 9/2/2009 | | | | 44.34 | 4917.55 |
| | 1/28/2009 | | | | 45.09 | 4916.80 |
| | 7/1/2008 | | | | Inaccessable. Not Measured | |
| | 12/19/2007 | | | | 45.18 | 4916.71 |
| | 5/17/2007 | | | | 43.49 | 4918.4 |
| CA-FSY-14 | 1/13/2016 | 1492635.52 | 1520970.42 | 4962.78 | 35.78 | 4927.00 |
| | 6/29/2015 | | | | 36.56 | 4926.22 |
| | 12/29/2014 | | | | 37.31 | 4925.47 |
| | 6/17/2014 | | | | 37.75 | 4925.03 |
| | 12/17/2013 | | | | 38.54 | 4924.24 |
| CHMW-E | 1/13/2016 | 1493521.74 | 1520938.70 | 4962.33 | 35.85 | 4926.48 |
| | 6/29/2015 | | | | 36.67 | 4925.66 |
| | 12/29/2014 | | | | 37.42 | 4924.91 |
| | 6/18/2014 | | | | 37.71 | 4924.62 |
| | 12/17/2013 | | | | 38.69 | 4923.64 |
| | 6/5/2013 | | | | 38.91 | 4923.42 |
| | 12/5/2012 | | | | 39.72 | 4922.61 |
| | 4/3/2012 | | | | 39.97 | 4922.36 |
| | 4/1/2011 | | | | 41.07 | 4921.26 |
| | 9/2/2009 | | | | 43.14 | 4919.19 |
| | 1/28/2009 | | | | 42.85 | 4919.48 |
| | 7/1/2008 | | | | 43.09 | 4919.24 |
| | 12/19/2007 | | | | 42.78 | 4919.55 |
| | 5/17/2007 | | | | 42.35 | 4919.98 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| MW-4H-01 | 1/13/2016 | 1492661.55 | 1520401.76 | 4962.90 | 33.74 | 4929.16 |
| | 6/29/2015 | | | | 34.41 | 4928.49 |
| | 12/29/2014 | | | | 35.09 | 4927.81 |
| | 6/17/2014 | | | | 35.91 | 4926.99 |
| | 12/17/2013 | | | | 36.28 | 4926.62 |
| MW-4H-02 | 1/13/2016 | 1492458.91 | 1520137.72 | 4962.73 | 32.79 | 4929.94 |
| | 6/29/2015 | | | | 33.50 | 4929.23 |
| | 12/29/2014 | | | | 34.15 | 4928.58 |
| | 6/17/2014 | | | | 34.59 | 4928.14 |
| | 12/17/2013 | | | | 35.23 | 4927.50 |
| MW-4H-04 | 1/13/2016 | 1493078.70 | 1519875.46 | 4963.00 | 32.22 | 4930.78 |
| | 6/29/2015 | | | | 32.98 | 4930.02 |
| | 12/29/2014 | | | | 33.55 | 4929.45 |
| | 6/17/2014 | | | | 34.06 | 4928.94 |
| | 12/17/2013 | | | | 34.60 | 4928.40 |
| | 6/5/2013 | | | | 34.94 | 4928.06 |
| | 12/5/2012 | | | | 35.52 | 4927.48 |
| | 4/3/2012 | | | | 37.71 | 4925.29 |
| | 4/1/2011 | | | | 38.83 | 4924.17 |
| | 9/2/2009 | | | | 38.44 | 4924.56 |
| | 1/28/2009 | | | | 38.53 | 4924.47 |
| | 7/1/2008 | | | | 38.23 | 4924.77 |
| | 12/19/2007 | | | | 37.96 | 4925.04 |
| | 5/17/2007 | | | | Not Measured | |
| MW-4H-06 | 1/13/2016 | 1493016.51 | 1521058.02 | 4961.16 | 34.80 | 4926.36 |
| | 6/29/2015 | | | | 35.66 | 4925.50 |
| | 12/29/2014 | | | | 36.47 | 4924.69 |
| | 6/17/2014 | | | | 36.97 | 4924.19 |
| | 12/17/2013 | | | | 37.79 | 4923.37 |
| NI-MW-2 | 1/13/2016 | 1493125.60 | 1520049.81 | 4962.74 | 32.84 | 4929.90 |
| | 6/29/2015 | | | | 33.43 | 4929.31 |
| | 12/29/2014 | | | | 34.25 | 4928.49 |
| | 6/17/2014 | | | | 34.77 | 4927.97 |
| | 12/17/2013 | | | | 35.35 | 4927.39 |
| | 6/5/2013 | | | | 35.64 | 4927.10 |
| | 12/5/2012 | | | | 36.22 | 4926.52 |
| | 4/3/2012 | | | | 36.52 | 4926.22 |
| | 4/1/2011 | | | | 37.39 | 4925.35 |
| | 9/2/2009 | | | | 39.51 | 4923.23 |
| | 1/28/2009 | | | | 39.22 | 4923.52 |
| | 7/1/2008 | | | | 39.36 | 4923.38 |
| | 12/19/2007 | | | | 38.69 | 4924.05 |
| | 5/17/2007 | | | | Not Measured | |
| RayMar -W | 1/13/2016 | 1493133.53 | 1521195.91 | 4962.78 | 36.97 | 4925.81 |
| | 6/29/2015 | | | | 37.85 | 4924.93 |
| | 12/29/2014 | | | | 38.72 | 4924.06 |
| | 6/17/2014 | | | | 39.17 | 4923.61 |
| | 12/17/2013 | | | | 39.99 | 4922.79 |
| | 6/5/2013 | | | | 40.22 | 4922.56 |
| | 12/5/2012 | | | | Inaccessable. Not Measured | |
| | 4/2/2012 | | | | 41.24 | 4921.54 |
| | 3/31/2011 | | | | 42.31 | 4920.47 |
| | 9/2/2009 | | | | 44.54 | 4918.24 |
| | 1/28/2009 | | | | 44.23 | 4918.55 |
| | 7/1/2008 | | | | 44.68 | 4918.10 |
| | 12/19/2007 | | | | 44.26 | 4918.52 |
| | 5/17/2007 | | | | 43.68 | 4919.10 |

# TABLE 2. SUMMARY OF MONITORING WELL FLUID GAUGING DATA
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Measured | Northing[a] | Easting[a] | Casing Elevation[b] | Depth to Water[c] | Groundwater Elevation[b] |
|---|---|---|---|---|---|---|
| RayMar -E | 1/13/2016 | 1493130.46 | 1521306.83 | 4962.94 | 37.67 | 4925.27 |
| | 6/29/2015 | | | | 38.42 | 4924.52 |
| | 12/29/2014 | | | | 39.49 | 4923.45 |
| | 6/17/2014 | | | | 40.02 | 4922.92 |
| | 12/17/2013 | | | | 40.95 | 4921.99 |
| SBM-1 | 1/14/2016 | 1492887.91 | 1524401.46 | 4995.03 | 86.18 | 4908.85 |
| | 7/2/2015 | | | | 89.48 | 4905.55 |
| | 1/5/2015 | | | | 89.60 | 4905.43 |
| SBM-2 | 1/14/2016 | 1492885.10 | 1524417.29 | 4995.61 | 86.57 | 4909.04 |
| | 7/2/2015 | | | | 89.51 | 4906.10 |
| | 1/5/2015 | | | | 89.95 | 4905.66 |

NOTES:

[a] = Horizontal control to NM State Plane Coordinates Central NAD83 Grid Coordinates (in feet)

[b] = Vertical Control to NAVD88 Datum in feet above mean sea level

[c] = Measured in feet below the top of casing at survey point on north side of well

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| Laun-Dry Monitoring Wells | | | | | | |
| MW-1 | 13-Jan-16 | 7.43 | 1,490 | 18.9 | NM | NM |
| | 30-Jun-15 | 7.25 | 1,435 | 20.8 | NM | 1.97 |
| | 31-Dec-14 | 7.23 | 1,521 | 17.9 | NM | 3.04 |
| | 17-Jun-14 | 7.07 | 1,528 | 20.0 | NM | 3.64 |
| | 18-Dec-13 | 7.26 | 1,910 | 19.5 | NM | 2.84 |
| MW-2 | 13-Jan-16 | 7.41 | 705 | 18.4 | NM | NM |
| | 30-Jun-15 | 7.26 | 1,426 | 21.2 | NM | 1.12 |
| | 31-Dec-14 | 7.16 | 1,387 | 17.7 | NM | 1.13 |
| | 18-Jun-14 | 7.18 | 1,406 | 20.5 | NM | 1.10 |
| | 19-Dec-13 | 7.32 | 1,275 | 18.5 | NM | 2.03 |
| MW-3 | 13-Jan-16 | 7.39 | 1,290 | 17.2 | NM | NM |
| | 30-Jun-15 | 7.21 | 1,436 | 19.4 | NM | 0.84 |
| | 31-Dec-14 | 7.17 | 1,256 | 16.9 | NM | 1.13 |
| | 19-Jun-14 | 7.08 | 1,358 | 22.3 | -59.8 | 0.15 |
| | 18-Dec-13 | 7.31 | 1,161 | 18.6 | NM | 1.31 |
| MW-4 | 15-Jan-16 | 7.03 | 1,396 | 19.0 | NM | NM |
| | 30-Jun-15 | 7.19 | 1,640 | 20.1 | NM | 0.73 |
| | 31-Dec-14 | 7.12 | 1,582 | 17.9 | NM | 1.97 |
| | 19-Jun-14 | 7.00 | 1,592 | 21.5 | 19.9 | 0.21 |
| | 19-Dec-13 | 7.29 | 1,471 | 18.4 | NM | 1.56 |
| MW-5 | 13-Jan-16 | 7.41 | 1,708 | 18.0 | NM | NM |
| | 30-Jun-15 | 7.22 | 1,763 | 20.4 | NM | 0.83 |
| | 28-Jan-15 | 7.26 | 1,719 | 19.6 | NM | 1.68 |
| | 18-Jun-14 | 7.13 | 1,739 | 19.9 | NM | 1.36 |
| | 19-Dec-13 | 7.29 | 1,458 | 19.6 | NM | 2.28 |
| MW-6 | 13-Jan-16 | 7.43 | 1,299 | 16.6 | NM | NM |
| | 30-Jun-15 | 7.26 | 1,292 | 19.2 | NM | 0.85 |
| | 31-Dec-14 | 7.18 | 1,246 | 16.5 | NM | 2.37 |
| | 19-Jun-14 | 7.06 | 1,320 | 22.2 | 76.8 | 0.30 |
| | 19-Dec-13 | 7.33 | 1,101 | 18.7 | NM | 1.69 |
| MW-6A | 20-Jan-16 | 7.71 | 1,425 | 18.4 | -14.5 | 0.17 |
| | 22-Jul-15 | 6.59 | 1,408 | 21.75 | -24.9 | 0.55 |
| | 30-Dec-14 | 7.10 | 1,333 | 16.8 | -62.2 | 0.41 |
| | 19-Jun-14 | 7.10 | 1,316 | 21.1 | -49.5 | 0.16 |
| | 19-Dec-13 | 7.36 | 1,155 | 19.0 | NM | 0.77 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| MW-6B | 14-Jan-16 | 7.51 | 702 | 18.0 | NM | NM |
| | 1-Jul-15 | 7.32 | 1,545 | 22.4 | NM | 2.47 |
| | 30-Dec-14 | 7.07 | 1,289 | 13.4 | -33.7 | 0.15 |
| | 19-Jun-14 | 7.07 | 1,299 | 21.9 | 38.4 | 0.49 |
| | 19-Dec-13 | 7.44 | 1,560 | 18.8 | NM | 1.99 |
| MW-6C | 20-Jan-16 | 7.65 | 1,401 | 18.1 | -102.4 | 0.90 |
| | 22-Jul-15 | 6.28 | 1,571 | 20.85 | -94.1 | 0.74 |
| | 30-Dec-14 | 7.08 | 1,287 | 10.4 | -39.0 | 1.04 |
| | 19-Jun-14 | 7.09 | 1,302 | 21.5 | -34.4 | 0.38 |
| | 19-Dec-13 | 7.43 | 1,560 | 19.0 | NM | 1.14 |
| MW-6D | 13-Jan-16 | 7.35 | 1,994 | 18.7 | NM | NM |
| | 30-Jun-15 | 7.60 | 1,562 | 20.0 | NM | 5.62 |
| | 31-Dec-14 | 7.18 | 1,335 | 17.6 | NM | 1.98 |
| | 17-Jun-14 | 7.26 | 1,297 | 20.0 | NM | 2.56 |
| | 18-Dec-13 | 7.38 | 1,183 | 19.7 | NM | 2.65 |
| MW-6E | 15-Jan-16 | 7.18 | 1,295 | 18.6 | NM | NM |
| | 1-Jul-15 | 7.40 | 1,103 | 19.5 | NM | 1.25 |
| | 16-Jan-15 | 7.17 | 1,428 | 19.5 | NM | 0.44 |
| | 18-Jun-14 | 7.32 | 1,417 | 20.5 | NM | 1.47 |
| | 19-Dec-13 | 7.17 | 1,167 | 17.7 | NM | 0.71 |
| MW-6F | 13-Jan-16 | 7.42 | 1,766 | 18.6 | NM | NM |
| | 29-Jun-15 | 7.23 | 1,706 | 19.6 | NM | 1.04 |
| | 29-Dec-14 | 7.29 | 1,680 | 19.0 | NM | 0.74 |
| | 18-Jun-14 | 7.29 | 1,795 | 19.6 | 138.3 | 0.79 |
| | 18-Dec-13 | 7.03 | 1,386 | 17.3 | NM | 0.88 |
| MW-6G | 15-Jan-16 | Not Enough Water to Measure | | | | |
| | 29-Jun-15 | Could Not Access | | | | |
| | 29-Dec-14 | Not Enough Water to Measure | | | | |
| | 19-Jun-14 | 7.14 | 1,745 | 19.5 | NM | 1.43 |
| MW-6H-S | 14-Jan-16 | 7.51 | 1,471 | 17.9 | NM | NM |
| | 30-Jun-15 | 7.22 | 1,018 | 18.8 | NM | 0.92 |
| | 29-Dec-14 | 7.07 | 1,750 | 19.4 | NM | 0.37 |
| | 18-Jun-14 | 7.02 | 2,152 | 19.6 | -31.6 | 0.52 |
| | 18-Dec-13 | 6.56 | 1,457 | 16.0 | NM | 0.81 |
| MW-6H-D | 13-Jan-16 | 7.55 | 1,412 | 17.6 | NM | NM |
| | 30-Jun-15 | 7.46 | 690 | 19.6 | NM | 1.79 |
| | 29-Dec-14 | 7.40 | 1,430 | 19.2 | NM | 0.52 |
| | 18-Jun-14 | 7.36 | 1,544 | 19.4 | -65.6 | 0.71 |
| | 18-Dec-13 | 6.82 | 1,242 | 17.9 | NM | 0.74 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| MW-8 | 13-Jan-16 | 7.48 | 1,328 | 18.1 | NM | NM |
| | 1-Jul-15 | 7.29 | 1,341 | 20.4 | NM | 1.12 |
| | 31-Dec-14 | 7.24 | NM | 17.8 | NM | 0.47 |
| | 18-Jun-14 | 7.22 | 1,342 | 20.8 | NM | 1.14 |
| | 18-Dec-13 | 7.36 | 1,600 | 18.5 | NM | 1.35 |
| MW-9 | 13-Jan-16 | 7.36 | 1,172 | 18.5 | NM | NM |
| | 30-Jun-15 | 7.28 | 1,222 | 20.2 | NM | 0.76 |
| | 31-Dec-14 | 7.23 | 1,236 | 17.3 | NM | 0.97 |
| | 17-Jun-14 | 7.26 | 1,267 | 20.8 | NM | 0.94 |
| | 18-Dec-13 | 6.63 | 1,116 | 17.8 | NM | 0.83 |
| MW-10 | 13-Jan-16 | 7.38 | 671 | 18.7 | NM | NM |
| | 29-Jun-15 | 7.03 | 1,625 | 21.9 | NM | NM |
| | 29-Dec-14 | 7.09 | 1,607 | 17.9 | NM | 1.68 |
| | 17-Jun-14 | 6.89 | 1,727 | 20.6 | NM | 1.91 |
| | 17-Dec-13 | 7.46 | 2,140 | 18.6 | NM | 1.64 |
| MW-11 | 13-Jan-16 | 7.36 | 1,078 | 17.7 | NM | NM |
| | 30-Jun-15 | 7.34 | 1,137 | 19.5 | NM | 1.11 |
| | 31-Dec-14 | 7.21 | 1,046 | 17.3 | NM | 2.18 |
| | 17-Jun-14 | 7.21 | 1,106 | 19.9 | NM | 1.25 |
| | 17-Dec-13 | 7.47 | 1,170 | 19.0 | NM | 1.80 |
| MW-12 | 13-Jan-16 | 7.35 | 1,209 | 18.0 | NM | NM |
| | 30-Jun-15 | 7.27 | 1,199 | 20.7 | NM | 0.84 |
| | 31-Dec-14 | 7.18 | 1,113 | 17.6 | NM | 1.23 |
| | 18-Jun-14 | 7.17 | 1,374 | 20.3 | NM | 1.52 |
| | 19-Dec-13 | 6.82 | 1,034 | 19.2 | NM | 0.83 |
| MW-14S | 20-Jan-16 | 7.88 | 846 | 16.6 | 291.9 | 4.84 |
| | 22-Jul-15 | 7.10 | 746 | 22.9 | -45.3 | 5.54 |
| | 22-Jan-15 | 7.71 | 904 | 17.8 | NM | 2.06 |
| | 31-Dec-14 | 7.36 | NM | 18.4 | NM | 0.83 |
| | 18-Jun-14 | 7.35 | 1,409 | 19.9 | NM | 1.64 |
| | 19-Dec-13 | 7.34 | 1,254 | 19.3 | NM | 1.49 |
| MW-14D | 14-Jan-16 | 7.49 | 574 | 18.1 | NM | NM |
| | 1-Jul-15 | 7.42 | 1,052 | 24.1 | NM | 0.63 |
| | 30-Dec-14 | 7.30 | 1,020 | 15.9 | 36.1 | 0.65 |
| | 19-Jun-14 | 7.32 | 1,060 | 19.5 | -33.0 | 0.02 |
| | 18-Dec-13 | 7.53 | 925 | 19.6 | NM | 1.25 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| MW-15S | 15-Jan-16 | 7.10 | 1,234 | 18.9 | NM | NM |
| | 30-Jun-15 | 7.22 | 1,429 | 20.6 | NM | 0.56 |
| | 31-Dec-14 | 7.18 | 1,351 | 17.1 | NM | 1.05 |
| | 17-Jun-14 | 7.07 | 1,382 | 19.6 | NM | 1.06 |
| | 18-Dec-13 | 7.33 | 1,286 | 19.5 | NM | 1.03 |
| MW-15D | 20-Jan-16 | 7.42 | 969 | 18.2 | NM | NM |
| | 1-Jul-15 | 7.57 | 1,034 | 23.2 | NM | 0.61 |
| | 30-Dec-14 | 7.43 | 1,042 | 17.1 | 16.3 | 0.40 |
| | 19-Jun-14 | 7.45 | 1,085 | 19.6 | 31.1 | 0.07 |
| | 18-Dec-13 | 7.70 | 975 | 17.4 | NM | 4.69 |
| MW-16 | 13-Jan-16 | 7.29 | 677 | 19.3 | NM | NM |
| | 29-Jun-15 | 7.16 | 1,449 | 20.2 | NM | NM |
| | 16-Dec-14 | 7.29 | 1,295 | 18.9 | NM | NM |
| MW-17 | 15-Jan-16 | 6.86 | 1,557 | 19.2 | NM | NM |
| | 30-Jun-15 | 7.00 | 909 | 22.0 | NM | 0.83 |
| | 16-Dec-14 | 7.13 | 1,728 | 18.6 | NM | NM |
| MW-18S | 13-Jan-16 | 7.18 | 1,730 | 19.0 | NM | NM |
| | 29-Jun-15 | 7.06 | 1,793 | 20.8 | NM | 1.11 |
| | 16-Dec-14 | 7.20 | 1,516 | 20.1 | NM | NM |
| MW-18D | 14-Jan-16 | 8.04 | 305 | 19.1 | NM | NM |
| | 1-Jul-15 | 7.98 | 398 | 21.7 | NM | 0.59 |
| | 16-Jan-15 | 7.97 | 401 | 19.2 | NM | NM |
| MW-19 | 13-Jan-16 | 7.26 | 637 | 21.2 | NM | 1.28 |
| | 29-Jun-15 | 7.14 | 1,389 | 20.7 | NM | 1.05 |
| | 16-Dec-14 | 7.12 | 1,465 | 18.3 | NM | NM |
| OB-1 | 14-Jan-16 | 7.43 | 1,117 | 18.2 | NM | NM |
| | 30-Jun-15 | 7.32 | 1,250 | 18.7 | NM | 0.45 |
| | 30-Dec-14 | 7.21 | 1,204 | 16.4 | -107.1 | 0.12 |
| OB-2 | 20-Jan-16 | 7.70 | 1,339 | 19.0 | -88.5 | 0.45 |
| | 22-Jul-15 | 6.67 | 1,486 | 21.98 | -81.8 | 0.17 |
| | 30-Dec-14 | 7.16 | 1,338 | 16.7 | -123.3 | 0.30 |
| OB-3 | 20-Jan-16 | 7.93 | 1,324 | 16.50 | -40.5 | 0.36 |
| | 22-Jul-15 | 6.86 | 1,330 | 22.11 | -65.4 | 0.26 |
| | 28-Jan-15 | 7.31 | 1,302 | 19.0 | NM | 0.19 |
| SVE-1 | 20-Jan-16 | 7.70 | 1,852 | 18.4 | 107.4 | 0.77 |
| | 22-Jul-15 | 6.71 | 1,714 | 21.9 | 13.3 | 0.35 |
| | 30-Dec-14 | 6.99 | 1,740 | 15.2 | 33.1 | 0.62 |
| | 19-Jun-14 | 6.99 | 1,684 | 21.1 | 101.1 | 0.19 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| SVE-2 | 14-Jan-16 | 7.41 | 1,286 | 18.2 | NM | NM |
| | 30-Jun-15 | 7.25 | 1,344 | 19.2 | NM | 0.81 |
| | 30-Dec-14 | 7.07 | 1,323 | 16.3 | -57.6 | 0.13 |
| | 19-Jun-14 | 7.05 | 1,379 | 21.8 | 3.6 | 0.26 |
| SVE-3 | 14-Jan-16 | 7.27 | 1,443 | 17.8 | NM | NM |
| | 30-Jun-15 | 7.19 | 1,542 | 20.3 | NM | 0.82 |
| | 31-Dec-14 | 7.11 | 1,458 | 17.6 | NM | 1.42 |
| | 18-Jun-14 | 7.67 | 1,354 | 20.5 | NM | 1.09 |
| Various Other Site Monitoring Wells | | | | | | |
| BIA-MW-1 | Well Not Sampled | | | | | |
| | 30-Jun-15 | Not Enough Water to Measure | | | | |
| | 29-Dec-14 | Not Enough Water to Measure | | | | |
| | Well Not Sampled | | | | | |
| | 17-Dec-13 | 6.87 | 1,650 | 17.1 | NM | 3.87 |
| BIA-MW-3 | 13-Jan-16 | 7.35 | 682 | 19.0 | NM | NM |
| | 30-Jun-15 | 7.34 | 1,617 | 18.9 | NM | 1.20 |
| | 29-Dec-14 | 7.19 | 1,698 | 17.7 | NM | 1.28 |
| | 17-Jun-14 | 7.14 | 1,861 | 20.2 | NM | 1.02 |
| | 17-Dec-13 | 7.23 | 1,870 | 18.9 | NM | 1.45 |
| New BIA-E-MW | 13-Jan-16 | 7.40 | 1,290 | 18.2 | NM | NM |
| | 1-Jul-15 | 7.13 | 647 | 19.0 | NM | 4.50 |
| | 29-Dec-14 | 7.10 | NM | 18.9 | NM | 0.50 |
| | 18-Jun-14 | 7.33 | 1,571 | 20.3 | NM | 1.43 |
| | 18-Dec-13 | 7.29 | 1,970 | 19.1 | NM | 1.40 |
| BG-BMW-8 | 13-Jan-16 | 7.08 | 1,280 | 18.8 | NM | NM |
| | 30-Jun-15 | 7.07 | 771 | 20.1 | NM | 1.01 |
| | 29-Dec-14 | 6.96 | 2,000 | 19.6 | NM | 0.54 |
| | 18-Jun-14 | 6.92 | 2,038 | 20.1 | -66.7 | 0.39 |
| | 18-Dec-13 | 6.63 | 1,814 | 18.8 | NM | 0.73 |
| BG-BMW-12 | 15-Jan-16 | 7.19 | 1,316 | 19.2 | NM | NM |
| | 30-Jun-15 | 7.32 | 315 | 19.6 | NM | 1.10 |
| | 29-Dec-14 | 7.16 | 3,880 | 19.4 | NM | 0.46 |
| | 18-Jun-14 | 7.17 | 1,630 | 19.8 | -25.7 | 0.43 |
| | 18-Dec-13 | 6.58 | 1,304 | 17.1 | NM | 0.91 |
| CA-FSY-14 | 13-Jan-16 | 7.37 | 1,644 | 18.4 | NM | NM |
| | 29-Jun-15 | 7.04 | 1,637 | 19.7 | NM | 2.45 |
| | 29-Dec-14 | 7.06 | 1,610 | 18.2 | NM | 0.75 |
| | 18-Jun-14 | 7.21 | 1,594 | 19.7 | 95.1 | 0.45 |
| | 18-Dec-13 | 6.72 | 1,165 | 15.2 | NM | 1.28 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| Catholic Cemetary North Well | 2-Jul-15 | 7.83 | 870 | 21.4 | NM | NM |
| Catholic Cemetary South Well | 2-Jul-15 | 7.61 | 1,223 | 21.1 | NM | NM |
| CHMW-E | 13-Jan-16 | 7.36 | 1,573 | 18.5 | NM | NM |
| | 29-Jun-15 | 7.17 | 1,544 | 19.5 | NM | 0.98 |
| | 29-Dec-14 | 7.03 | 1,670 | 19.3 | NM | 0.51 |
| | 18-Jun-14 | 7.04 | 1,721 | 19.8 | 57.5 | 0.32 |
| | 18-Dec-13 | 6.68 | 1,340 | 19.0 | NM | 0.88 |
| MW-4H-01 | 13-Jan-16 | 7.47 | 691 | 19.3 | NM | NM |
| | 29-Jun-15 | 7.42 | 1,546 | 20.2 | NM | 1.45 |
| | 29-Dec-14 | 7.00 | 1,261 | 18.3 | NM | 1.25 |
| | 17-Jun-14 | 7.22 | 1,583 | 19.8 | 140.1 | 0.62 |
| | 18-Dec-13 | 6.95 | 998 | 13.1 | NM | 1.46 |
| MW-4H-02 | 13-Jan-16 | 7.57 | 688 | 19.4 | NM | 1.73 |
| | 29-Jun-15 | 7.54 | 1,604 | 20.2 | NM | 2.75 |
| | 29-Dec-14 | 7.25 | 1,580 | 18.6 | NM | 0.84 |
| | 18-Jun-14 | 7.38 | 1,530 | 19.9 | 40.7 | 0.71 |
| | 18-Dec-13 | 7.13 | 1,107 | 15.8 | NM | 1.22 |
| MW-4H-04 | 13-Jan-16 | 7.51 | 1,387 | 17.7 | NM | NM |
| | 1-Jul-15 | 7.50 | 322 | 20.0 | NM | 3.31 |
| | 31-Dec-14 | 7.38 | NM | 18.0 | NM | 0.55 |
| | 18-Jun-14 | 7.30 | 1,530 | 19.4 | 127.7 | 0.40 |
| | 19-Dec-13 | 7.01 | 1,167 | 16.3 | NM | 0.86 |
| MW-4H-06 | 15-Jan-16 | 7.12 | 1,377 | 18.5 | NM | NM |
| | 7-Jul-15 | 7.25 | 1,606 | 20.3 | NM | 1.20 |
| | 29-Dec-14 | 7.03 | NM | 19.0 | NM | 0.54 |
| | 18-Jun-14 | 7.10 | 1,736 | 19.7 | 64.9 | 50.1 |
| | 18-Dec-13 | 6.86 | 1,357 | 16.0 | NM | 0.63 |
| NI-MW-2 | 15-Jan-16 | 7.14 | 1,459 | 19.6 | NM | NM |
| | 30-Jun-15 | 7.32 | 414 | 20.1 | NM | 1.28 |
| | 31-Dec-14 | 6.98 | 1,150 | 19.4 | NM | 0.95 |
| | 18-Jun-14 | 7.15 | 1,693 | 20.2 | -33.4 | 0.42 |
| | 19-Dec-13 | 7.17 | 1,364 | 17.1 | NM | 1.07 |
| RayMar-W | 15-Jan-16 | 7.32 | 1,233 | 18.4 | NM | NM |
| | 7-Jul-15 | 7.39 | 1,496 | 20.4 | NM | 1.56 |
| | 31-Dec-14 | 6.81 | NM | 17.2 | NM | 0.98 |
| | 18-Jun-14 | 7.32 | 1,583 | 19.8 | 7.3 | 0.65 |
| | 19-Dec-13 | 7.28 | 1,179 | 14.4 | NM | 1.03 |

## TABLE 3. SUMMARY OF GROUNDWATER FIELD PARAMETERS
## LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Well Number | Date Sampled | pH | SpC (uS/cm) | Temp | ORP (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|
| RayMar-E | 15-Jan-16 | 7.30 | 1,246 | 18.5 | NM | NM |
| | 1-Jul-15 | 7.56 | 538 | 19.4 | NM | 1.85 |
| | 31-Dec-14 | 7.39 | NM | 18.8 | NM | 0.85 |
| | 18-Jun-14 | 7.29 | 1,569 | 19.8 | 14.3 | 0.75 |
| | 19-Dec-13 | 7.27 | 1,317 | 18.5 | NM | 1.17 |
| SBM-1 | 14-Jan-16 | 7.28 | 737 | 17.7 | NM | NM |
| | 2-Jul-15 | 7.29 | 1,189 | 21.3 | NM | 0.63 |
| | 5-Jan-15 | 6.97 | 1,211 | 16.9 | 180.5 | 0.63 |
| SBM-2 | 14-Jan-16 | 7.35 | 675 | 19.4 | NM | NM |
| | 2-Jul-15 | 7.37 | 1,119 | 22.7 | NM | 6.85 |
| | 5-Jan-15 | 7.17 | 886 | 17.1 | 189.4 | 7.44 |

NOTES:
DO = Dissolved oxygen
mg/L = Milligrams per liter
mV = Millivolts
NA = Not analyzed
NM = Not measured
ORP = Oxidation Reduction Potential
Data rejected

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Laun-Dry Monitoring Wells** | | | | | | | | | | |
| MW-1 | 1/15/2016 | 18 | 4.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 21 | 3.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 26 | 7.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | 56 | 7.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | 330 | 19 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/6/2013 | 680 | 24 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/6/2012 | 690 | 23 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 4/5/2012 | 570 | 28 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 4/1/2011 | 580 | 36 | 2.3 | 3.3 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 220 | 60 | 2.4 | 2.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 390 | 61 | 2.5 | 3.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/3/2008 | 620 | 67 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/20/2007 | 1,800 | 130 | 5.9 | 7.7 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/18/2007 | 930 | 110 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 8/21/2006 | 1,700 | 160 | <50 | <50 | <50 | <50 | <100 | <75 | <200 |
| | 6/22/2005 | 660 | 110 | 4.0 | 4.0 | <1 | <5 | <1 | <1 | <5 |
| | 9/26/2003 | 340 | 36 | <1.0 | <1.0 | <1.0 | <2.0 | <1.0 | <1.0 | <4.0 |
| MW-2 | 1/15/2016 | 42 | 22 | 2.9 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 49 | 25 | 4.0 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 80 | 38 | 5.6 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/18/2014 | 260 | 74 | 6.7 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2013 | 1,200 | 90 | 7.5 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/6/2013 | 1,600 | 83 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/6/2012 | 1,300 | 61 | 5.8 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/5/2012 | 890 | 72 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/1/2011 | 330 | 53 | 3.6 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 1,700 | 270 | 9.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/27/2009 | 1,200 | 230 | 6.1 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/3/2008 | 720 | 180 | 6.6 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/20/2007 | 1,700 | 140 | 4.6 | 2.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 5/18/2007 | 87 | 29 | 2.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 8/21/2006 | 4,500 | 730 | <50 | <50 | <50 | <50 | <100 | <75 | <200 |
| | 6/22/2005 | 4,200 | 560 | 11 | 2.9 | <1 | <5 | <1 | <1 | <5 |
| | 9/26/2003 | 3,200 | 860 | 2.7 | 8.3 | <1.0 | <2.0 | <1.0 | <1.0 | <4.0 |
| MW-3 | 1/15/2016 | 39 | 14 | 3.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 12 | 13 | 2.5 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/31/2014 | 3.1 | 17 | 2.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | 22 | 33 | 2.8 | 1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | 1,500 | 25 | 3.5 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/6/2013 | 440 | 76 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/6/2012 | 2,900 | 72 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 4/5/2012 | 450 | 73 | 3.0 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | 380 | 150 | 5.7 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/12/2009 | 76 | 180 | 6.8 | 2.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 32 | 170 | 5.4 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/3/2008 | 120 | 220 | 10 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/20/2007 | 3,300 | 260 | 10 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/18/2007 | 680 | 370 | 13 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 8/21/2006 | 1,500 | 450 | <50 | <50 | <50 | <50 | <100 | <75 | <200 |
| | 6/22/2005 | 1,100 | 400 | 8.6 | 2.2 | <1 | <5 | <1 | <1 | <5 |
| | 9/26/2003 | 10,000 | 780 | 5.7 | <1.0 | <1.0 | <2.0 | <1.0 | <1.0 | <4.0 |
| MW-4 | 1/15/2016 | 130 | 290 | 29 | 5.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 160 | 380 | 34 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/31/2014 | 240 | 570 | 31 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 6/19/2014 | 750 | 920 | 38 | 8.2 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2013 | 3,400 | 1,000 | 34 | 9.5 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/5/2013 | 2,300 | 1,100 | 43 | <20 | <20 | <20 | <20 | <20 | <80 |
| | 12/6/2012 | 3,100 | 1,300 | 49 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 4/5/2012 | 3,100 | 2,000 | 61 | <20 | <20 | <20 | <20 | <20 | <80 |
| | 4/1/2011 | 3,400 | 3,600 | 39 | 8.4 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 700 | 1,300 | 16 | 6.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/26/2009 | 1,100 | 1,600 | 18 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/3/2008 | 430 | 970 | 12 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/20/2007 | 600 | 980 | 13 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 5/16/2007 | 5,000 | 4,400 | 42 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 8/21/2006 | 930 | 1,200 | <50 | <50 | <50 | <50 | <100 | <75 | <200 |
| | 6/22/2005 | 6,400 | 3,200 | 12 | 2.2 | <1 | <5 | <1 | <1 | <5 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-5 | 1/15/2016 | 130 | 1,500 | 76 | 17 | <10 | <10 | <10 | <10 | <40 |
| | 6/30/2015 | 88 | 1,500 | 110 | 35 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/28/2015 | 100 | 1,800 | 120 | 33 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/18/2014 | 120 | 2,000 | 130 | 63 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2013 | 60 | 2,200 | 160 | 52 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/6/2013 | 260 | 2,900 | 69 | 13 | <10 | <10 | <10 | <10 | <40 |
| | 12/5/2012 | 250 | 2,800 | 71 | 21 | <10 | <10 | <10 | <10 | <40 |
| | 4/3/2012 | 10 | 1,600 | 150 | 82 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 3/31/2011 | 5.5 | 1,500 | 140 | 46 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | <10 | 2,200 | 190 | 78 | <10 | <10 | <10 | <10 | <40 |
| | 1/27/2009 | Damaged. Not Sampled | | | | | | | | |
| | 7/3/2008 | Damaged. Not Sampled | | | | | | | | |
| | 12/19/2007 | Damaged. Not Sampled | | | | | | | | |
| | 5/16/2007 | 940 | 3,600 | 39 | 12 | <10 | <10 | <10 | <10 | <40 |
| | 8/21/2006 | 1,400 | 6,400 | <100 | <100 | <100 | <100 | <200 | <150 | <400 |
| | 6/22/2005 | 1,200 | 3,000 | 37 | 15 | <1 | <5 | <1 | <1 | <5 |
| MW-6 | 1/15/2016 | 12 | 8.3 | 2.6 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 17 | 8.1 | 2.4 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/31/2014 | 13 | 11 | 3.9 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/19/2014 | 120 | 28 | 4.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/19/2013 | 280 | 25 | 5.7 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/6/2013 | 2,600 | 110 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 12/6/2012 | 2,400 | 90 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 4/5/2012 | 640 | 91 | 7.4 | 2.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | 1,900 | 320 | 6.7 | 2.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 1,900 | 490 | 10 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/27/2009 | 1,800 | 520 | 9.6 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/3/2008 | 850 | 500 | 11 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/20/2007 | 1,700 | 470 | 17 | 5.1 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/18/2007 | 1,500 | 720 | 21 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 8/21/2006 | 1,800 | 590 | <50 | <50 | <50 | <50 | <100 | <75 | <200 |
| | 6/22/2005 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <5.0 |
| MW-6A | 1/20/2016 | <1.0 | 5.1 | 2.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | 1.2 | 4.7 | 2.3 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 3.2 | 6.3 | 2.7 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | 8.8 | 11 | 2.5 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2013 | 5,000 | 74 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 6/6/2013 | 35 | 21 | 3.7 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 5,600 | 77 | 5.2 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/5/2012 | 900 | 43 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| MW-6B | 1/14/2016 | 110 | 3.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | 30 | 4.3 | 1.5 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 17 | 7.7 | 2.8 | 2.3 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | 750 | 7.8 | 2.1 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/19/2013 | 1,300 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <40 |
| | 6/5/2013 | 170,000 | 94 | <50 | <50 | <50 | <50 | <50 | <50 | <200 |
| | 12/6/2012 | 57,000 | 160 | <50 | <50 | <50 | <50 | <50 | <50 | <200 |
| | 4/5/2012 | 10,000 | 56 | <20 | <20 | <20 | <20 | <20 | <20 | <80 |
| MW-6C | 1/20/2016 | 2.3 | 1.2 | 22 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | 24 | 6.4 | 22 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 4.1 | 61 | 11 | 4.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | 29 | 190 | 14 | 4.4 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2013 | 1.0 | 170 | 14 | 4.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/6/2013 | 2,700 | 860 | 14 | 5.5 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/6/2012 | 720 | 950 | 21 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/5/2012 | 290 | 1,100 | 16 | <10 | <10 | <10 | <10 | <10 | <40 |
| MW-6D | 1/14/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 3.0 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | <2.0 | 35 | 18 | 16 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/17/2014 | <1.0 | 73 | 43 | 38 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <2.0 | 64 | 43 | 45 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/5/2013 | <1.0 | 96 | 50 | 46 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <2.0 | 110 | 46 | 38 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 4/4/2012 | <2.0 | 180 | 50 | 41 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| MW-6E | 1/15/2016 | <1.0 | 210 | 87 | 87 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | 260 | 93 | 84 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/16/2015 | <10 | 360 | 100 | 100 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | <10 | 410 | 120 | 92 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2013 | <10 | 510 | 110 | 93 | <10 | <10 | <10 | <10 | <40 |
| | 6/5/2013 | <1.0 | 690 | 120 | 87 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 680 | 120 | 83 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | 1.6 | 760 | 140 | 71 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-6F | 1/14/2016 | <1.0 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | 2.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <2.0 | 3.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/5/2013 | <1.0 | 4.0 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <2.0 | 5.5 | 2.8 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 4/3/2012 | <2.0 | 11 | 7.2 | 2.7 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| MW-6G | 1/15/2016 | 1.3 | 91 | 65 | 83 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | Not Sampled - No Access | | | | | | | | |
| | 12/29/2014 | 2.1 | 69 | 45 | 61 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/19/2014 | <2.0 | 80 | 49 | 80 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/17/2013 | Not Sampled - No Access | | | | | | | | |
| | 6/5/2013 | 2.5 | 69 | 41 | 69 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | Not Sampled | | | | | | | | |
| | 4/4/2012 | 1.3 | 71 | 42 | 66 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-6H-S | 1/15/2016 | <1.0 | 140 | 59 | 70 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 110 | 53 | 68 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | 94 | 45 | 52 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | 47 | 38 | 50 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <2.0 | 5.8 | 37 | 63 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/5/2013 | <2.0 | 7.2 | 32 | 42 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/5/2012 | <2.0 | 8.0 | 23 | 25 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 4/3/2012 | 2.8 | 43 | 20 | 21 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-6H-D | 1/15/2016 | 3.2 | 110 | 29 | 34 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 3.8 | 90 | 26 | 30 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | 4.0 | 90 | 24 | 29 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/18/2014 | 4.1 | 90 | 22 | 30 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | 4.2 | 87 | 22 | 29 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <1.0 | 2.5 | 28 | 35 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 1.7 | 50 | 13 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/3/2012 | 6.5 | 62 | 15 | 19 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-8 | 1/15/2016 | <1.0 | 260 | 99 | 89 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | 73 | 23 | 18 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | <5.0 | 400 | 110 | 79 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/18/2014 | <5.0 | 580 | 130 | 83 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/18/2013 | 7.9 | 550 | 120 | 88 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/5/2013 | 11 | 880 | 150 | 90 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <5.0 | 1,000 | 130 | 76 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/4/2012 | <5.0 | 1,000 | 150 | 96 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 3/31/2011 | 2.4 | 1,500 | 150 | 57 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 15 | 1,200 | 170 | 72 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/26/2009 | 8.4 | 1,400 | 140 | 64 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/7/2008 | <5.0 | 1,500 | 160 | 70 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2007 | <5.0 | 1,200 | 274 | 84 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/15/2007 | 17 | 2,300 | 240 | 82 | <10 | <10 | <10 | <10 | <40 |
| MW-9 | 1/14/2016 | <1.0 | 4.2 | 4.4 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 5.9 | 5.3 | 2.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 2.4 | 9.3 | 7.6 | 3.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | 6.2 | 20 | 11 | 6.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | 21 | 21 | 9.8 | 6.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/6/2013 | 53 | 67 | 20 | 12 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/6/2012 | 58 | 95 | 20 | 14 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/4/2012 | 14 | 130 | 32 | 27 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | 4.2 | 140 | 22 | 28 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | 7.1 | 50 | 7.7 | 6.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 4.3 | 44 | 5.6 | 3.4 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2008 | 130 | 280 | 26 | 18 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2007 | 55 | 200 | 20 | 17 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 5/16/2007 | 140 | 160 | 8.0 | 5.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-10 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/17/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 1.4 | 4.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2008 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/20/2007 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 2.1 |
| | 5/16/2007 | <1.0 | 1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 11 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-11 | 1/14/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 1.7 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 1.7 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | 15 | 10 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/17/2013 | 4.7 | 13 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | 4.9 | 2.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 37 | 6.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | 32 | 47 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | 31 | 18 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | 5.8 | 24 | 1.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 10 | 35 | 1.6 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2008 | 8.1 | 49 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2007 | 28 | 59 | 2.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 5/16/2007 | 24 | 51 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-12 | 1/14/2016 | 11 | 29 | 8.9 | 7.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 12 | 47 | 10 | 7.8 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 23 | 96 | 17 | 13 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/18/2014 | 89 | 310 | 23 | 20 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2013 | 130 | 340 | 16 | 18 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/6/2013 | 11 | 330 | 14 | 8.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 31 | 260 | 28 | 17 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | 3.7 | 81 | 27 | 18 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | 5.0 | 210 | 29 | 25 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | 1.1 | 210 | 33 | 24 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | 3.7 | 180 | 37 | 21 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 7/1/2008 | 5.2 | 140 | 11 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2007 | 8.3 | 230 | 35 | 23 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 5/16/2007 | 8.2 | 170 | 4.1 | 1.2 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-14S | 1/20/2016 | <1.0 | 6.0 | 1.8 | 3.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | 2.5 | 95 | 16 | 10 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | <10 | 850 | 200 | 77 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | 5.6 | 1,500 | 220 | 73 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/19/2013 | 30 | 1,700 | 200 | 85 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/5/2013 | 97 | 3,100 | 220 | 77 | <20 | <20 | <20 | <20 | <80 |
| | 12/6/2012 | 110 | 3,100 | 200 | 70 | <20 | <20 | <20 | <20 | <80 |
| | 4/5/2012 | 36 | 3,700 | 280 | 93 | <20 | <20 | <20 | <20 | <80 |
| | 4/1/2011 | 4.5 | 4,200 | 370 | 96 | 1.4 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 49 | 2,000 | 300 | 170 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/26/2009 | 61 | 2,100 | 230 | 76 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/3/2008 | 26 | 2,400 | 230 | 48 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2007 | 14 | 970 | 220 | 22 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/16/2007 | 18 | 190 | 11 | 2.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-14D | 1/14/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | <1.0 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | 3.3 | 5.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 2.8 | 5.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/5/2012 | 1.8 | 4.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | 15 | 28 | <1.0 | 1.2 | <1.0 | <1.0 | <1.0 | <4.0 | <4.0 |
| | 9/1/2009 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/26/2009 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/3/2008 | 10 | 19 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2007 | 2.0 | 4.8 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 5/15/2007 | <1.0 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-15S | 1/15/2016 | 17 | 140 | 110 | 110 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 20 | 170 | 96 | 120 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/31/2014 | 32 | 210 | 150 | 190 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/17/2014 | 31 | 210 | 140 | 240 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | 79 | 310 | 130 | 240 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/5/2013 | 11 | 220 | 140 | 290 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 46 | 240 | 150 | 250 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/5/2012 | 11 | 31 | 19 | 35 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | 4.0 | 270 | 160 | 290 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 1.7 | 250 | 130 | 250 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/26/2009 | <1.0 | 280 | 180 | 330 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/3/2008 | <10 | 470 | 220 | 440 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2007 | <10 | 560 | 260 | 440 | <10 | <10 | <10 | <10 | <40 |
| | 5/16/2007 | <1.0 | 720 | 300 | 430 | <10 | <10 | <10 | <10 | <40 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-15D | 1/20/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | <1.0 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | 3.1 | 5.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/6/2012 | 2.8 | 4.5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | <1.0 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | <1.0 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/26/2009 | <1.0 | 3.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/3/2008 | <1.0 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2007 | <1.0 | 1.9 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 5/15/2007 | <1.0 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-16 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/16/2014 | 1.1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-17 | 1/15/2016 | 3.1 | 240 | 50 | 46 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 2.7 | 150 | 35 | 35 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/16/2014 | 1.2 | 57 | 13 | 11 | <1.0 | <1.0 | <1.0 | 1.0 | <4.0 |
| MW-18S | 1/15/2016 | <1.0 | 15 | 7.3 | 8.9 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | 4.1 | 2.5 | 1.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/16/2014 | <1.0 | 3.4 | 1.6 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-18D | 1/14/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/16/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| MW-19 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 4.3 | <4.0 |
| | 6/29/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 4.7 | <4.0 |
| | 12/16/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 3.6 | <4.0 |
| OB-1 | 1/14/2016 | <1.0 | 3.6 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <2.0 | 3.2 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/30/2014 | <1.0 | 7.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| OB-2 | 1/20/2016 | 28 | 38 | 15 | 5.2 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | 130 | 140 | 40 | 14 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 37 | 130 | 26 | 5.1 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| OB-3 | 1/20/2016 | <1.0 | 130 | 68 | 17 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | <1.0 | 220 | 75 | 17 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/28/2015 | <1.0 | 440 | 84 | 13 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| SVE-1 | 1/20/2016 | 190 | 51 | 4.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/22/2015 | 230 | 33 | 4.2 | 1.6 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 510 | 56 | 6.6 | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/19/2014 | 860 | 160 | 13 | <10 | <10 | <10 | <10 | <10 | <40 |
| SVE-2 | 1/14/2016 | 15 | 22 | 3.2 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | 11 | 26 | 2.6 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/30/2014 | 14 | 36 | 4.9 | 1.7 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/19/2014 | 120 | 70 | 3.6 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| SVE-3 | 1/14/2016 | 9.9 | 12 | 3.2 | 4.1 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/30/2015 | 16 | 7.6 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/31/2014 | 22 | 5.7 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | 54 | 12 | 2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Various Other Site Monitoring Wells** | | | | | | | | | | |
| BIA-MW-1 (AKA BIA-MW-2) | 6/30/2015 | <1.0 | 3.1 | 3.3 | 1.6 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <1.0 | 6.7 | 6.6 | 4.5 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | Not Sampled | | | | | | | | |
| | 12/17/2013 | <1.0 | 11 | 9.6 | 5.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | Not Sampled | | | | | | | | |
| | 12/5/2012 | Not Sampled | | | | | | | | |
| | 3/31/2011 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.1 | <4.0 |
| | 9/1/2012 | <1.0 | 1.8 | 4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | Bailer still obstructing well. | | | | | | | | |
| | 7/7/2008 | Bailer lost in well. | | | | | | | | |
| | 12/19/2007 | <1.0 | 40 | 30 | 8.6 | <1.0 | <1.0 | <1.0 | 1.1 | <4.0 |
| | 5/16/2007 | <1.0 | 31 | 27 | 5.4 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| BIA-MW-3 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/17/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.7 | <4.0 |
| | 1/26/2009 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.5 | <4.0 |
| | 7/7/2008 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 2.0 | <4.0 |
| | 12/19/2007 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 2.8 | <4.0 |
| | 5/15/2007 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 1.6 | <4.0 |
| New BIA-E-MW | 1/15/2016 | <1.0 | 53 | 32 | 43 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/1/2015 | <1.0 | 83 | 51 | 72 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <5.0 | 180 | 110 | 130 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/18/2014 | <1.0 | 280 | 140 | 150 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <5.0 | 330 | 120 | 160 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/5/2013 | <1.0 | 570 | 170 | 160 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 310 | 77 | 68 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/4/2012 | <5.0 | 1,100 | 200 | 89 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 3/31/2011 | <1.0 | 1,300 | 190 | 40 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | <1.0 | 1,600 | 190 | 75 | 1.1 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/27/2009 | <1.0 | 1,200 | 190 | 54 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/7/2008 | <1.0 | 1,000 | 230 | 46 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2007 | <1.0 | 500 | 93 | 31 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| BG-BMW-1 | 12/17/2013 | Not Sampled - Could Not Locate | | | | | | | | |
| | 6/5/2013 | <1.0 | 6.3 | 46 | 91 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 19 | 47 | 83 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/2/2012 | <1.0 | 10 | 45 | 79 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | <1.0 | 1.9 | 18 | 29 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | <1.0 | 38 | 31 | 42 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/28/2009 | 3.1 | 81 | 28 | 32 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/2/2008 | <1.0 | 56 | 43 | 57 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/20/2007 | 2.4 | 140 | 42 | 48 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 5/17/2007 | <2.0 | 140 | 96 | 96 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| BG-BMW-7 | 1/27/2009 | Paved Over. Not Sampled. | | | | | | | | |
| | 7/2/2008 | Dry | | | | | | | | |
| | 12/19/2007 | Dry | | | | | | | | |
| | 5/17/2007 | <5.0 | 290 | 150 | 160 | <5.0 | <5.0 | <5.0 | 10 | <20 |
| BG-BMW-8 | 1/15/2016 | <1.0 | 26 | 43 | 68 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 21 | 38 | 59 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | 24 | 37 | 54 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | 17 | 35 | 60 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | 16 | 27 | 40 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <0.2 | 6.9 | 34 | 54 | <0.2 | 0.5 | <0.1 | <0.1 | <0.3 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| BG-BMW-12 | 1/15/2016 | <1.0 | 280 | 73 | 75 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 230 | 59 | 62 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | 190 | 53 | 58 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | 180 | 47 | 55 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | 140 | 36 | 43 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <1.0 | 150 | 36 | 46 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 110 | 30 | 38 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/2/2012 | 1.3 | 94 | 28 | 38 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | <1.0 | 44 | 16 | 20 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/1/2009 | 1.3 | 59 | 18 | 23 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/28/2009 | 2.2 | 46 | 41 | 50 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/2/2008 | No Access. Not Sampled. | | | | | | | | |
| | 12/21/2007 | <2.0 | 90 | 61 | 74 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 5/17/2007 | 2.2 | 130 | 29 | 30 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| CA-FSY-14 | 1/14/2016 | <1.0 | 1.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | 1.2 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | 1.7 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | 1.4 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/6/2013 | 0.2 | 1.7 | 0.4 | <0.2 | <0.2 | <0.3 | <0.1 | <0.1 | <0.3 |
| Catholic Cemetary North Well | 7/2/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | 4.7 | <4.0 |
| | 6/26/2013 | <0.2 | <0.2 | <0.1 | <0.2 | <0.2 | <0.3 | <0.1 | 5.2 | <0.3 |
| Catholic Cemetary South Well | 7/2/2015 | 21 | 44 | 1.3 | <1.0 | <1.0 | <1.0 | <1.0 | 4.8 | <4.0 |
| | 6/26/2013 | 17 | 28 | 0.6 | <0.2 | <0.2 | <0.3 | <0.1 | 4.7 | <0.3 |
| CHMW-E | 1/15/2016 | <1.0 | 6.4 | 2.7 | <1.0 | <1.0 | <1.0 | <1.0 | 6.6 | <4.0 |
| | 6/29/2015 | <1.0 | 6.9 | 3.0 | <1.0 | <1.0 | <1.0 | <1.0 | 6.9 | <4.0 |
| | 12/29/2014 | <2.0 | 6.1 | 2.8 | <2.0 | <2.0 | <2.0 | <2.0 | 6.4 | <8.0 |
| | 6/18/2014 | <1.0 | 8.4 | 3.4 | <1.0 | <1.0 | <1.0 | <1.0 | 5.7 | <4.0 |
| | 12/18/2013 | <1.0 | 8.9 | 3.7 | <1.0 | <1.0 | <1.0 | <1.0 | 6.3 | <4.0 |
| | 6/5/2013 | 1.0 | 9.4 | 2.6 | <1.0 | <1.0 | <1.0 | <1.0 | 9.6 | <4.0 |
| | 12/5/2012 | <1.0 | 9.1 | 3.0 | <1.0 | <1.0 | <1.0 | <1.0 | 13 | <4.0 |
| | 4/3/2012 | <2.0 | 24 | 7.5 | <2.0 | <2.0 | <2.0 | <2.0 | 9.1 | <8.0 |
| | 4/1/2011 | <1.0 | 18 | 4.4 | 1.3 | <1.0 | <1.0 | <1.0 | 13 | <4.0 |
| | 9/1/2009 | <1.0 | 23 | 6.1 | 1.2 | <1.0 | <1.0 | 2.5 | 15 | <4.0 |
| | 1/28/2009 | 2.6 | 19 | 3.9 | <1.0 | <1.0 | <1.0 | <1.0 | 18 | <4.0 |
| | 7/2/2008 | <1.0 | 15 | 2.9 | <1.0 | <1.0 | <10 | <1.0 | 17 | <4.0 |
| | 12/20/2007 | <1.0 | 11 | 2.0 | <1.0 | <1.0 | <10 | <1.0 | 22 | <4.0 |
| | 5/17/2007 | <1.0 | 19 | 2.6 | <1.0 | <1.0 | <1.0 | <1.0 | 20 | <4.0 |
| MW-4H-01 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/17/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <0.2 | 1.4 | 0.5 | <0.2 | <0.1 | <0.3 | <0.1 | <0.1 | <0.3 |
| MW-4H-02 | 1/13/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/29/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 6/18/2014 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/18/2013 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | <0.2 | <0.2 | <0.1 | <0.2 | <0.1 | <0.3 | <0.1 | <0.1 | <0.3 |
| MW-4H-04 | 1/15/2016 | 9.9 | 840 | 190 | 130 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/1/2015 | 14 | 730 | 160 | 90 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | 20 | 930 | 170 | 98 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | 25 | 1,200 | 180 | 120 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2013 | 23 | 1,300 | 170 | 110 | <10 | <10 | <10 | <10 | <40 |
| | 6/5/2013 | 24 | 1,400 | 140 | 24 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/5/2012 | 19 | 1,100 | 130 | 93 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/3/2012 | 19 | 1,100 | 120 | 100 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 4/1/2011 | 26 | 910 | 71 | 70 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 27 | 880 | 110 | 120 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/28/2009 | 30 | 980 | 110 | 97 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/2/2008 | 59 | 1,400 | 120 | 130 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/20/2007 | 110 | 1,400 | 130 | 120 | <10 | <10 | <10 | <10 | <40 |
| | 5/17/2007 | 170 | 2,900 | 210 | 170 | <10 | <10 | <10 | <10 | <40 |
| MW-4H-06 | 1/15/2016 | 1.5 | 400 | 100 | 86 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/7/2015 | 1.7 | 460 | 91 | 83 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/29/2014 | <5.0 | 340 | 81 | 68 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/18/2014 | 8.9 | 270 | 62 | 68 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/18/2013 | <5.0 | 230 | 59 | 55 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 6/6/2013 | 12 | 220 | 52 | 54 | 0.2 | <0.3 | <0.1 | <0.1 | <0.3 |

# TABLE 4. SUMMARY OF ORGANIC GROUNDWATER ANALYTICAL RESULTS
# LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO

| Monitoring Well | Date Sampled | PCE (µg/L) | TCE (µg/L) | *cis* DCE (µg/L) | *trans* DCE (µg/L) | 1,1 DCE (µg/L) | Vinyl Chloride (µg/L) | 1,1 DCA (µg/L) | MTBE (µg/L) | Total Napthalenes (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| NI-MW-2 | 1/15/2016 | <1.0 | 140 | 190 | 200 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/30/2015 | <1.0 | 190 | 220 | 250 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | <10 | 210 | 190 | 230 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | <10 | 320 | 230 | 280 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2013 | <10 | 270 | 200 | 230 | <10 | <10 | <10 | <10 | <40 |
| | 6/5/2013 | <1.0 | 470 | 210 | 250 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/5/2012 | <1.0 | 350 | 160 | 170 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/3/2012 | <1.0 | 460 | 210 | 220 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 4/1/2011 | <1.0 | 510 | 140 | 150 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | <5.0 | 750 | 210 | 160 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/28/2009 | <5.0 | 820 | 180 | 120 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/2/2008 | <5.0 | 1,300 | 200 | 160 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 12/20/2007 | <5.0 | 1,300 | 230 | 140 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/17/2007 | <10 | 1,700 | 250 | 150 | <10 | <10 | <10 | <10 | <40 |
| RayMar-W | 1/15/2016 | <5.0 | 730 | 100 | 86 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/7/2015 | <1.0 | 710 | 110 | 82 | <1.0 | <1.0 | <1.0 | 1.3 | <4.0 |
| | 12/31/2014 | <10 | 540 | 82 | 64 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | <10 | 580 | 90 | 65 | <10 | <10 | <10 | <10 | <40 |
| | 12/19/2013 | <10 | 500 | 80 | 60 | <10 | <10 | <10 | <10 | <40 |
| | 6/5/2013 | <2.0 | 590 | 73 | 58 | <2.0 | <2.0 | <2.0 | <2.0 | <8.0 |
| | 12/5/2012 | Not Sampled | | | | | | | | |
| | 4/2/2012 | 9.5 | 570 | 78 | 81 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 3/31/2011 | <1.0 | 550 | 50 | 57 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 9/2/2009 | 15 | 700 | 92 | 75 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 1/28/2009 | 12 | 960 | 92 | 63 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/2/2008 | <10 | 870 | 91 | 76 | <10 | <10 | <10 | <10 | <40 |
| | 12/20/2007 | <5.0 | 930 | 130 | 82 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 5/17/2007 | 12 | 1,500 | 150 | 92 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| RayMar-E | 1/15/2016 | <5.0 | 740 | 98 | 90 | <5.0 | <5.0 | <5.0 | <5.0 | <20 |
| | 7/1/2015 | 1.1 | 660 | 92 | 82 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/31/2014 | <10 | 590 | 78 | 69 | <10 | <10 | <10 | <10 | <40 |
| | 6/18/2014 | 3.6 | 700 | 89 | 78 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 12/19/2013 | 3.7 | 590 | 79 | 71 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 6/5/2013 | 7.0 | 680 | 91 | 89 | 0.5 | <0.3 | <0.1 | <0.1 | <0.3 |
| SBM-1 | 1/14/2016 | <1.0 | 44 | 3.9 | <1.0 | <1.0 | <1.0 | <1.0 | 17 | <4.0 |
| | 7/2/2015 | 1.0 | 33 | 2.9 | <1.0 | <1.0 | <1.0 | <1.0 | 15 | <4.0 |
| | 1/5/2015 | <1.0 | 22 | 1.5 | <1.0 | <1.0 | <1.0 | <1.0 | 12 | <4.0 |
| SBM-2 | 1/14/2016 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 7/2/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| | 1/5/2015 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <4.0 |
| NMWQCC Groundwater Standard | | **20** | **100** | - | - | **5** | **1** | 25 | 100* | 30 |

NOTES:
* Environmental Improvement Board standard
Shaded where concentration is at or exceeds the NMWQCC standard.
- = Not Analyzed
cis, trans DCE = 1,2 dichloroethene
DCA = dichloroethane
MTBE = methyl tert-butyl ether
ND = non-detect/not detected
NMWQCC = New Mexico Water Quality Control Commission
PCE = perchloroethylene
TCE = trichloroethylene
µg/L = micrograms per liter

# TABLE 5. SVE PILOT TEST SYSTEM PERFORMANCE
# LAUN-DRY SUPPLY COMPANY INC., ALBUQUERQUE, NEW MEXICO

| | Flow Rate (scfm) | | | | | PID (ppmv) | | | | | | | | Lab Analysis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Effluent | | | | |
| Date | SVE-1 | SVE-2 | SVE-3 | MW-6B | Influent | SVE-1 | SVE-2 | SVE-3 | MW-6B | Influent | Between GAC 1 & GAC 2 | Post GAC | System Effluent | Influent $C_{PCE}$ (µg/L) | Influent $C_{TCE}$ (µg/L) |
| 12/1/2015 | SYSTEM OFF | | | | | NM | NM | NM | NM | NM | --- | --- | NM | NM | NM |
| 12/1/2015 | 38 | OFF | OFF | 48 | 86 | 6.9 | OFF | OFF | 9.4 | 8.3 | --- | --- | 0.0 | NM | NM |
| 11/5/2015 | 38 | OFF | OFF | 54 | 92 | 19.7 | OFF | OFF | 14.8 | 4.2 | --- | --- | 0.0 | NM | NM |
| 9/24/2015 | 38 | OFF | OFF | 48 | 86 | 15.5 | OFF | OFF | 38.3 | 16.5 | --- | --- | 0.0 | NM | NM |
| 9/4/2015 | SYSTEM OFF | | | | | NM | NM | NM | NM | NM | --- | --- | NM | NM | NM |
| 9/4/2015 | 38 | OFF | OFF | 47 | 85 | 10.9 | OFF | OFF | 11.3 | 7.2 | --- | --- | 0.0 | 35 | 1.7 |
| 8/3/2015 | 35 | OFF | OFF | 45 | 80 | 28.7 | OFF | OFF | 66.7 | 27.3 | --- | --- | 0.0 | NM | NM |
| 8/3/2015 | 28 | 22 | 32 | 35 | 117 | 28.7 | 0.0 | 3.2 | 66.7 | 27.3 | --- | --- | 0.0 | NM | NM |
| 6/25/2015 | SYSTEM OFF | | | | | NM | NM | NM | NM | NM | --- | --- | NM | NM | NM |
| 6/25/2015 | 36 | OFF | OFF | 45 | 81 | 0.0 | OFF | OFF | 8.6 | 6.4 | --- | --- | 0.0 | NM | NM |
| 6/5/2015 | 30 | 34 | 33 | 38 | 135 | 6.5 | 0.2 | 0.1 | 6.2 | 0.6 | --- | --- | 0.0 | NM | NM |
| 5/22/2015 | 30 | 30 | 35 | 38 | 133 | 23.5 | 16.7 | 15.6 | 39.4 | 11.7 | --- | --- | 7.0 | 34 | 1.1 |
| 4/23/2015 | SYSTEM OFF | | | | | NM | NM | NM | NM | NM | --- | --- | NM | NM | NM |
| 3/30/2015 | 24 | 35 | 40 | 38 | 137 | 29.5 | 12.9 | 13.1 | 56 | 30.5 | --- | --- | 24.7 | NM | NM |
| 12/5/2014 | 22 | 35 | 45 | 42 | 144 | 9.9 | 8.7 | 7.9 | 26.3 | 7.7 | --- | --- | NM | NM | NM |
| 11/19/2014 | 23 | 35 | 45 | 42 | 145 | 7.9 | 7.6 | 6.3 | 10.3 | 7.2 | --- | --- | 8.0 | 10 | 0.68 |
| 10/31/2014 | 22 | 34 | 44 | 41 | 141 | 16.8 | 12.1 | 12.1 | 20.7 | 12.5 | --- | --- | 12.2 | NM | NM |
| 10/17/2014 | 23 | 35 | 44 | 44 | 146 | 12.5 | 6.3 | 6.7 | 15.6 | 6.6 | --- | --- | 15.2 | NM | NM |
| 10/3/2014 | 23 | 35 | 44 | 41 | 143 | 20.8 | 14.8 | 15.7 | 29.7 | 18.7 | --- | --- | 18.4 | NM | NM |
| 9/12/2014 | 18 | 35 | 44 | 42 | 139 | 17.1 | 19.0 | 10.4 | 19.8 | 6.2 | --- | --- | 22.1 | NM | NM |
| 8/29/2014 | 18 | 35 | 43 | 40 | 136 | 38.4 | 20.4 | 23.1 | 44.3 | 23.0 | --- | --- | 21.8 | NM | NM |
| 8/14/2014 | 15 | 35 | 42 | 40 | 132 | 40.0 | 23.2 | 21.4 | 51.8 | 27.4 | --- | --- | 22.4 | NM | NM |
| 8/1/2014 | 17 | 35 | 42 | 40 | 134 | 35.5 | 20.3 | 19.8 | 55.5 | 24.6 | --- | --- | 24.3 | NM | NM |
| 7/18/2014 | 23 | 33 | 41 | 40 | 137 | 49.8 | 17.8 | 12.3 | 86.4 | 17.5 | --- | --- | 28.2 | NM | NM |
| 6/20/2014 | 23 | 46 | 52 | 50 | 171 | 49.8 | 17.8 | 12.3 | 86.4 | 17.5 | --- | 59.3 | --- | 48 | 1.1 |
| 6/16/2014 | 17 | 16 | 25 | 31 | 89 | 44.6 | 17.0 | 24.1 | 62.9 | 37.4 | --- | 73.4 | --- | 50 | 1.6 |
| 5/28/2014 | 14.5 | 15 | 21 | 32 | 82.5 | 45.7 | 18.8 | 27.6 | 52.3 | 28.4 | 45.3 | --- | --- | NM | NM |
| 5/5/2014 | 19 | 17 | 25 | 34 | 95 | 37.2 | 18.9 | 17.8 | 57.7 | 21.7 | 4.8 | --- | --- | NM | NM |
| 4/24/2014 | 21 | 17 | 25 | 32 | 95 | 18.6 | 6.6 | 24.6 | 44.2 | 26.9 | 0.0 | --- | --- | NM | NM |
| 4/10/2014 | 20 | 17 | 25 | 31 | 93 | 43.2 | 21.5 | 18.9 | 53.5 | 23.9 | 0.0 | --- | --- | NM | NM |
| 4/1/2014 | 22 | 17 | 25 | 32 | 96 | 38.3 | 21.8 | 28.9 | 75.6 | 25.5 | 0.0 | --- | --- | 49 | 2.0 |
| 3/14/2014 | 20 | 17 | 20 | 34 | 91 | 37.7 | 10.9 | 12.9 | 114 | 54.5 | 0.0 | --- | --- | NM | NM |
| 2/28/2014 | 17.5 | 23.5 | 16 | 35.5 | 92.5 | 42.1 | 14.1 | 39.8 | 107 | 38.8 | 0.0 | --- | --- | NM | NM |
| 2/12/2014 | 17.5 | 12.5 | 11 | 40 | 81 | 67.3 | 36.9 | 33.4 | 205 | 113 | 0.0 | --- | --- | NM | NM |
| 1/31/2014 | 20 | 26 | 27 | 25 | 98 | 170 | 54.5 | 53.8 | 456 | 116 | 0.0 | --- | --- | 490 | 10 |
| 1/20/2014 | 24 | 25 | 25 | 25 | 99 | 116 | 84.3 | 281 | 558 | 146 | 0.0 | --- | --- | NM | NM |
| 12/23/2013 | 25 | 27 | 26 | 24 | 102 | 198 | 110 | 127 | 596 | 195 | 7.1 | --- | --- | NM | NM |
| 12/20/2013 | 23 | 28 | 27 | 25 | 103 | 233 | 149 | 159 | 1040 | 348 | 0.0 | --- | --- | NM | NM |
| 12/16/2013 | 22.5 | 22 | 27 | 25 | 96.5 | 303 | 155 | 175 | 803 | 344 | 0.0 | --- | --- | NM | NM |
| 12/12/2013 | 21 | 22 | 24 | 25 | 92 | 531 | 268 | 293 | 1210 | 492 | 0.0 | --- | --- | NM | NM |
| 12/9/2013 | 20 | 22 | 28 | 27 | 97 | 1240 | 398 | 579 | 2980 | 825 | 0.0 | --- | --- | 2100 | 32 |
| 12/5/2013 | 20 | 22 | 30 | 27 | 99 | 3040 | 838 | 1240 | > 4000 | 1560 | 0.0 | --- | --- | NM | NM |
| 12/2/2013 | 25 | 22.5 | 26 | 25 | 98.5 | > 4000 | > 4000 | 3250 | > 4000 | > 4000 | 0.0 | --- | --- | 6900 | 43 |

NOTES:
Granular activated carbon (GAC) vessels were removed on 6/18/2014
1 µg/L = 6.24E-08 lb/ft3
C = concentration
PCE = perchloroethylene
PID = photoionization detector
ppmv = parts per million per volume
scfm = standard cubic feet per minute
TCE = trichloroethylene
µg/L = microgram per liter

# TABLE 6. SVE PILOT TEST SYSTEM MASS REMOVAL
# LAUN-DRY SUPPLY COMPANY INC., ALBUQUERQUE, NEW MEXICO

| Date | Influent Flow Rate (scfm) | Average Flow Rate (scfm) | Influent PID (ppmv) | Lab Analysis (C) | | PID Ratio | | Estimated C ($C_E$) | | Mass Flow Rate (lb/hr) | | Mass Removal (lbs) | | Total Mass Removed (lbs) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $C_{PCE}$ (µg/L) | $C_{TCE}$ (µg/L) | PID/PCE | PID/TCE | $C_{EPCE}$ (µg/L) | $C_{ETCE}$ (µg/L) | $\dot{m}_{PCE}$ | $\dot{m}_{TCE}$ | PCE | TCE | PCE | TCE |
| 12/1/2015 | SYSTEM OFF | | | NM | NM | NA | NA | NA | NA | | | | | | |
| 12/1/2015 | 86 | 89 | 8.3 | NM | NM | NA | NA | 40 | 2 | 0.0134443 | 0.000653 | 21.941 | 1.066 | 703 | 15.03 |
| 11/5/2015 | 92 | 89 | 4.2 | NM | NM | NA | NA | 20 | 1 | 0.0068032 | 0.00033 | 27.267 | 1.324 | 681 | 13.96 |
| 9/24/2015 | 86 | 85.5 | 16.5 | NM | NM | NA | NA | 80 | 4 | 0.0256757 | 0.001247 | 12.324 | 0.599 | 840 | 18.84 |
| 9/4/2015 | SYSTEM OFF | | | NM | NM | NA | NA | NA | NA | | | | | | |
| 9/4/2015 | 85 | 82.5 | 7.2 | 35 | 1.7 | 0.2057143 | 4.2352941 | 35 | 2 | 0.0108108 | 0.000525 | 8.303 | 0.403 | 828 | 18.24 |
| 8/3/2015 | 80 | 98.5 | 27.3 | NM | NM | NA | NA | 79 | 3 | 0.0292569 | 0.000947 | 180.456 | 5.838 | 820 | 17.83 |
| 8/3/2015 | 117 | 99 | 27.3 | NM | NM | NA | NA | 79 | 3 | 0.0294054 | 0.000951 | 27.523 | 0.890 | 677 | 13.37 |
| 6/25/2015 | SYSTEM OFF | | | NM | NM | NA | NA | NA | NA | | | | | | |
| 6/25/2015 | 81 | 108 | 6.4 | NM | NM | NA | NA | 19 | 1 | 0.0075203 | 0.000243 | 3.610 | 0.117 | 649 | 12.48 |
| 6/5/2015 | 135 | 134 | 0.6 | NM | NM | NA | NA | 2 | 0 | 0.0008748 | 2.83E-05 | 1.407 | 0.046 | 645 | 12.36 |
| 5/22/2015 | 133 | 135 | 11.7 | 34 | 1.1 | 0.3441176 | 10.636364 | 34 | 1 | | | | | | |
| 4/23/2015 | SYSTEM OFF | | | NM | NM | NA | NA | NA | NA | 0.0174396 | 0.000564 | 10.045 | 0.325 | 654 | 12.64 |
| 3/30/2015 | 137 | 140.5 | 30.5 | NM | NM | NA | NA | 42 | 3 | | | | | | |
| 12/5/2014 | 144 | 144.5 | 7.7 | NM | NM | NA | NA | 11 | 1 | 0.0057858 | 0.000393 | 2.222 | 0.151 | 644 | 12.31 |
| 11/19/2014 | 145 | 143 | 7.2 | 10 | 0.68 | 0.72 | 10.588235 | 10 | 1 | 0.0053539 | 0.000364 | 2.441 | 0.166 | 642 | 12.16 |
| 10/31/2014 | 141 | 143.5 | 12.5 | NM | NM | NA | NA | 34 | 1 | 0.0184205 | 0.000422 | 6.189 | 0.142 | 639 | 12.00 |
| 10/17/2014 | 146 | 144.5 | 6.6 | NM | NM | NA | NA | 18 | 0 | 0.0097938 | 0.000224 | 3.291 | 0.075 | 633 | 11.85 |
| 10/3/2014 | 143 | 141 | 18.7 | NM | NM | NA | NA | 51 | 1 | 0.027077 | 0.000621 | 13.647 | 0.313 | 630 | 11.78 |
| 9/12/2014 | 139 | 137.5 | 6.2 | NM | NM | NA | NA | 17 | 0 | 0.0087545 | 0.000201 | 2.942 | 0.067 | 616 | 11.47 |
| 8/29/2014 | 136 | 134 | 23 | NM | NM | NA | NA | 63 | 1 | 0.0316499 | 0.000725 | 11.394 | 0.261 | 613 | 11.40 |
| 8/14/2014 | 132 | 133 | 27.4 | NM | NM | NA | NA | 75 | 2 | 0.0374232 | 0.000858 | 11.676 | 0.268 | 602 | 11.14 |
| 8/1/2014 | 134 | 135.5 | 24.6 | NM | NM | NA | NA | 67 | 2 | 0.0342305 | 0.000784 | 11.501 | 0.264 | 590 | 10.87 |
| 7/18/2014 | 137 | 140.5 | 17.5 | NM | NM | NA | NA | 48 | 1 | 0.0252495 | 0.000579 | 16.968 | 0.389 | 579 | 10.61 |
| 6/20/2014 | 144 | 116.5 | 17.5 | 48 | 1.1 | 0.3645833 | 15.909091 | 48 | 1 | 0.02094 | 0.00048 | 2.010 | 0.046 | 562 | 10.22 |
| 6/16/2014 | 89 | 85.75 | 37.4 | 50 | 1.6 | 0.748 | 23.375 | 50 | 2 | 0.01605 | 0.00051 | 7.320 | 0.234 | 560 | 10.17 |
| 5/28/2014 | 82.5 | 88.75 | 28.4 | NM | NM | NA | NA | 55 | 2 | 0.01813 | 0.00074 | 10.010 | 0.409 | 552 | 9.94 |
| 5/5/2014 | 95 | 95 | 21.7 | NM | NM | NA | NA | 42 | 2 | 0.01483 | 0.00061 | 3.915 | 0.160 | 542 | 9.53 |
| 4/24/2014 | 95 | 94 | 26.9 | NM | NM | NA | NA | 52 | 2 | 0.01819 | 0.00074 | 6.112 | 0.249 | 538 | 9.37 |
| 4/10/2014 | 93 | 94.5 | 23.9 | NM | NM | NA | NA | 46 | 2 | 0.01625 | 0.00066 | 3.510 | 0.143 | 532 | 9.12 |
| 4/1/2014 | 96 | 93.5 | 25.5 | 49 | 2.0 | 0.5204082 | 12.75 | 49 | 2 | 0.01715 | 0.00070 | 7.410 | 0.302 | 529 | 8.98 |
| 3/14/2014 | 91 | 91.75 | 54.5 | NM | NM | NA | NA | 230 | 5 | 0.07908 | 0.00161 | 26.571 | 0.542 | 521 | 8.67 |
| 2/28/2014 | 92.5 | 86.75 | 38.8 | NM | NM | NA | NA | 164 | 3 | 0.05323 | 0.00109 | 20.441 | 0.417 | 495 | 8.13 |
| 2/12/2014 | 81 | 89.5 | 113 | NM | NM | NA | NA | 477 | 10 | 0.15995 | 0.00326 | 46.065 | 0.940 | 474 | 7.71 |
| 1/31/2014 | 98 | 98.5 | 116 | 490 | 10 | 0.2367347 | 11.6 | 490 | 10 | 0.18070 | 0.00369 | 47.706 | 0.974 | 428 | 6.77 |
| 1/20/2014 | 99 | 100.5 | 146 | NM | NM | NA | NA | 372 | 6 | 0.13984 | 0.00213 | 93.970 | 1.432 | 381 | 5.80 |
| 12/23/2013 | 102 | 102.5 | 195 | NM | NM | NA | NA | 496 | 8 | 0.19048 | 0.00290 | 13.715 | 0.209 | 287 | 4.37 |
| 12/20/2013 | 103 | 99.75 | 348 | NM | NM | NA | NA | 886 | 13 | 0.33082 | 0.00504 | 31.759 | 0.484 | 273 | 4.16 |
| 12/16/2013 | 96.5 | 94.25 | 344 | NM | NM | NA | NA | 876 | 13 | 0.30899 | 0.00471 | 29.663 | 0.452 | 241 | 3.68 |
| 12/12/2013 | 92 | 94.5 | 492 | NM | NM | NA | NA | 1252 | 19 | 0.44310 | 0.00675 | 31.903 | 0.486 | 212 | 3.22 |
| 12/9/2013 | 97 | 98 | 825 | 2100 | 32 | 0.3928571 | 25.78125 | 2100 | 32 | 0.77052 | 0.01174 | 73.969 | 1.127 | 180 | 2.74 |
| 12/5/2013 | 99 | 98.75 | 1560 | NM | NM | NA | NA | 3971 | 61 | 1.46812 | 0.02237 | 105.705 | 1.611 | 106 | 1.61 |
| 12/2/2013 | 98.5 | 98.5 | 4000+ | 6900 | 43 | NA | NA | 6900 | 43 | 2.54461 | 0.01586 | | | | |

NOTES:
All estimated concentrations and mass removal calculations are based off of the most recent
Mass removal on 4/23/15 was calculated using the estimated concentrations from 5/22/15.
1 (µg/L) = 6.24E-08 lb/ft3
$\dot{m}$ = Q*C (Average flow rate * Estimated concentration)
C = concentration
lbs = pounds
PCE = perchloroethylene
PID = photoionization detector
ppmv = parts per million per volume
scfm = standard cubic feet per minute
TCE = trichloroethylene
µg/L = microgram per liter

**TABLE 7. SCREENING EVALUATION OF APPLICABLE TECHNOLOGIES**
**LAUN-DRY SUPPLY COMPANY, ALBUQUERQUE, NEW MEXICO**

| Target | | General Response Action | Technology | Process Option | Effectiveness/Benefits | Implementability | Status |
|---|---|---|---|---|---|---|---|
| Media | COC | | | | | | |
| Groundwater and Soil | PCE, TCE, DCE | No Further Action | None | Not applicable | Uses primarily dilution and intrinsic degradation to meet standards. Lack of monitoring provides no information regarding plume migration and stability. No clean-up costs. | Implementable as no remedial action will be conducted. | Not Selected |
| Soil | PCE, TCE, DCE | Treatment | Physical Removal | Soil Vapor Extraction | Presumptive for VOCs and cost effective | Implementable | **Selected** |
| Groundwater | PCE, TCE, DCE | Limited Action | Institutional Controls | OSE Order | Can be used with other technologies to maintain long-term effectiveness. | Implementable | **Selected** |
| | | | Engineered Controls | Site Restrictions; Point of Use Treatment | Source materials have been effectively cleaned up; restrictions in areas of solute plume not necessary. Point of Use Treatment not needed since no groundwater withdrawals currently exist within APA. | Implementable | Not Selected |
| | | | Long Term Monitoring | Ground water sampling and analysis | Provides data to monitor plume migration and stability. Can be used to assess trends in areas of APA outside of active treatment zones. | Implementable | **Selected** |
| Groundwater | PCE, TCE, DCE | Containment | Vertical Barriers | Slurry wall | Can be used to address plume containment in source area and isolate source contaminants from further aquifer degradation. | Not economically feasible in source area due to the total depth of aquifer. Not necessary since source contamination has been substantially reduced by SVE. | Not Selected |
| | | | | Grout curtain | Can be used to address plume containment in source area and isolate source contaminants from further aquifer degradation. | Not economically feasible in source area due to the total depth of aquifer. Not necessary since source contamination has been substantially reduced by SVE. | Not Selected |
| | | | | Sheet piling | Can be used to address plume containment in source area and isolate source contaminants from further aquifer degradation. | Not economically feasible in source area due to the total depth of aquifer. Not necessary since source contamination has been substantially reduced by SVE. | Not Selected |
| | | | Hydraulic Containment | Ground water pump and treat | Hydraulic containment can arrest plume expansion. However, large volumes of groundwater may need to be pumped and treated just to maintain hydraulic control. Site cleanup can require significantly greater volumes of pumped water and attendant treatment than just containment. | Implementable but expensive to operate. Long-term results with failure of pump-and-treat to achieve standards has resulted in trend toward in situ methods (e.g., reactive barriers, enhanced reductive dechlorination, chemical oxidation). | Not Selected |

**TABLE 7. SCREENING EVALUATION OF APPLICABLE TECHNOLOGIES**
**LAUN-DRY SUPPLY COMPANY, ALBUQUERQUE, NEW MEXICO**

| Target | | General Response Action | Technology | Process Option | Effectiveness/Benefits | Implementability | Status |
|---|---|---|---|---|---|---|---|
| Media | COC | | | | | | |
| Groundwater | PCE, TCE, DCE | In Situ Treatment | Biological | Monitored natural attenuation | PCE appears to naturally attenuate to TCE, and TCE to cis 1,2-DCE. Therefore, in select areas of the Laun-Dry plume, MNA is appropriate. | Implementable in that additional analytes and geochemical indicators would be added to LTM regimen. | **Selected** |
| | | | | Reductive Dechlorination (RDC) | RDC can be enhanced by injection (via wells or drive points) or placement (in trenched reactive barrier) of electron donor to lower redox potential and dissolved oxygen, thereby promoting natural biological dechlorination. Can be augmented with addition of dechlorinating bacteria (see bioaugmentation below). | Implementable - would cause increase of manganese and iron as well as other reducing metals to precipitate | **Selected** |
| | | | | Bioaugmentation | Bacteria that can reductively dechlorinate PCE, TCE and DCE can be added to the treatment zone once anaerobic conditions have been established in the aquifer. | Bioaugmentation can be used in concert with injection of electron donor in treatment zone. | **Selected** |
| | | | Chemical | Chemical Oxidation | Ozone, permanganate, percarbonate | Chemical oxidation requires contact with contaminant. This renders it applicable to source zones where numerous close injections are feasible. Generally not recommended for large solute plumes. | Not Selected |
| | | | Various reactions | Permeable reactive barrier | Lines of injection wells can be used to inject aquifer amendments that increase fraction organic carbon and provides electron donor in treatment zone. This in turn can adsorb and retard solute migration and destroy chlorinated solvents through RDC. | Implementable if lines of injection wells or drive points are employed. | **Selected** |
| Groundwater | PCE, TCE, DCE | Ex Situ Treatment | Physical Removal | Air stripping | Volatile organic compounds can be removed from groundwater via transfer from solute to vapor phase as water is passed through clean air stream. | Implementable. However, conveyance lines from pumping wells to ex situ treatment would require extensive piping and utility runs. Would require air permit and discharge plan. Intensive O&M depending on general water chemistry. | Not Selected |
| | | | | Granular Activated Carbon (GAC) filtration | Volatile organic compounds sorb onto activated carbon media being removed from the groundwater that passes through the treatment beds of GAC. | Implementable. Same negative factors as Air Stripping. Biofouling can be problematic. | Not Selected |

Notes:
PCE = Tetrachloroethene
TCE = Trichloroethene
DCE = Dichloroethene
VOC = Volatile organic compound
OSE = New Mexico Office of State Engineer
SVE = Soil vapor extraction
APA = Abatement plan area
RDC = Reductive dechlorination
LTM = Long term monitoring
O&M = Operation and maintenance
GAC = Granular activated carbon

**TABLE 8. SUMMARY SCOPE OF WORK GROUNDWATER MONITORING**
**LAUN-DRY SUPPLY CO., ALBUQUERQUE, NEW MEXICO**

| Well Number | Monitoring Frequency | | | Monitoring Regimen | | | Laboratory Analytical | | Field Measurements | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quarterly | Semi-Annual | Annual | LTM | MNA | Performance Assessment | VOC | TOC | D.O. | ORP | Conductivity | pH | Temperature |
| MW-1 | | | X | X | | | X | | | | X | X | X |
| MW-2 | | X | | | X | | X | | X | X | X | X | X |
| MW-3 | | X | | | X | | X | | X | X | X | X | X |
| MW-4 | | X | | | | X | X | | X | X | X | X | X |
| MW-5 | X | | | | | X | X | | X | X | X | X | X |
| MW-6 | | X | | | X | | X | | X | X | X | X | X |
| MW-6A | | | X | X | | | X | | | | X | X | X |
| MW-6B[3] | | X | | | | X | X | | X | X | X | X | X |
| MW-6C[3] | | | X | X | | | X | | | | X | X | X |
| MW-6D | | | X | X | | | X | | | | X | X | X |
| MW-6E | | X | | | | X | X | | X | X | X | X | X |
| MW-6F | | | X | X | | | X | | | | X | X | X |
| MW-6HS | | X | | | | X | X | | X | X | X | X | X |
| MW-6HD | | X | | | | X | X | | X | X | X | X | X |
| MW-6G | | X | | | | X | X | | X | X | X | X | X |
| MW-8 | X | | | | | X | X | | X | X | X | X | X |
| MW-9 | | | X | X | | | X | | | | X | X | X |
| MW-10 | | | X | X | | | X | | | | X | X | X |
| MW-11 | | | X | X | | | X | | | | X | X | X |
| MW-12 | | X | | | X | | X | | X | X | X | X | X |
| MW-14S | | X | | | X | | X | | X | X | X | X | X |
| MW-14D | | | X | X | | | X | | | | X | X | X |
| MW-15S | | X | | | | X | X | | X | X | X | X | X |
| MW-15D | | | X | X | | | X | | | | X | X | X |
| MW-16 | | | X | X | | | X | | | | X | X | X |
| MW-17 | | X | | | | X | X | | X | X | X | X | X |
| MW-18S | | X | | | X | | X | | X | X | X | X | X |
| MW-18D | | | X | X | | | X | | | | X | X | X |
| MW-19 | | | X | X | | | X | | | | X | X | X |
| BIA-MW-1* | | | | | | | | | | | | | |
| BIA MW-3 | | | X | X | | | X | | | | X | X | X |
| BIA-E MW | | X | | | | X | X | | | | X | X | X |
| BG-MW-8 | | X | | | | X | X | | X | X | X | X | X |
| BG-MW-12 | | X | | | X | | X | | X | X | X | X | X |
| CHMW-East | | X | | | X | | X | | X | | X | X | X |
| NI-MW-2 | | X | | | | X | X | | X | X | X | X | X |
| RayMar West | | X | | | | X | X | | X | X | X | X | X |

## TABLE 8. SUMMARY SCOPE OF WORK GROUNDWATER MONITORING
## LAUN-DRY SUPPLY CO., ALBUQUERQUE, NEW MEXICO

| Well Number | Monitoring Frequency | | | Monitoring Regimen | | | Laboratory Analytical | | Field Measurements | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quarterly | Semi-Annual | Annual | LTM | MNA | Performance Assessment | VOC | TOC | D.O. | ORP | Conductivity | pH | Temperature |
| RayMar East | | X | | | | X | X | | X | X | X | X | X |
| CA FSY-14 | | | X | X | | | X | | | | X | X | X |
| MW-4H-01 | | | X | X | | | X | | | | X | X | X |
| MW-4H-02 | | | X | X | | | X | | | | X | X | X |
| MW-4H-04 | | X | | | | X | X | | X | X | X | X | X |
| MW-4H-06 | | X | | | | X | X | | X | X | X | X | X |
| SBM-1 (deep) | | X | | | X | | X | | X | X | X | X | X |
| SBM-2 | | | X | X | | | X | | X | | X | X | X |
| N. Calvary | | X[1] | | X | | | X | | | | X | X | X |
| S. Calvary | | X[1] | | X | | | X | | | X | X | X | X |
| SVE-1 | | | X | | X | | X | | | X | X | X | X |
| SVE-2 | | | X | | X | | X | | | X | X | X | X |
| SVE-3 | | | X | | X | | X | | | X | X | X | X |
| OB-1 | | | X | | X | | X | | | | X | X | X |
| OB-2 | | | X | | X | | X | | | X | X | X | X |
| OB-3 | | X | | | | X | X | | X | X | X | X | X |
| Menaul School Well | | X[1] | | X | | | | | | | X | X | X |
| Sunset Production Wells | | X[1] | | X | | | X | | | | X | X | X |
| Sunset Hand Pump Well | | X[1] | | X | | | X | | | | X | X | X |
| Performance Assessment Well (PA) PA-01 | X | | | | | X | X | X | X | X | X | X | X |
| PA-02 | X | | | | | X | X | X | X | X | X | X | X |
| PA-03 | X | | | | | X | X | | X | X | X | X | X |
| PA-04 | X | | | | | X | X | X | X | X | X | X | X |

NOTES:
Additional analytes and field parameters will be added dependent upon the amendment injected.
[1] = Will be sampled semi-annually if operational. These wells are typically only operational during the irrigation season.
D.O. = Dissolved oxygen
LTM = Long term monitoring
MNA = Monitored Natural Attenuation
VOC = Volatile organic compounds by EPA method 8260B
X = Scheduled to be sampled and gauged

# FIGURES

## LEGEND

- Direct Push Soil Boring
- Injection Point
- Monitoring Well
- Observation Well
- SVE Well
- Railroad Alignment
- Loading Dock

N

0 25 50 100 Feet

1 inch = 50 feet
*(11x17 print-out)*

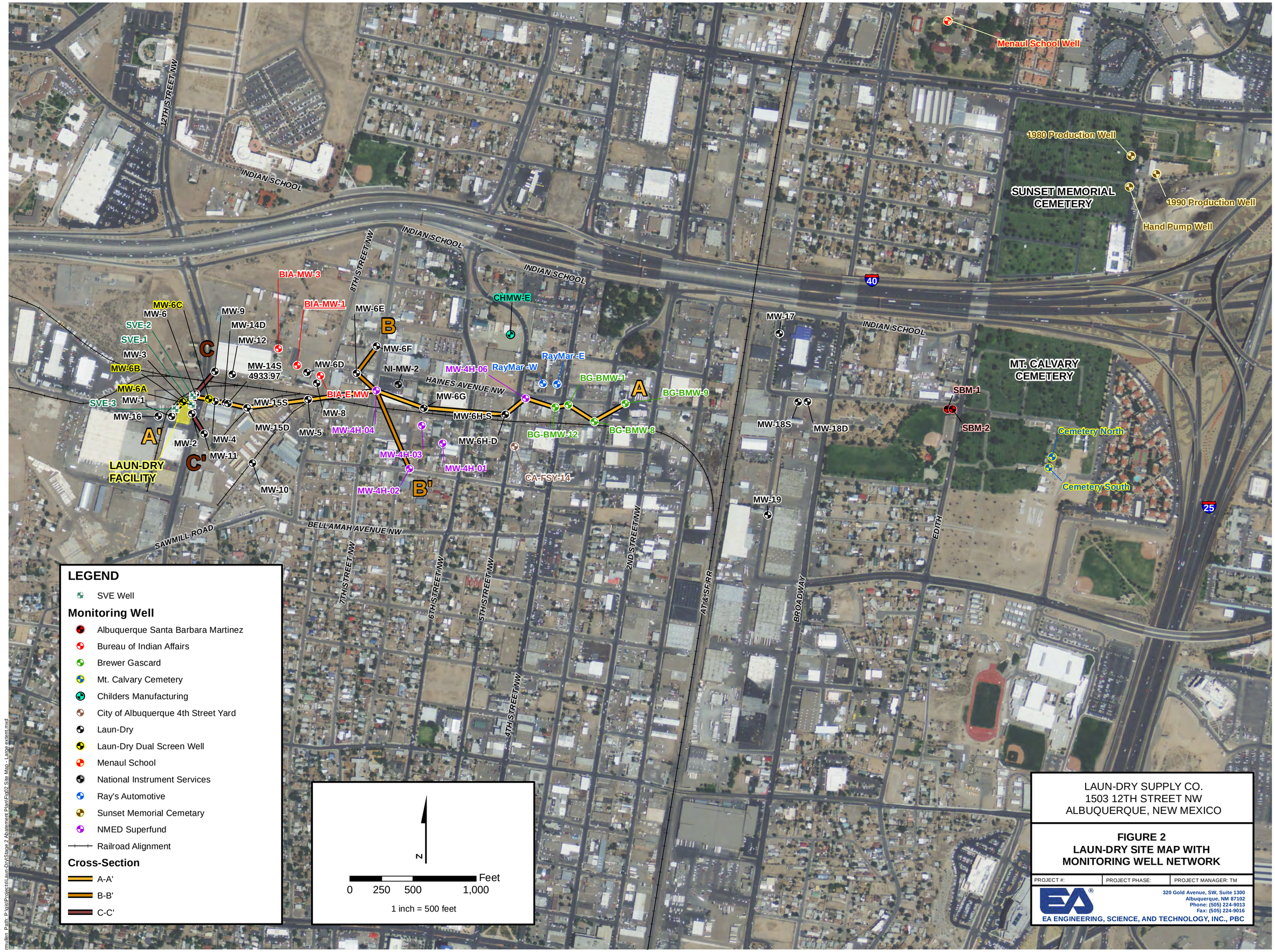
LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

# FIGURE 1
# SITE LOCATION MAP

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016

rmullen Path: P:\gis\Projects\Laun-Dry\Stage 2 Abatement Plan\Fig01 Site Map1.mxd



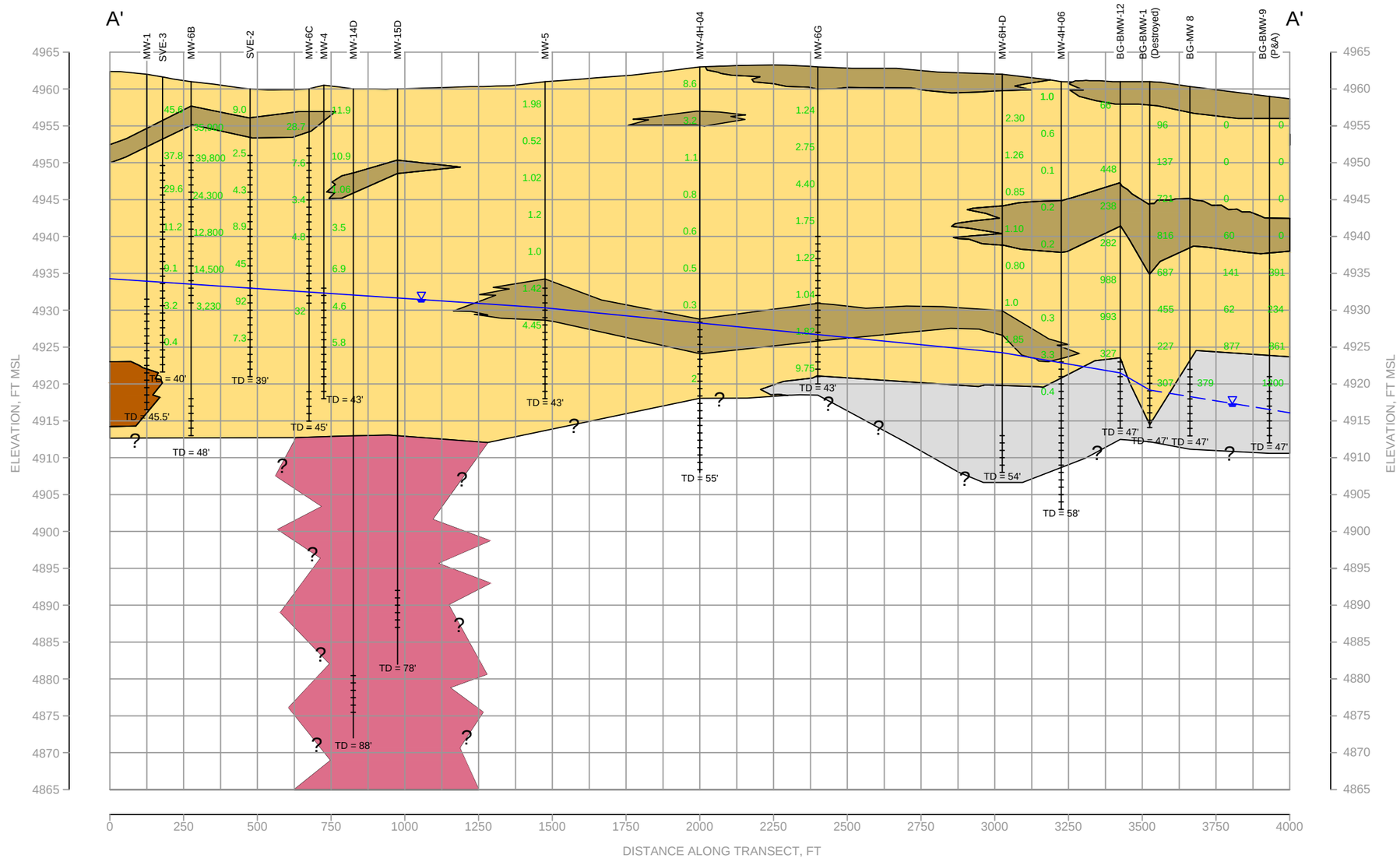

LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

**FIGURE 2**
**LAUN-DRY SITE MAP WITH MONITORING WELL NETWORK**

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|


EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
320 Gold Avenue, SW, Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016


mullen Path: P:\epl\Projects\Laun-Dry\Stage 2 Abatement Plan\Fig02 Site Map - Large extent.mxd




**Shallow Zone**

- Clay to silty clay and sandy clay, grayish brown to dark brown, medium plasticity
- Sand to gravelly sand, fine to coarse grained sand, light yellowish brown, poorly to well-graded, trace to 20% 1-3 cm diameter gravel
- Sand with gravel and cobbles, sand is medium to coarse grained
- Sandy silt, brown

**Deep Zone**

- Silty sand, fine grained

379 FID or PID reading in ppmv

Groundwater elevation (June 2013) Dashed where inferred

Screened interval

**Acronyms**

cm - centimeter
FID - flame ionization detector
FT - feet
MSL - mean sea level
P&A - plugged and abandoned
PID - photoionization detector
ppmv - parts per million by volume
TD - total depth

Note: Wells MW-4H-04 and MW-4H-06 were not logged to total depth.

16 8 0 16
VERTICAL SCALE IN FEET

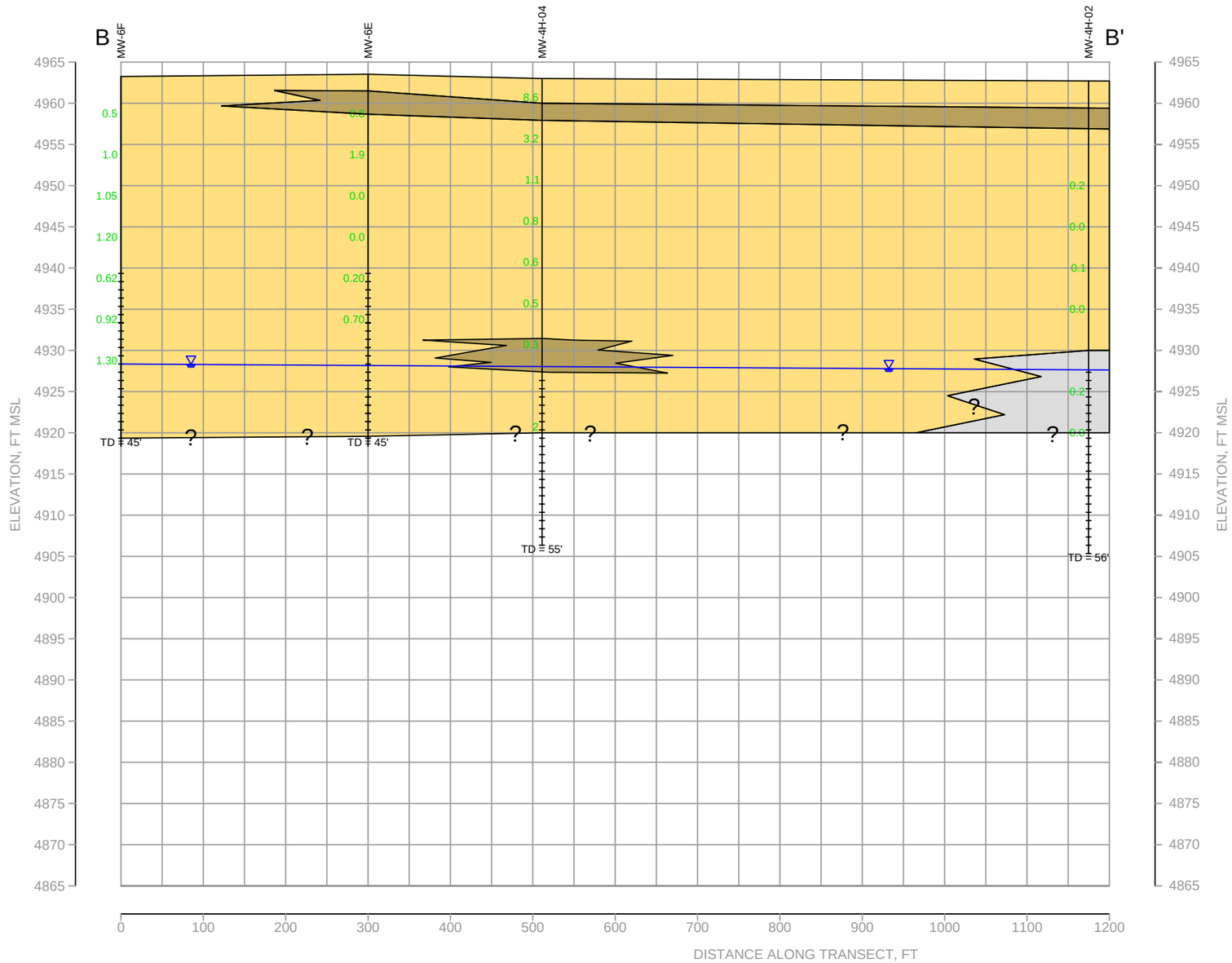
400 200 0 400
HORIZONTAL SCALE IN FEET

LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

# FIGURE 3
# A-A' GEOLOGIC CROSS-SECTION

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016




Shallow Zone

Clay to silty clay and sandy clay, grayish brown to dark brown, medium plasticity

Sand to gravelly sand, fine to coarse grained sand, light yellowish brown, poorly to well-graded, trace to 20% 1-3 cm diameter gravel

Sand with gravel and cobbles, sand is medium to coarse grained

379 FID or PID reading in ppmv

Groundwater elevation (June 2013)

Screened Interval

Acronyms
cm - centimeter
FID - flame ionization detector
FT - feet
MSL - mean sea level
PID - photoionization detector
ppmv - parts per million by volume
TD - total depth

Note: Wells MW-4H-02 and MW-4H-04 were not logged to total depth.

15 7.5 0 15
VERTICAL SCALE IN FEET

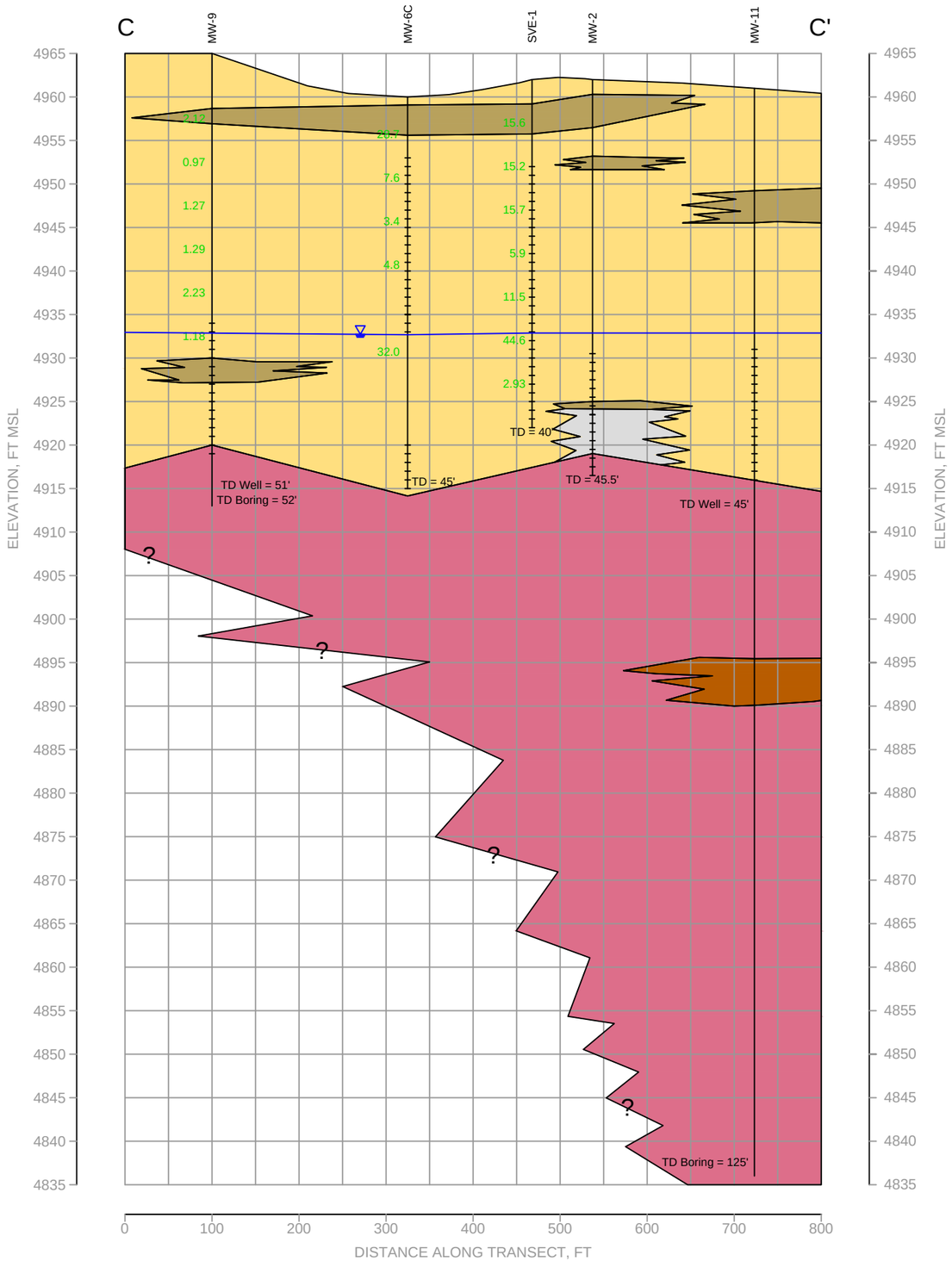
150 75 0 150
HORIZONTAL SCALE IN FEET

LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

# FIGURE 4
# B-B' GEOLOGIC CROSS-SECTION

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|

320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.




Shallow Zone

Clay to silty clay and sandy clay, grayish brown to dark brown, medium plasticity

Sand to gravelly sand, fine to coarse grained sand, light yellowish brown, poorly to well-graded, trace to 20% 1-3 cm diameter gravel

Sand with gravel and cobbles, sand is medium to coarse grained

Deep Zone

Silty sand, fine grained

Sandy silt, brown

379 FID or PID reading in ppmv

Groundwater elevation (June 2013)

Screened interval

Acronyms
cm - centimeter
FID - flame ionization detector
FT - feet
MSL - mean sea level
PID - photoionization detector
ppmv - parts per million by volume
TD - total depth

15 7.5 0 15
VERTICAL SCALE IN FEET

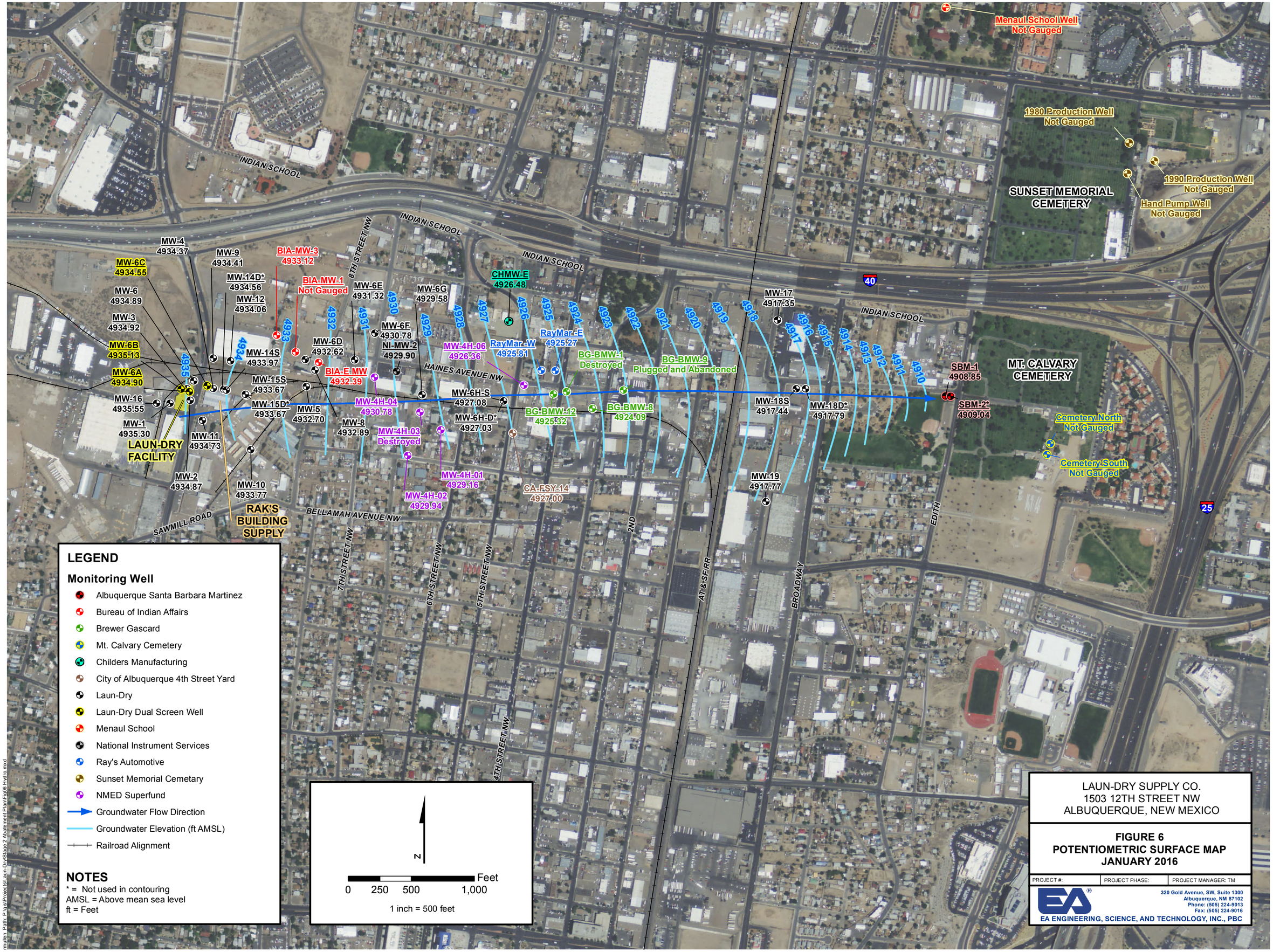
150 75 0 150
HORIZONTAL SCALE IN FEET

LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

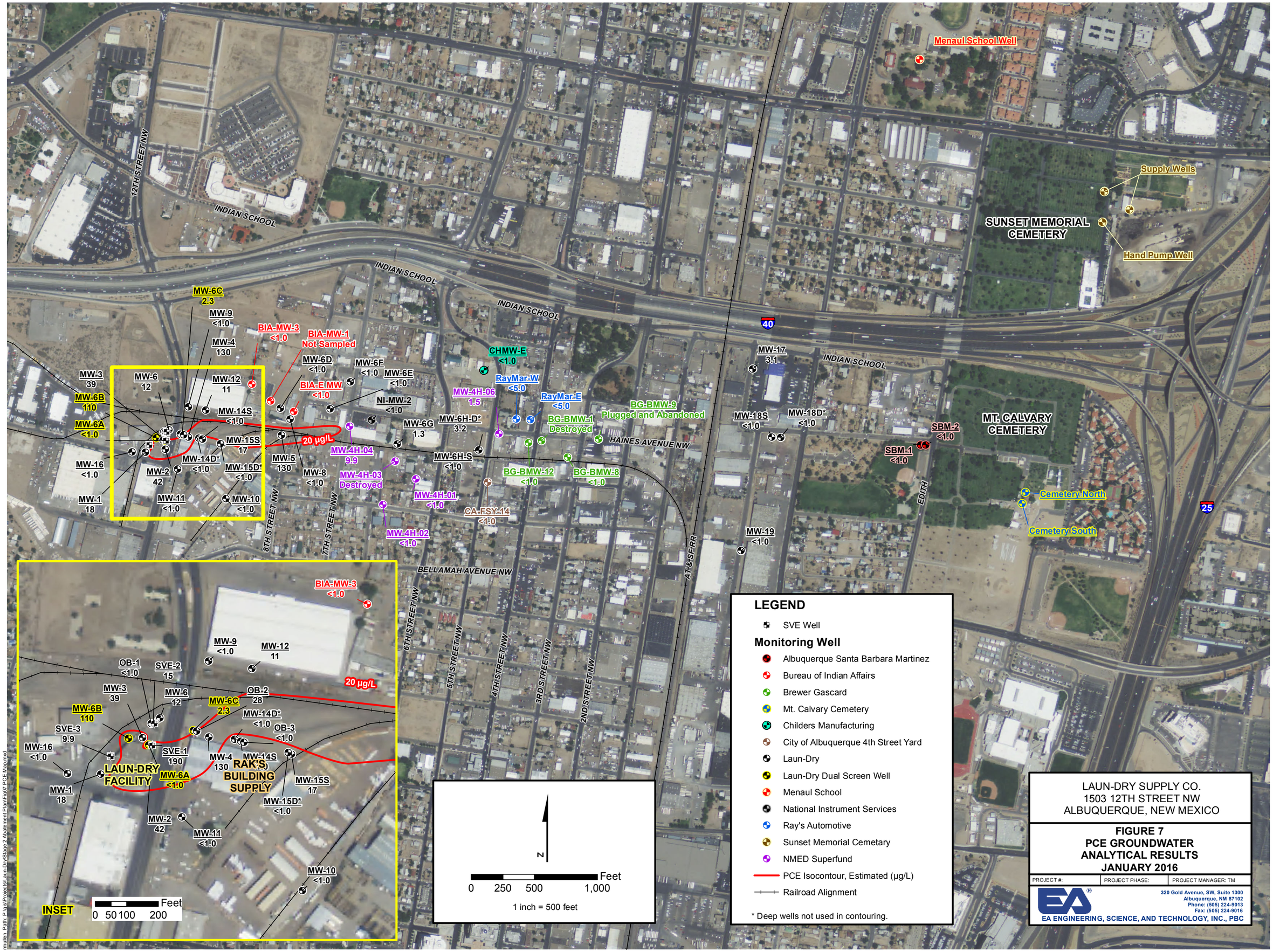
# FIGURE 5
# C-C' GEOLOGIC CROSS-SECTION

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016




mullen, Path: P:\gis\Projects\Laun-Dry\Stage 2 Abatement Plan\Fig06 Hydro.mxd

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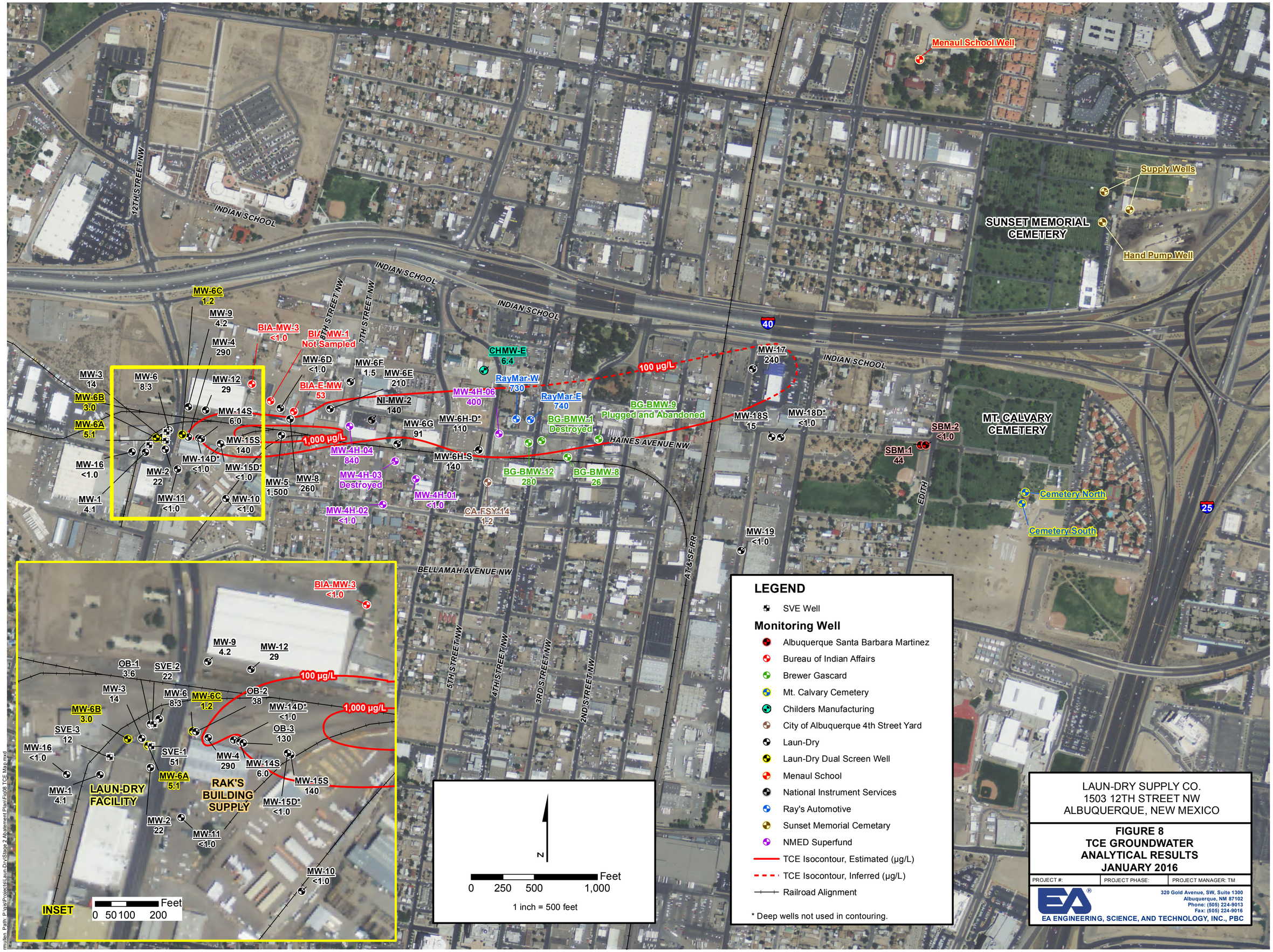
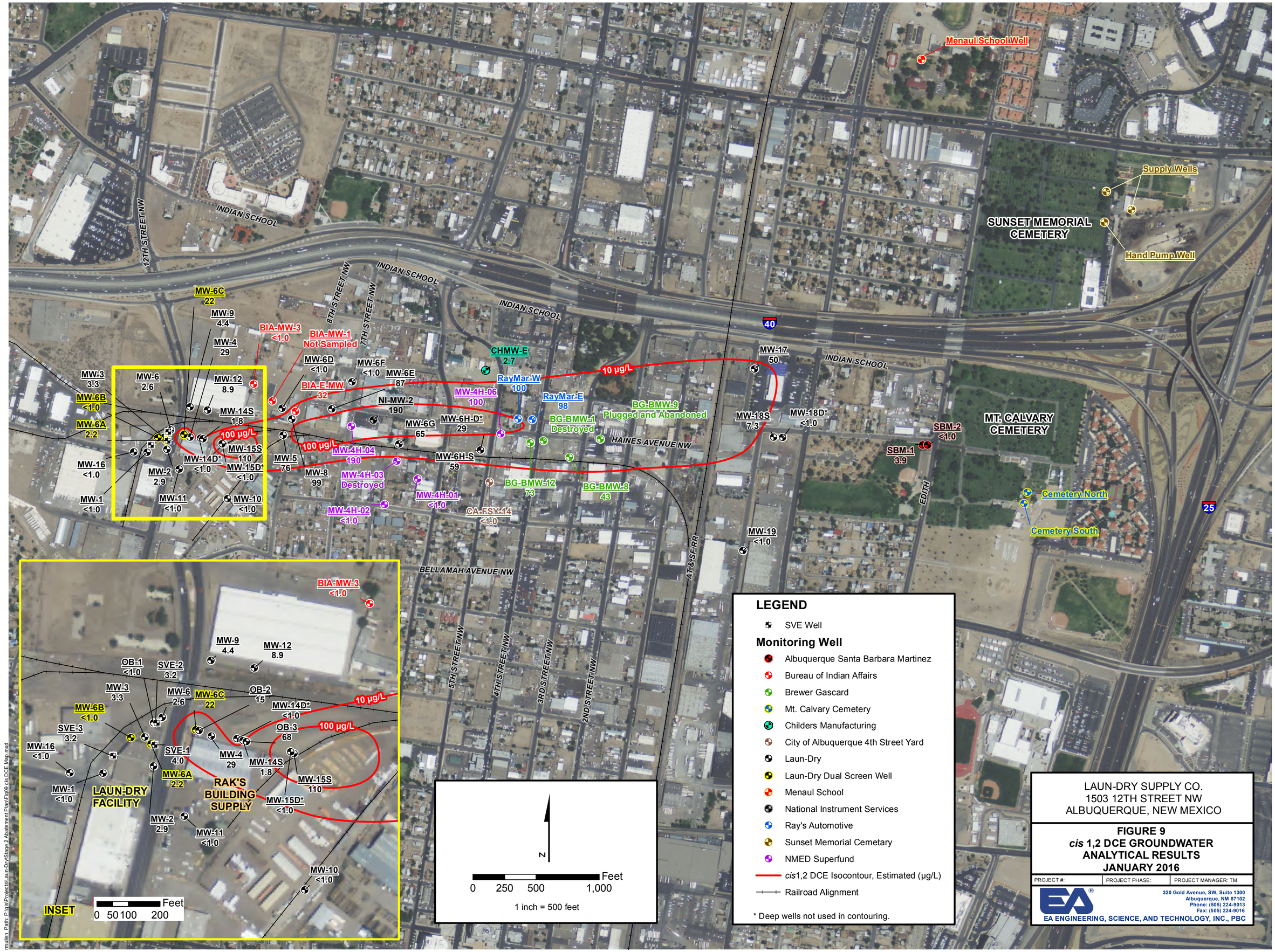
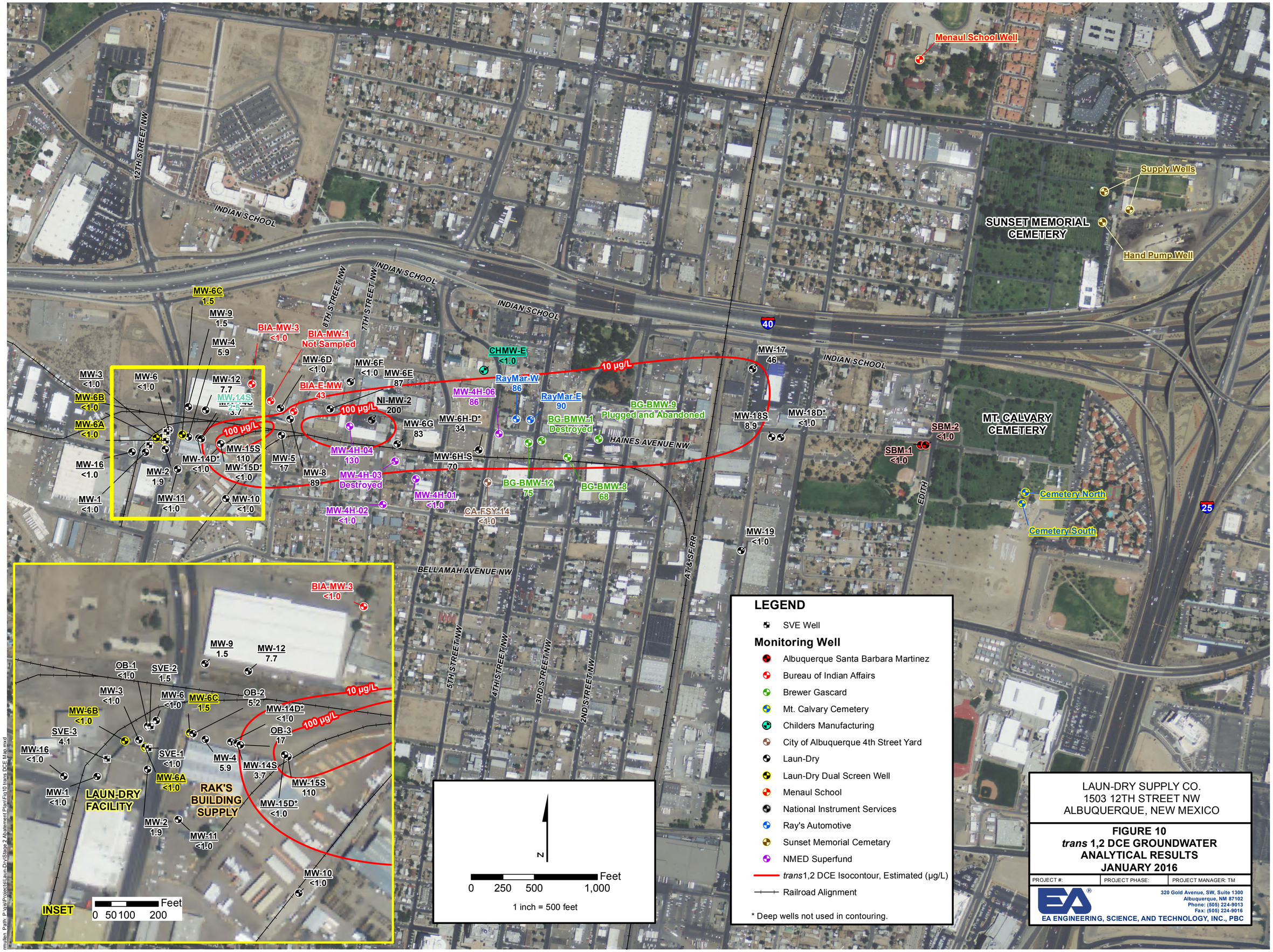
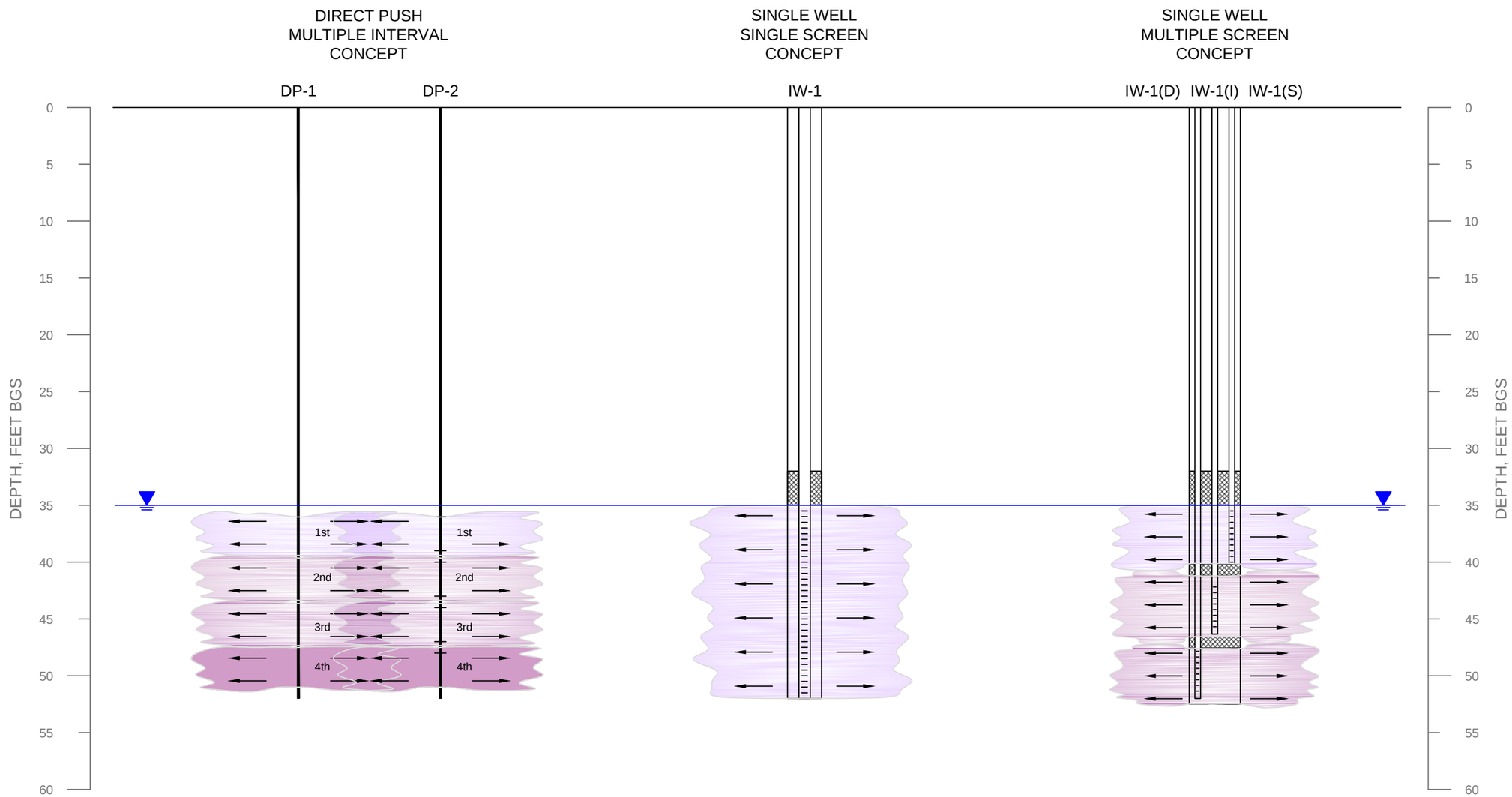

Menaul School Well
Supply Wells
Hand Pump Well
SUNSET MEMORIAL CEMETERY
MT. CALVARY CEMETERY
Cemetery North
Cemetery South
INDIAN SCHOOL
12TH STREET NW
8TH STREET NW
7TH STREET NW
HAINES AVENUE NW
BELLAMAH AVENUE NW
EDITH
AT&SF RR
5TH STREET NW
4TH STREET NW
3RD STREET NW
2ND STREET NW
40
25
100 µg/L
1,000 µg/L
MW-6C 1.2
MW-9 4.2
MW-4 290
BIA-MW-3 <1.0
BIA-MW-1 Not Sampled
MW-6D <1.0
MW-6F 1.5
MW-6E 210
BIA-E-MW 53
NI-MW-2 140
MW-3 14
MW-6B 3.0
MW-6A 5.1
MW-6 8.3
MW-12 29
MW-14S 6.0
MW-15S 140
MW-14D* <1.0
MW-15D* <1.0
MW-16 <1.0
MW-2 22
MW-1 4.1
MW-11 <1.0
MW-10 <1.0
MW-5 1,500
MW-8 260
MW-4H-04 840
MW-4H-03 Destroyed
MW-4H-02 <1.0
MW-4H-01 <1.0
MW-6G 91
MW-6H-D* 110
MW-6H-S 140
CA-FSY-14 1.2
CHMW-E 6.4
RayMar-W 730
RayMar-E 740
MW-4H-06 400
BG-BMW-1 Destroyed
BG-BMW-9 Plugged and Abandoned
BG-BMW-12 280
BG-BMW-8 26
MW-17 240
MW-18S 15
MW-18D* <1.0
SBM-2 <1.0
SBM-1 44
MW-19 <1.0
INSET
LAUN-DRY FACILITY
RAK'S BUILDING SUPPLY
OB-1 3.6
SVE-2 22
OB-2 38
OB-3 130
SVE-3 12
SVE-1 51
Feet
0 50 100 200
N
Feet
0 250 500 1,000
1 inch = 500 feet
LEGEND
SVE Well
Monitoring Well
Albuquerque Santa Barbara Martinez
Bureau of Indian Affairs
Brewer Gascard
Mt. Calvary Cemetery
Childers Manufacturing
City of Albuquerque 4th Street Yard
Laun-Dry
Laun-Dry Dual Screen Well
Menaul School
National Instrument Services
Ray's Automotive
Sunset Memorial Cemetary
NMED Superfund
TCE Isocontour, Estimated (µg/L)
TCE Isocontour, Inferred (µg/L)
Railroad Alignment
* Deep wells not used in contouring.
LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO
FIGURE 8
TCE GROUNDWATER ANALYTICAL RESULTS
JANUARY 2016
PROJECT #:
PROJECT PHASE:
PROJECT MANAGER: TM
320 Gold Avenue, SW, Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC




mullen, Path: P:\gis\Projects\Laun-Dry\Stage 2 Abatement Plan\Fig09 cis DCE Map.mxd




mullen, Path: P:\gis\Projects\Laun-Dry\Stage 2 Abatement Plan\Fig10 trans DCE Map.mxd




## LEGEND

- REMEDIATION FLUID (VARIATION IN COLOR INDICATES VARIOUS INJECTION INTERVAL)
- BENTONITE SEAL
- GROUNDWATER LEVEL
- REMEDIATION FLUID DISTRIBUTION DURING INJECTION
- WELL SCREEN

10 5 0 10
VERTICAL SCALE IN FEET

10 5 0 10
HORIZONTAL SCALE IN FEET

LAUN-DRY, ALBUQUERQUE, NEW MEXICO

**FIGURE 11**
**SCHEMATIC DIAGRAM OF PROPOSED ABATEMENT STRATEGY**

| PROJECT #: | 6236201 | PROJECT PHASE: | 25 | PROJECT MANAGER: | VM |
|---|---|---|---|---|---|

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016

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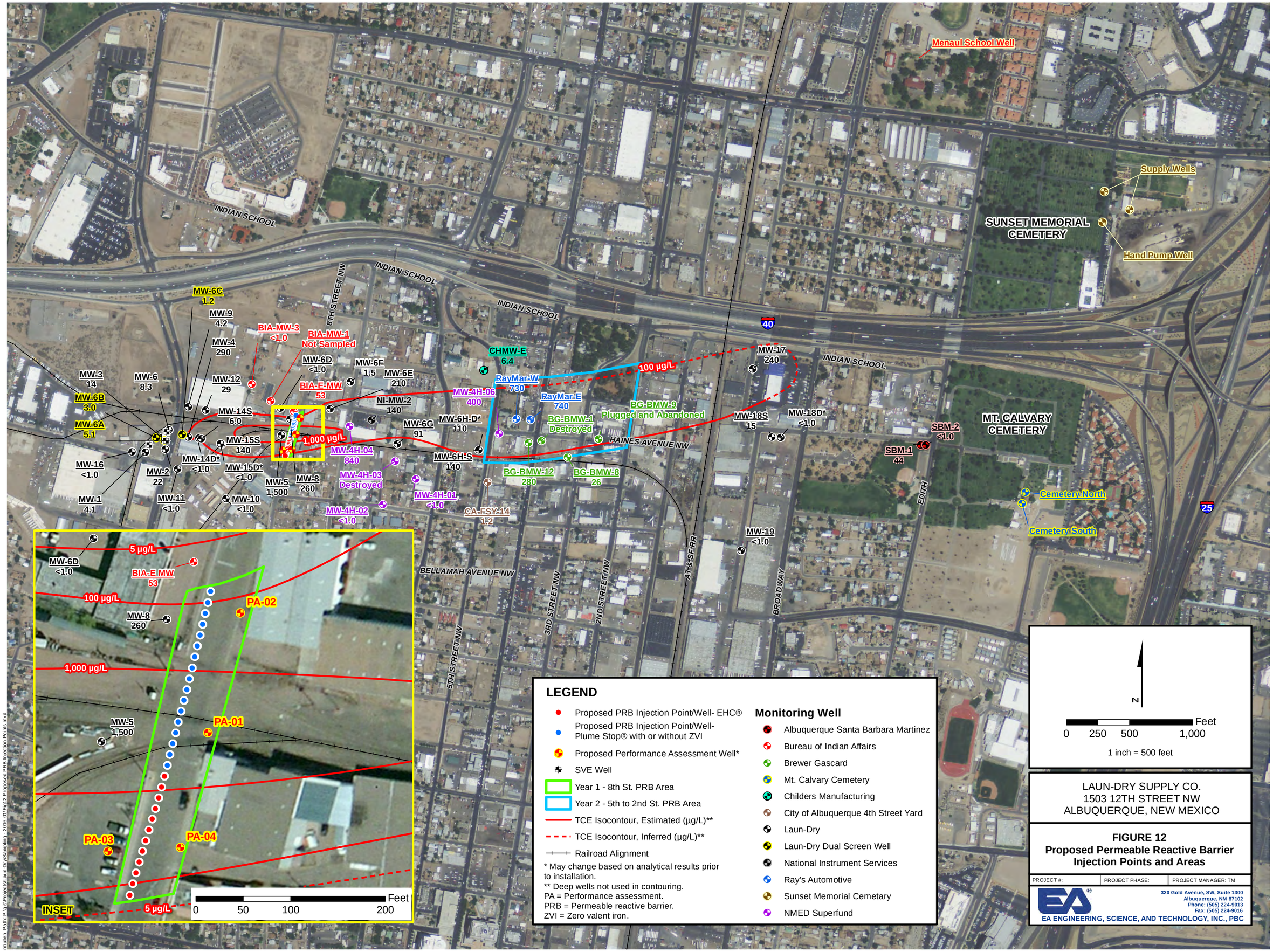
Menaul School Well
Supply Wells
Hand Pump Well
SUNSET MEMORIAL CEMETERY
MT. CALVARY CEMETERY
INDIAN SCHOOL
8TH STREET NW
HAINES AVENUE NW
BELLAMAH AVENUE NW
5TH STREET NW
3RD STREET NW
2ND STREET NW
AT&SF RR
BROADWAY
EDITH
40
25
MW-6C 1.2
MW-9 4.2
MW-4 290
BIA-MW-3 <1.0
BIA-MW-1 Not Sampled
MW-6D <1.0
MW-6F 1.5
MW-6E 210
BIA-E-MW 53
NI-MW-2 140
MW-3 14
MW-6 8.3
MW-12 29
MW-6B 3.0
MW-6A 5.1
MW-14S 6.0
MW-15S 140
1,000 µg/L
MW-14D* <1.0
MW-15D* <1.0
MW-16 <1.0
MW-2 22
MW-1 4.1
MW-11 <1.0
MW-10 <1.0
MW-5 1,500
MW-8 260
MW-4H-04 840
MW-4H-03 Destroyed
MW-4H-02 <1.0
MW-4H-01 <1.0
MW-6G 91
MW-6H-D* 110
MW-6H-S 140
MW-4H-06 400
CHMW-E 6.4
RayMar-W 730
RayMar-E 740
BG-BMW-1 Destroyed
BG-BMW-9 Plugged and Abandoned
BG-BMW-12 280
BG-BMW-8 26
CA-FSY-14 1.2
100 µg/L
MW-17 240
MW-18S 15
MW-18D* <1.0
SBM-2 <1.0
SBM-1 44
Cemetery North
Cemetery South
MW-19 <1.0
5 µg/L
PA-02
PA-01
PA-03
PA-04
INSET
Feet
0 50 100 200
LEGEND
Proposed PRB Injection Point/Well- EHC®
Proposed PRB Injection Point/Well- Plume Stop® with or without ZVI
Proposed Performance Assessment Well*
SVE Well
Year 1 - 8th St. PRB Area
Year 2 - 5th to 2nd St. PRB Area
TCE Isocontour, Estimated (µg/L)**
TCE Isocontour, Inferred (µg/L)**
Railroad Alignment
* May change based on analytical results prior to installation.
** Deep wells not used in contouring.
PA = Performance assessment.
PRB = Permeable reactive barrier.
ZVI = Zero valent iron.
Monitoring Well
Albuquerque Santa Barbara Martinez
Bureau of Indian Affairs
Brewer Gascard
Mt. Calvary Cemetery
Childers Manufacturing
City of Albuquerque 4th Street Yard
Laun-Dry
Laun-Dry Dual Screen Well
National Instrument Services
Ray's Automotive
Sunset Memorial Cemetary
NMED Superfund
N
Feet
0 250 500 1,000
1 inch = 500 feet
LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO
FIGURE 12
Proposed Permeable Reactive Barrier Injection Points and Areas
PROJECT #:
PROJECT PHASE:
PROJECT MANAGER: TM
320 Gold Avenue, SW, Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
mullen, Path: P:\gis\Projects\LaunDry\Sampling - 2016 01\Fig12 Proposed PRB Injection Points.mxd

**FIGURE 13**
**STAGE 2 ABATEMENT PLAN IMPLEMENTATION SCHEDULE**
**LAUN-DRY SUPPLY, ALBUQUERQUE, NEW MEXICO**

| | 2016 | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | | 2025 | | 2026 | | 2027 | | 2028 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** | **January** | **July** |
| LTM/MNA/Performance Monitoring | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5th Street and Haines Ave. Assessment | 16-Aug | 17-Feb | | | | | | | | | | | | | | | | | | | | | | | |
| Stage 2 Abatement Plan Approved | 16-Nov | | | | | | | | | | | | | | | | | | | | | | | | |
| Class V Injection Well Permit Approved | | 17-Jan | | | | | | | | | | | | | | | | | | | | | | | |
| OSE Order in Place | | | 17-Jul | | | | | | | | | | | | | | | | | | | | | | |
| Inject PRB 8th Street Transect | | 17-Mar | | | | | | | | | | | | | | | | | | | | | | | |
| Complete Plume Delineation MW-17 Area | | 17-Apr | | | | | | | | | | | | | | | | | | | | | | | |
| Inject PRB Vicinity 2nd to 5th Street | | | | 18-Mar | | | | | | | | | | | | | | | | | | | | | |
| Inject Additional PRBs Along New Transects (pending performance assessment) | | | | | | | | 20-Mar | | | | 22-Mar | | | | | | | | | | | | | |
| Semi-Annual Monitoring Report | 16-Jul | | 17-Jul | | 18-Jul | | 19-Jul | | 20-Jul | | 21-Jul | | 22-Jul | | 23-Jul | | 24-Jul | | 25-Jul | | 26-Jul | | 27-Jul | | 28-Jul |
| Performance Assessment Reporting [1] | | 17-Jan | | 18-Jan | | 19-Jan | | 20-Jan | | 21-Jan | | 22-Jan | | 23-Jan | | 24-Jan | | 25-Jan | | 26-Jan | | 27-Jan | | 28-Jan | |

Notes:
Groundwater Monitoring Activities
Assessment Activitities
Administrative/Planning Document Activity
S2AP Implementation Activity
Reporting and Performance Assessment Activity
[1]This assessment report will be included with semi-annual report and submitted approximately three months after sampling event
AP = Abatement Plan
PRB = Permeable Reactive Barrier
LTM = Long-Term Monitoring
MNA = Monitored Natural Attenuation
OSE - Office of the State Engineer
RDC = Reductive Dechlorination

# APPENDIX A
# BORING LOGS

KLEINFELDER

# Monitoring Well Log



| Date | | Project Number | Project | Well No. |
|---|---|---|---|---|
| Started: 9/24/2003 | | 34566 | Laun-Dry Supply | MW-1 |
| Completed: 9/24/2003 | | | | |
| Backfilled: 9/24/2003 | | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | | Longitude: | Location: SW Corner of Building | |

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3" O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

| Depth (ft) | Hour | Date |
|---|---|---|
| 33.71 | 1:00:00 PM | 9/24/2003 |
| 33.32 | 8:33:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) / Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | POORLY GRADED SAND WITH SILT (SP-SM) - light brown. | surface completion |
| | | | CS | | | | Dark brown. | |
| | | | | | | | Light reddish brown. | |
| | | | | | | | Light brown. | |
| 5 | | | | | | | Brown. | |
| | | | CS | | | MW1@7.5 | LEAN CLAY (CL) - dark grayish brown. | |
| | | | | | | | POORLY GRADED SAND WITH GRAVEL (SP) - light yellow-brown. | |
| 10 | | | | | | | Light brown. | |
| | | | | | | | Light brown and light gray. | |
| | | | CS | | | MW1@10-15 | Light brown. | grout slurry |
| 15 | | | | | | | | |
| | | | CS | | | | Brown. | |
| | | | | | | | Light brown and gray. | |
| 20 | | | | | | | | |
| | | | | | | | Light brown. | |
| | | | CS | | | MW1@20-25 | | |
| | | | | | | | Light brown and light gray, slightly moist. | |
| 25 | | | | | | | | |

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

Kleinfelder Inc., Copyright 11/4/2003

KLEINFELDER

# Monitoring Well Log



| Date | | Project Number | Project | Well No. |
|---|---|---|---|---|
| Started: 9/24/2003 | | 34566 | Launt-Dry Supply | MW-1 |
| Completed: 9/24/2003 | | | | |
| Backfilled: 9/24/2003 | | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | | Longitude: | Location: SW Corner of Building | |

Sample Type:
G - Grab Sample
CS - 3.5" I.D. Continuous Sampler
SPT - 2" O.D. 1.38" I.D. Tube Sample
U - 3 " O.D. 2.42" I.D. Ring Sample
ST - 3" O.D. Thin-Walled Shelby Tube
NR - No Recovery

Groundwater

| Depth (ft) | Hour | Date |
|---|---|---|
| 33.71 | 1:00:00 PM | 9/24/2003 |
| 33.32 | 8:33:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) | Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|---|
| | 25 | | | CS | | | | POORLY GRADED SAND WITH GRAVEL (SP) - light yellow-brown. | grout slurry |
| | | | | | | | | Light brown, moist. | |
| | | | | | | | | Light brown to dark brown with bands of light gray. | bentonite seal |
| | | | | | | | | Light brown to light gray, moist. | |
| | 30 | | | CS | | | MW1@32.4 | Light tan, slightly moist. | 10-20 sand |
| | 35 | | | CS | | | | Dark gray, wet. | |
| | 40 | | | CS | | | | SANDY SILT (ML) - brown, wet. | .01 screen, pre-packed |
| | 45 | | | CS | | | | | 4" Sump |

TOTAL DEPTH @ 45.5'.

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

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# Monitoring Well Log



| Date | | Project Number | Project | Well No. |
|---|---|---|---|---|
| Started: 9/24/2003 | | 34566 | Laun-Dry Supply | MW-2 |
| Completed: 9/24/2003 | | | | |
| Backfilled: 9/24/2003 | | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | | Longitude: | Location: West side of 12th St. - On Sidewalk | |

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3 " O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

**Groundwater**

| Depth (ft) | Hour | Date |
|---|---|---|
| 34.05 | 3:30:00 PM | 9/24/2003 |
| 33.34 | 9:43:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) | Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | SILTY SAND (SM) - red-brown, fine grained sand. | surface completion |
| | | | | CS | | | | SILTY LEAN CLAY (CL) - dark gray brown, slightly moist. | |
| | 5 | | | | | | | POORLY GRADED SAND WITH SILT (SP-SM) - light red-brown, slightly moist, fine grained sand. | |
| | | | | CS | | | MW2@5-10 | | |
| | | | | | | | | SANDY LEAN CLAY (CL) - light brown, slightly moist. | |
| | 10 | | | | | | | POORLY GRADED SAND (SP) - light red-brown, slightly moist, medium to coarse grained sand. | |
| | | | | CS | | | | | grout slurry |
| | 15 | | | | | | | Light brown. | |
| | | | | CS | | | | | |
| | 20 | | | | | | | Increased gravel content. | |
| | | | | CS | | | | | |
| | 25 | | | | | | | Fine to medium grained sand. Increased gravel content. | |

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

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# Monitoring Well Log



| Date | Project Number | Project | Well No. |
|---|---|---|---|
| Started: 9/24/2003 | 34566 | Laun-Dry Supply | MW-2 |
| Completed: 9/24/2003 | | | |
| Backfilled: 9/24/2003 | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | Longitude: | Location: West side of 12th St. - On Sidewalk | |

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3 " O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

| Depth (ft) | Hour | Date |
|---|---|---|
| 34.05 | 3:30:00 PM | 9/24/2003 |
| 33.34 | 9:43:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) | Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|---|
| | 25 | | | | | | | POORLY GRADED SAND (SP) - light red-brown, slightly moist, medium to coarse grained sand. | grout slurry |
| | | | | | | | MW2@26.5 | | |
| | | | | CS | | | | | bentonite seal |
| | | | | | | | | | 10-20 sand |
| | 30 | | | | | | | | |
| | | | | CS | | | MW2@30-35 | | |
| | 35 | | | | | | | | |
| | | | | CS | | | | SANDY LEAN CLAY (CL) - gray brown, wet. Dark brown. | .01 screen, pre-packed |
| | | | | | | | | POORLY GRADED GRAVEL WITH SAND (GP) gray brown, wet. | |
| | 40 | | | | | | | | |
| | | | | CS | | | | POORLY GRADED SAND WITH SILT (SP-SM) - brown, wet. | |
| | 45 | | | | | | | | 4" sump |

TOTAL DEPTH @ 45.5'.

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

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# Monitoring Well Log



| Date | Project Number | Project | Well No. |
|---|---|---|---|
| Started: 9/25/2003 | 34566 | Laun-Dry Supply | MW-3 |
| Completed: 9/25/2003 | | | |
| Backfilled: 9/25/2003 | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | Longitude: | Location: North Loading Dock | |

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3" O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

| Depth (ft) | Hour | Date |
|---|---|---|
| 34.0 | 10:00:00 AM | 9/25/2003 |
| 34.39 | 10:37:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) | Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | SILTY FINE SAND (SM) - light redish brown, slightly moist. | surface completion |
| | | | | | | | | SILTY CLAY (CL) - dark brown, (thin bands of dark brown/black, some coarse sand, some fine to medium gravels). | |
| | | | | CS | | | MW3@0-5 | POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM) - reddish brown. | |
| | 5 | | | | | | | Light reddish brown, increased silt content, decreased gravel content. | |
| | | | | CS | | | | Light brown, (iron - red,yellow - mottled staining). | |
| | | | | | | | | LEAN CLAY (CL) - dark brown, (gray & white nodules, break easily). | |
| | | | | | | | | Light reddish brown. | |
| | 10 | | | | | | | POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM) - light reddish brown, (mottled with red-yellow staining; iron, 1" band of light brown silt). | |
| | | | | | | | | Light tan, (some red-yellow mottling). | |
| | | | | CS | | | | | grout slurry |
| | 15 | | | | | | | Light brown, (with thin bands of red-yellow stained soil and thin bands of coarse sand, also with some fine gravel). | |
| | | | | CS | | | MW3@15-20 | | |
| | | | | | | | | (some red-yellow mottling). | |
| | 20 | | | | | | | Slightly moist. | |
| | | | | | | | | (medium to coarse grained sand). | |
| | | | | CS | | | | (with some fine gravels). | |
| | 25 | | | | | | | | bentonite seal |

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

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# Monitoring Well Log



| Date | | Project Number | Project | Well No. |
|---|---|---|---|---|
| Started: 9/25/2003 | | 34566 | Laun-Dry Supply | MW-3 |
| Completed: 9/25/2003 | | | | |
| Backfilled: 9/25/2003 | | Rig Type: CME 75 | Surface Elevation: N/A | Logged By: Dacia Tucholke |
| Latitude: | | Longitude: | Location: North Loading Dock | |

Sample Type: G - Grab Sample; CS - 3.5" I.D. Continuous Sampler; SPT - 2" O.D. 1.38" I.D. Tube Sample; U - 3 " O.D. 2.42" I.D. Ring Sample; ST - 3" O.D. Thin-Walled Shelby Tube; NR - No Recovery

Groundwater

| Depth (ft) | Hour | Date |
|---|---|---|
| 34.0 | 10:00:00 AM | 9/25/2003 |
| 34.39 | 10:37:00 AM | 9/26/2003 |

| Groundwater Depth (ft.) | Depth (ft.) | Graphical Log | Sample Taken | Sample Type | Penetration Resistance (Blows per foot) | PID Heated Headspace Reading | Analytical Sample Number | Visual Classification | WELL CONSTRUCTION |
|---|---|---|---|---|---|---|---|---|---|
| | 25 | | | CS | | | MW3@25-30 | POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM) - light brown, slightly moist. | bentonite seal; 10-20 sand |
| | | | | | | | | SANDY LEAN CLAY (CL) - dark brown, moist, (coarse sand, trace of fine gravels). | |
| | 30 | | | CS | | | MW3@30-35 | POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM) - light brown, moist. (coarse sand). | |
| ▼ | 35 | | | CS | | | | Light gray - brown, wet, (trace of small gravel). (water) (NO RECOVERY 40-45'). | .01 screen, pre-packed |
| | 40 | | | CS | | | | | 4" sump |

TOTAL DEPTH @ 43'.

## Additional Groundwater Measurements

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

| Depth (ft) | Hour | Date |
|---|---|---|
| | | |
| | | |

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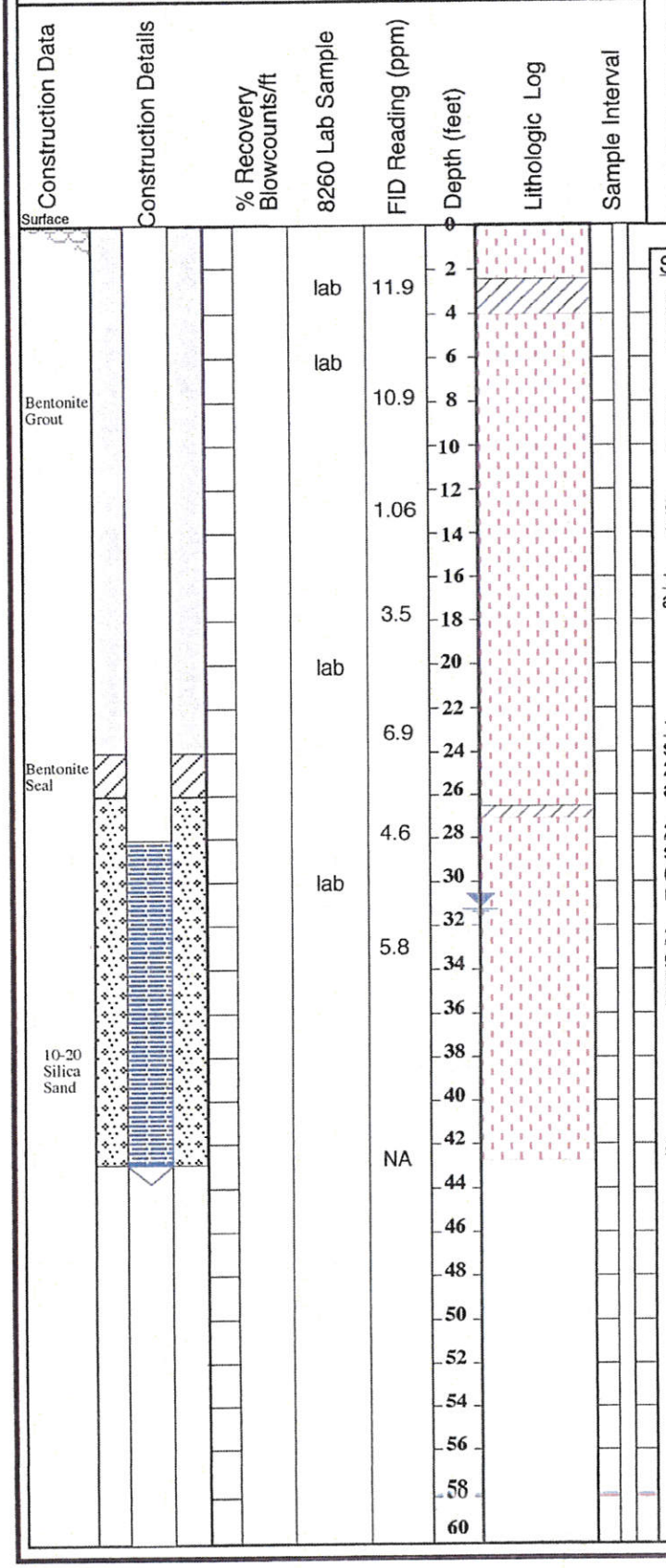
SITE: LaunDry
LOCATION: Albuquerque, New Mexico

**Well Name: MW-4**



Date of Drilling: 6/20/05
Drilling Co: Rodgers & Associates, Inc.
Driller: Logged By: William Mansker
Borehole Diameter: 7-1/2"
Type of Drilling: Hollow Stem Auger
Sample Method: 5' Continuous Sampler
Top of Casing: 4961.49
Casing: 0-28'
Screen: 15'
Depth to Water: ~31.4'
Total Depth: 43'
Surface Completion: 8" Traffic-rated, at-grade manholes




## Lithologic Description

Surface conditions:

0.0'-3.0' 0-2' Gravelly silt and trash. 2'-2.25' Moist, loose, light brown sand **(SM)**. 2.5'-3' Tight, plastic, brown clay **(CL)**. No apparent odor present.

3.0'-8.0' 3-4' As above; plastic clay **(CL)**. 4-6' Red-brown, loose, damp sand **(SM)**. 6-8' loose, damp, brown sand **(SM)**, no apparent odor present.

8.0'-13.0' 4' recovery. As above, light brown sand, **(SM)**, no apparent odor present.

13.0'-18.0' 3' recovery. As above, light brown sand, **(SM)**, no apparent odor present.

18.0'-23.0' 3' recovery. 20-21' Medium-grained gravelly, red-stained, sand **(SM)**. 21-22' Medium-grained gravelly sand **(SM)**. 22-23' Medium to fine- grained, loose, damp, sand **(SM)**, no apparent odor present.

23.0'-28.0' 3' recovery. 25-26' fine-grained, loose, damp, brown sand **(SM)**. 26-27' as above, 6" gravelly sand **(SM)** with 3" clay **(CL)** layer. 27-28' fine to medium-grained, gravelly sand **(SM)**, no apparent odor present.

28.0'-33.0' 3' recovery. 30-31' as above, damp, moist, fine-grained sand **(SM)**. 31-32' as above, moist sand; last 6" gravelly **(SM)**. 32-33' as above, last 8" wet (GW). Static groundwater level ~31.4' bgs.

33.0'-43.0' Overdrill to 43' bgs, as above, wet, gravelly sand.

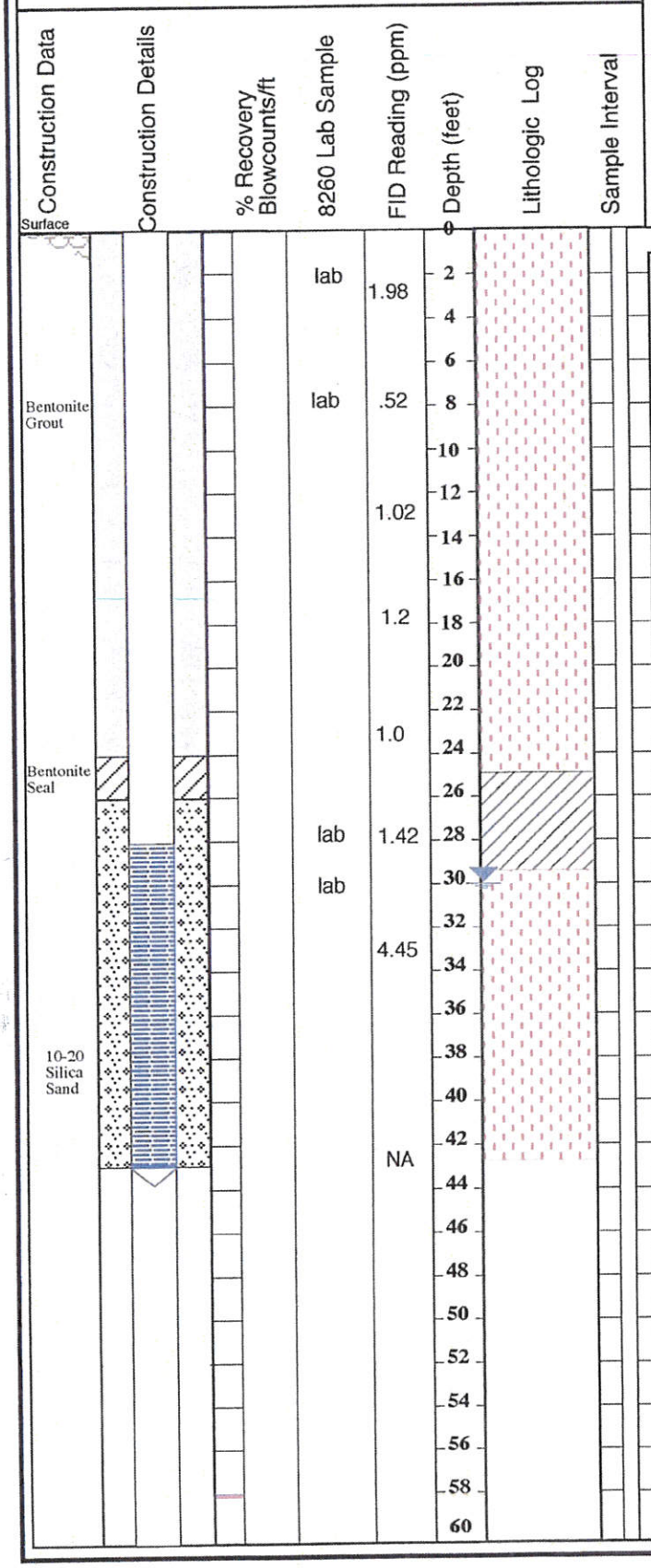
**INNOVATIVE EXPLORATIONS/ W. MANSKER**

SITE: LaunDry
LOCATION: Albuquerque, New Mexico

# Well Name: MW-5



Date of Drilling: 6/20/05
Drilling Co: Rodgers & Associates, Inc.
Driller: Logged By: William Mansker
Borehole Diameter: 7-1/2"
Type of Drilling: Hollow Stem Auger
Sample Method: 5' Continuous Sampler
Top of Casing: 4961.25
Casing: 0-28'
Screen: 15'
Depth to Water: ~30.0'
Total Depth: 43'
Surface Completion: 8" Traffic-rated, at-grade manholes




## Lithologic Description

Surface conditions:

0.0'-3.0' 0-2' Black, trashy silty loam. 2'-3' Fine-grained, loose, dry, sand **(SM)**. 2-3' Slight odor present.

3.0'-8.0' ~2.5' recovery'. Loose, damp, fine-grained sand with minor gravel **(SM)**, no apparent odor present.

8.0'-13.0' ~2.5' recovery. Loose, damp, sand, **(SM)**, no apparent odor present.

13.0'-18.0' 3.0' recovery. As above, fine to medium-grained loose, damp, sand, **(SM)**, with minor pea gravel, no apparent odor present.

18.0'-23.0' As above, sand with minor gravel **(SM)**, no apparent odor present.

23.0'-28.0' 23-25' As above, gravelly sand **(SM)**. 25-26.5' damp, silty clay **(CL)**, moist, last 6", no apparent odor present.

28.0'-33.0' As above, 18" moist, plastic clay **(CL)**. 18" moist-wet, loose, gravelly sand, **(SM)**. Static groundwater level ~30.0' bgs, no apparent odor present.

33.0'-43.0' Overdrill to 43' bgs, as above, wet, gravelly sand.

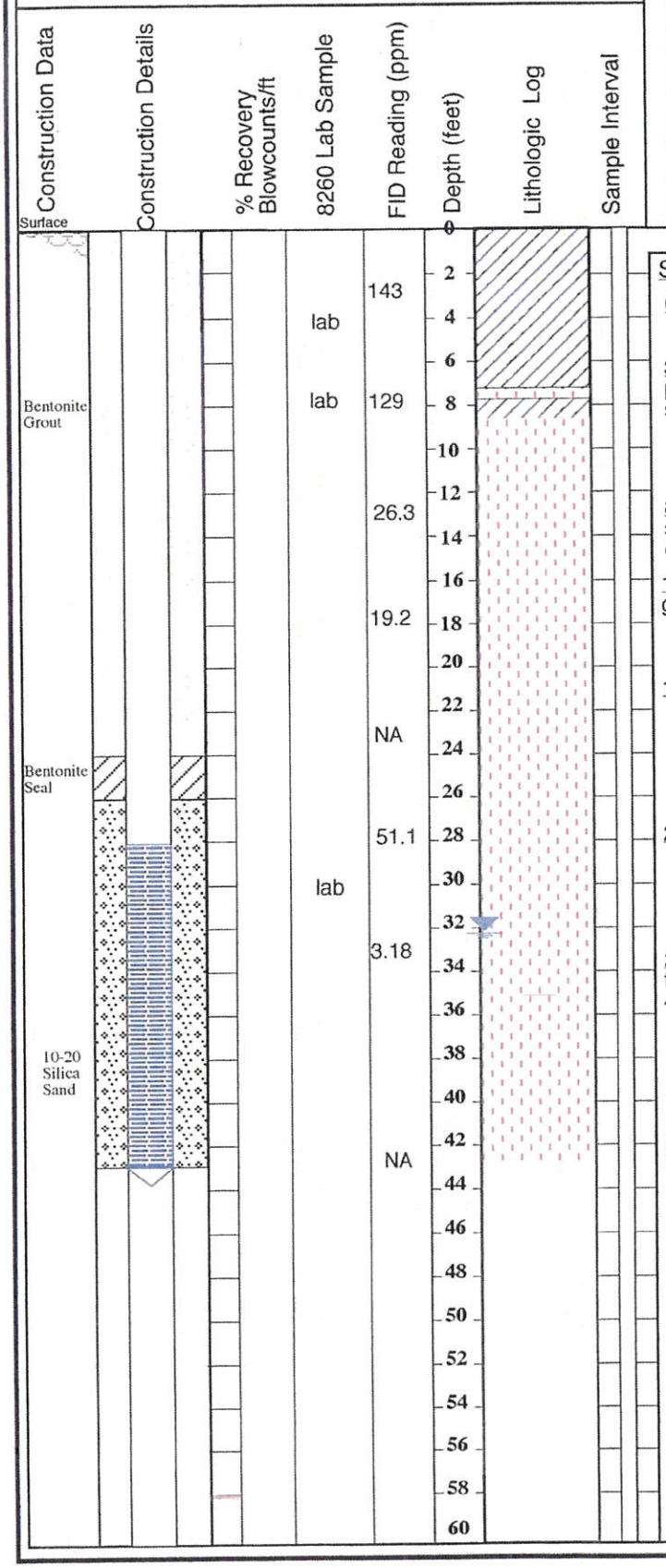
**INNOVATIVE EXPLORATIONS/ W. MANSKER**

SITE: LaunDry
LOCATION: Albuquerque, New Mexico

# Well Name: MW-6



Date of Drilling: 6/20/05
Drilling Co: Rodgers & Associates, Inc.
Driller: Logged By: William Mansker
Borehole Diameter: 7-1/2"
Type of Drilling: Hollow Stem Auger
Sample Method: 5' Continuous Sampler
Top of Casing: 4962.87
Casing: 0-28'
Screen: 15'
Depth to Water: ~32.4'
Total Depth: 43'
Surface Completion: 8" Traffic-rated, at-grade manholes




## Lithologic Description

Surface conditions:

0.0'-3.0' Black, trashy, gravelly loam, slight odor present.

3.0'-8.0' 3-6' firm, silty clay **(CL)**, slight hydrocarbon odor present. 6-7' Tight, firm, plastic clay **(CL)**. 7-8' damp, brown, silty sand, **(SM)**, last 4" clay **(CL)**, no apparent odor present.

8.0'-13.0' ~3' recovery. Medium to fine-grained, damp, loose, sand with minor Fe-staining and thin clay stringer, no apparent odor present

13.0'-18.0' 1' recovery. 13-14', 8" loose, damp, sand **(SM)**, 4" gravelly sand, no apparent odor present.

18.0'-23.0' No recovery, stone in sampler shoe.

23.0'-28.0' 6" recovery, stone in sampler shoe.

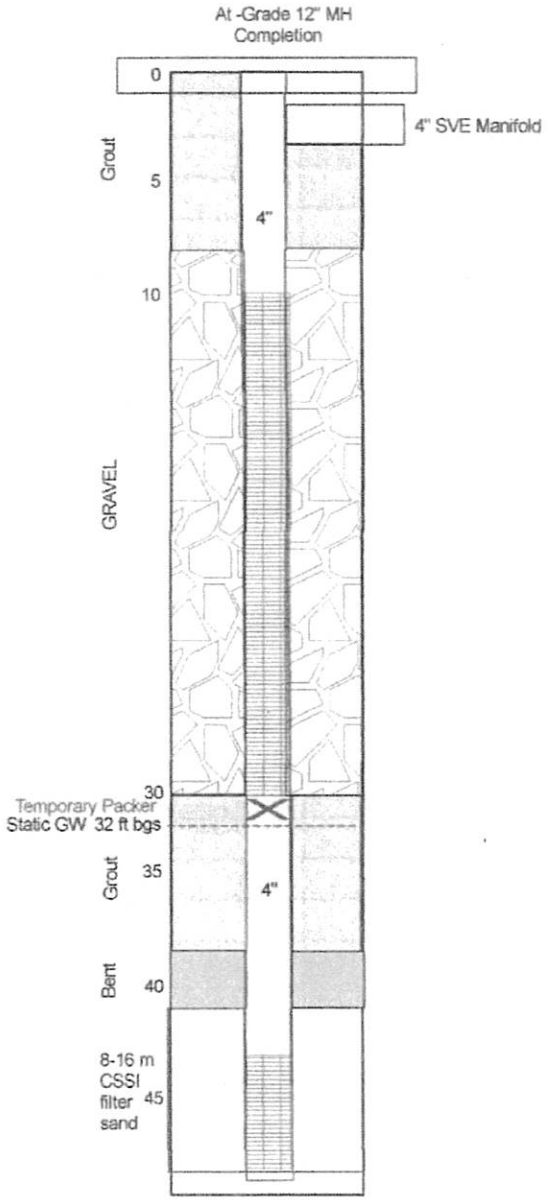
28.0'-33.0' ~3' recovery. Gravelly, loose, moist, sand **(SM)** with fine-grained stringers, last 8" wet, static groundwater level ~32.4' bgs.

33.0'-43.0' Overdrill to 43' bgs, as above, wet, gravelly sand.

**INNOVATIVE EXPLORATIONS/ W. MANSKER**

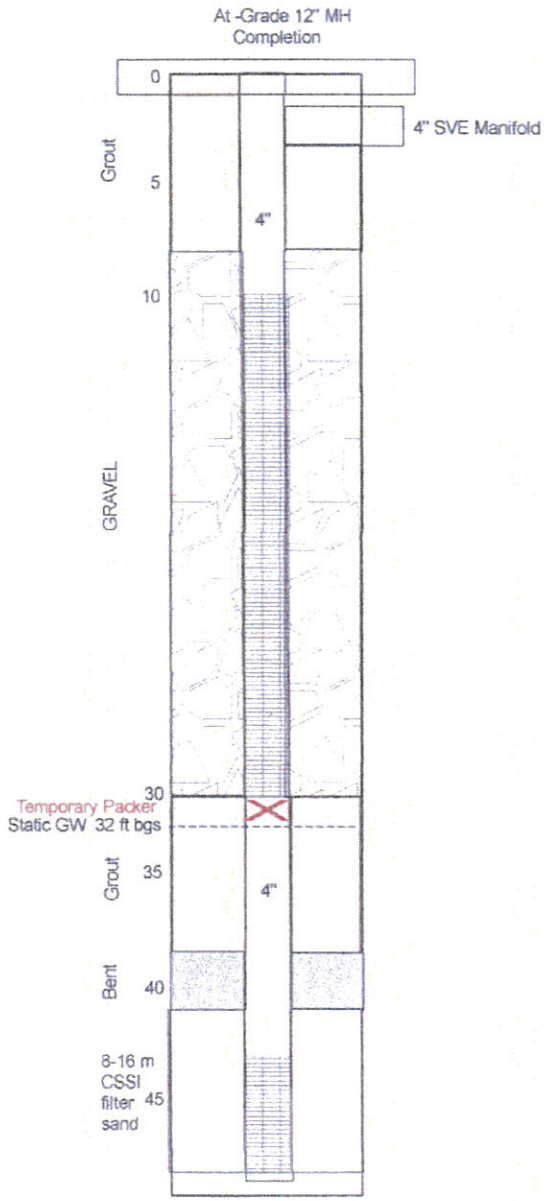
Boring: 6-A 4" SVMW DATE: 3/19/12
LaunDry P6S1AP Task 2
Project Manager: W. L. Mansker, Ph.D
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 10" O.D.

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| 2" Asphalt | | |
| Red Brn Silty Sand | | |
| Brn Silty Clay | 5 | 10.1 |
| Loose damp med silty sand | | |
| | 10 | 130 |
| -do- Gvly med silty sand | | |
| | 15 | 51.0 |
| -do- | | |
| | 20 | 27.4 |
| -do- | | |
| | 25 | 71.3 |
| -do- | | |
| | 30 | NS |
| -do- GW ~ 32 ft | | |
| | 35 | 50.8 |
| -do-wet silty sand | | |
| | 40 | |
| -do- | | |
| | 45 | |



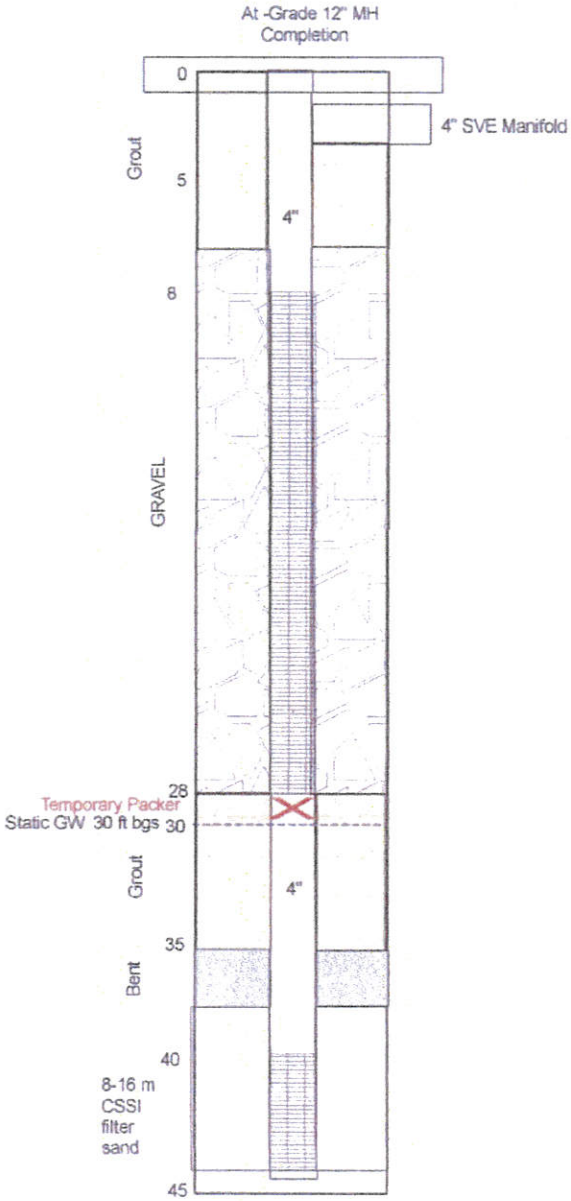
Boring: 6-B 4" SVMW DATE: 3/20/12
LaunDry P6S1AP Task 2
Project Manager: W. L. Mansker, Ph.D.
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 10" O.D.

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Trashy silty sand | | |
| Red Brn Silty Sand | | |
| Brn Silty Clay | | |
| Loose damp med silty sand PCE Odor | 5 | 35,900 |
| | 10 | 34,800 |
| -do- Gvly med silty sand | | |
| | 15 | 24,300 |
| -do- | | |
| | 20 | 12,800 |
| -do- | | |
| | 25 | 14,500 |
| -do- | | |
| | 30 | 3,230 |
| -do- GW - 32 ft | | |
| | 35 | |
| -do-wet silty sand | | |
| | 40 | |
| -do- | | |
| | 45 | |



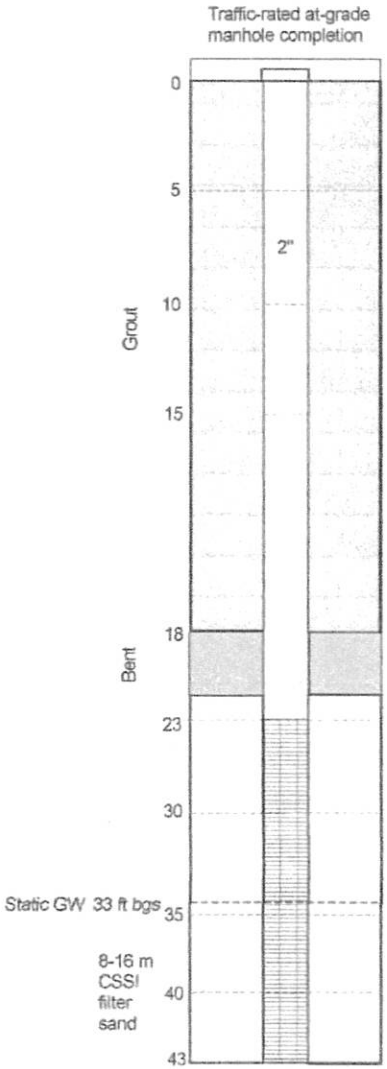
Boring 6-C 4" SVMW DATE 3/21/12
LaunDry P6S1AP Task 2
Project Manager W. L. Mansker, Ph D
Driller Rodgers Environmental Services
RIG CME - 75 HSA 10" O.D.

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Trashy silty sand | | |
| Red Brn Silty Sand | | |
| Brn Silty Clay | | |
| | 5 | 28.7 |
| Loose damp med silty sand | | |
| | 10 | 7.60 |
| -do- Gvly med silty sand | | |
| | 15 | 3.40 |
| -do- | | |
| | 20 | 4.80 |
| -do- | | |
| | 25 | NS |
| -do- | | |
| | 30 | 32.0 |
| -do- GW ~ 30 ft | | |
| | 35 | |
| -do-wet silty sand | | |
| | 40 | |
| -do- | | |
| | 45 | |



Boring: 6-D 2" MW DATE: 3/26/12
LaunDry PGS1AP Task 2
Project Manager: W. L. Mansker, Ph.D
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 7.5" O.D.

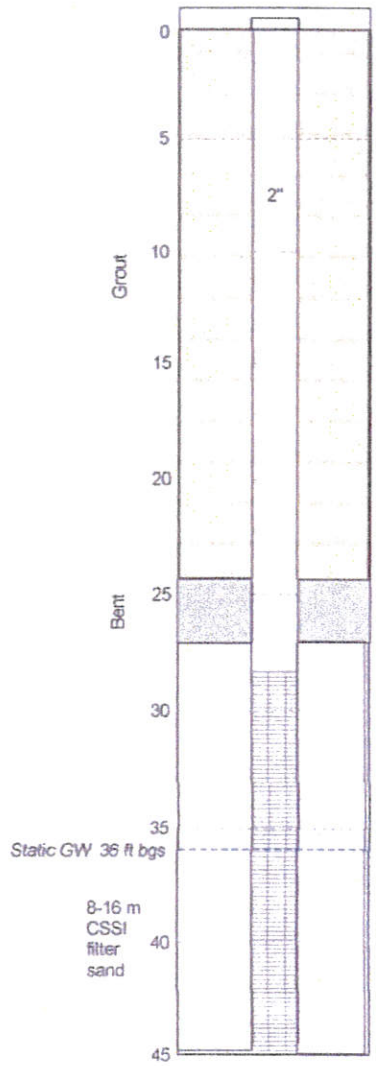
| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Lt Brn Silty sand | | |
| | 5 | 0.0 |
| Loose damp med silty sand | | |
| | 10 | 0.0 |
| -do- Gvly Silty sand | | |
| | 15 | 0.0 |
| -do- | | |
| | 20 | 0.0 |
| -do- | | |
| | 25 | 0.25 |
| -do- | | |
| | 30 | 0.20 |
| -do- GW – 33 ft | | |
| | 35 | 2.20 |
| -do-wet silty sand and sandy Gvl | | |
| | 40 | |
| -do- | | |
| | 45 | |



Boring: 6-E 2" MW DATE 3/23/12
LauniDry P6S1AP Task 2
Project Manager W. L. Mansker, Ph.D
Driller Rodgers Environmental Services
RIG CME - 75 HSA 7 5" O.D

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Loose damp med silty sand | | |
| Thin Clays | | |
| | 5 | 0.80 |
| Loose damp med silty sand | | |
| | 10 | 1.90 |
| -do- Gvly med silty sand | | |
| | 15 | 0.0 |
| -do- | | |
| | 20 | 0.0 |
| -do- | | |
| | 25 | 0.20 |
| -do- | | |
| | 30 | 0.70 |
| -do- | | |
| GW ~ 36 ft | 35 | NSR |
| -do-wet silty sand | | |
| | 40 | |
| -do- | | |
| | 45 | |

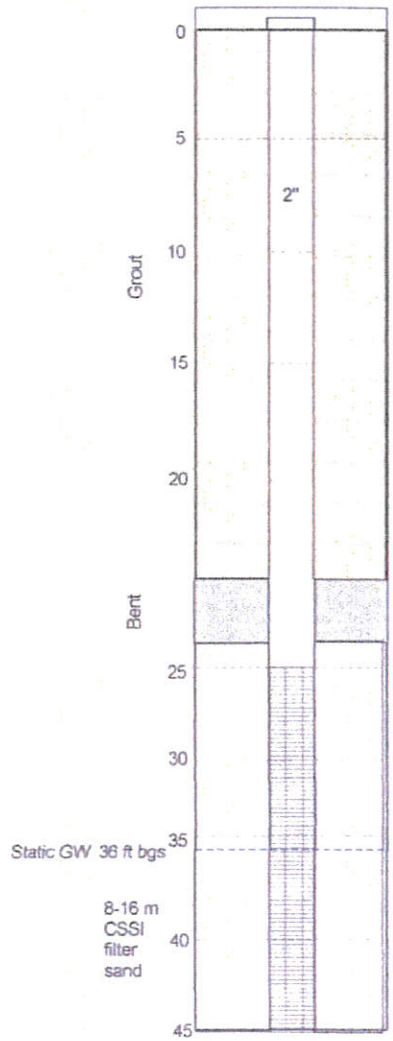
Traffic-rated at-grade manhole completion



Boring: 6-F 2" MW DATE: 3/23/12
LaunDry P6S1AP Task 2
Project Manager: W. L. Mansker, Ph.D
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 7.5" O.D

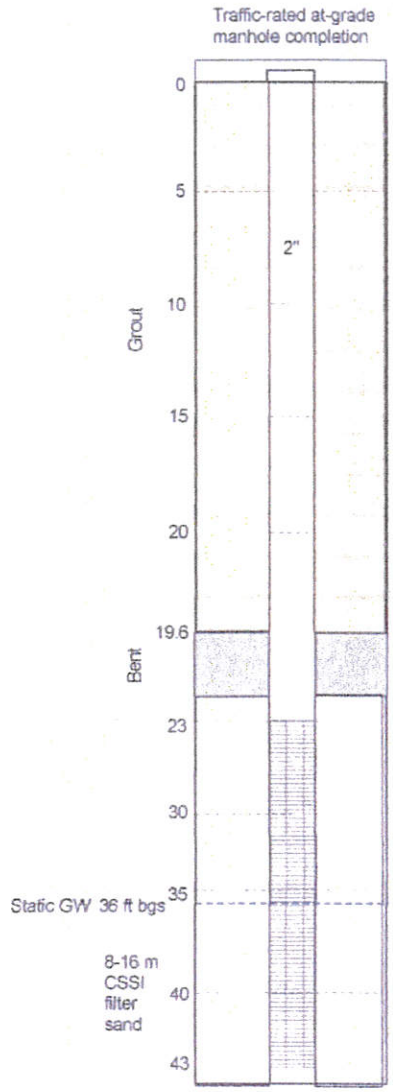
| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Loose damp med silty sand | | |
| | 5 | 0.50 |
| Gwly med silty sand | | |
| | 10 | 1.00 |
| -do- | | |
| | 15 | 1.05 |
| -do- | | |
| | 20 | 1.20 |
| -do- | | |
| | 25 | 0.62 |
| -do- | | |
| | 30 | 0.92 |
| -do- | | |
| GW ~ 36 ft | 35 | 1.30 |
| -do-wet silty sand | | |
| | 40 | |
| -do- | | |
| | 45 | |

Traffic-rated at-grade manhole completion



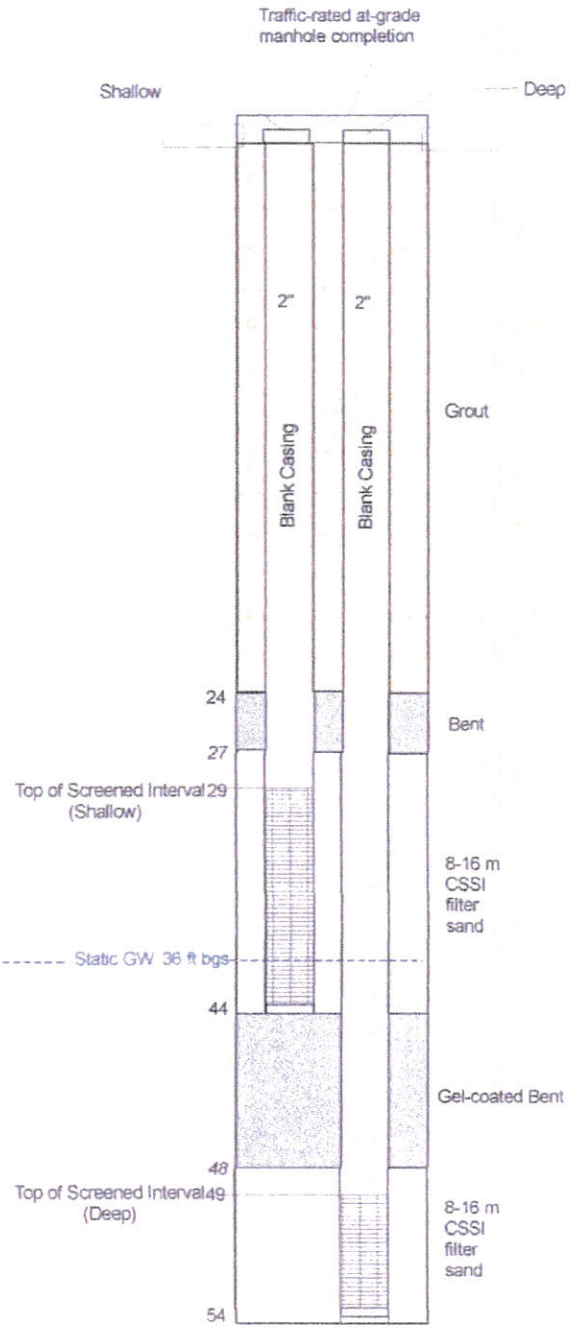
Boring: 6-G 2" MW DATE 3/26/12
LaunDry P6S1AP Task 2
Project Manager: W L Mansker, Ph D
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 7 5" O D

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Loose damp med Gvly silty sand silty clay | 5 | 1.24 |
| Gvly med silty sand | 10 | 2.75 |
| -do- | 15 | 4.40 |
| -do- | 20 | 1.78 |
| -do- | 25 | 1.22 |
| -do- | 30 | 1.04 |
| Moist silty clay | 35 | 1.82 |
| GW ~ 36 ft | | |
| -do-wet silty sand | 40 | 9.75 |
| Cobbley gravel Edith Gravel? | 45 | |



Boring: 6-H S/D DATE: 3/22/12
LaunDry P6S1AP Task 2
Project Manager: W. L. Mansker, Ph.D
Driller: Rodgers Environmental Services
RIG: CME - 75 HSA 10" O.D

| Lithology | Depth bgs | FID ppm |
|---|---|---|
| Dk Brn Silty Clay | | |
| Red Brn Silty Clay | | |
| Brn Silty Sand | 5 | 2.30 |
| Loose damp med silty sand | 10 | 1.26 |
| -do- minor coarse sand | 15 | 0.85 |
| Tight Silty Clay | 20 | 1.10 |
| Gvly loose silty sand | 25 | 0.80 |
| Gvly Sand | | |
| Gravel | 30 | 1.00 |
| Lt Brn Clay | | |
| Moist silty sand | 35 | 1.85 |
| -do-wet silty sand | 40 | |
| Edith Gravel | 45 | |
| Edith Gravel | 50 | |



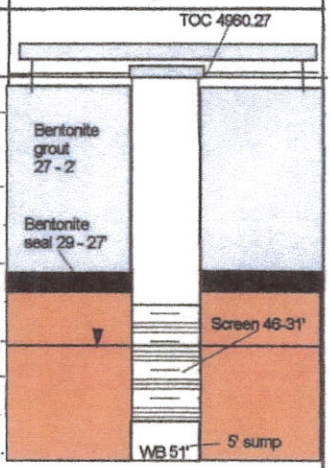
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 5/09/07 Boring: MW - 8

Driller: Rodgers Env. Services Rig: CME-75 (HSA) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | Dirt surface underlain by fine loose sand |
| | | ns | loose sand to 3' |
| | | 0.65 | fine - med loose sands w/ thin clays to 28' |
| | | 0.47 | |
| | | 0.60 | |
| 25 | | 1.14 | Thin (~ 1") tight clay layer @ 22' |
| | | | Thin (~ 2") tight clay layer @ 24' |
| | | 1.08 | fine - med loose sands w/ thin clays to 28' |
| | | 2.46 | interlayered 10" fine sands and clays 29 - 33' |
| | | | GW @ ~ 35.8 ft bgs in wet silty sand |
| | | | fine - med loose sands 33 - 45' |
| 50 | | | fine, silty sand (heaving sands) 45 - 52' |
| | | | TD @ 52 ft bgs |
| 75 | | | |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.




Page _1__ of __1__

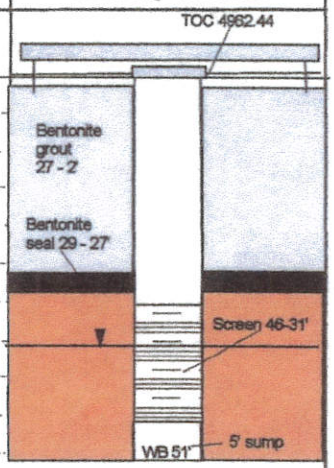
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 5/09/07 Boring: MW - 9

Driller: Rodgers Env. Services Rig: CME-75 (HSA) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | Asphalt surface underlain by gravelly loose sand |
| | | ns | loose sand to 3' |
| | | 2.12 | dk tight clay 7-8' |
| | | 0.97 | |
| | | 1.27 | gravelly sand 8-45' |
| 25 | | 1.29 | |
| | | 2.23 | 1" thick coarse gravel @ 28' |
| | | 1.18 | thin (4") tight clay layer 35-36' |
| | | | GW @ ~ 36 ft bgs in wet, gravelly sand |
| | | | gravelly sand 8-45' |
| 50 | | | fine, silty sand (heaving sands) 45 - 52' |
| | | | TD @ 52 ft bgs |
| 75 | | | |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.

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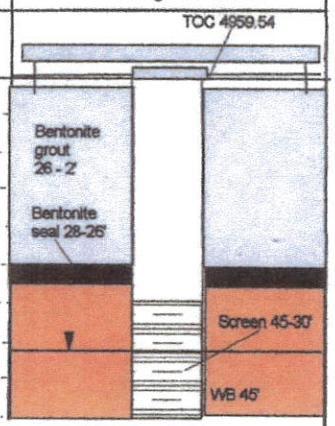
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation  Date: 4/23/07  Boring: MW-10

Driller: Rodgers Env. Services  Rig: CME-75 (HSA)  Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | Asphalt surface underlain by red silty sand to 3' |
| | | 0.23 | tan, silty sand 3 - 8' |
| | | 0.05 | |
| | | 0.34 | interlayered sand and thin clays 8 to 23' |
| | | 0.02 | |
| 25 | | 0.93 | loose sand 23' - 33' |
| | | 0.36 | |
| | | 0.34 | GW @ ~ 36 ft bgs in wet, gravelly sand |
| | | 2.43 | gravelly sand 33 - 43' |
| | | | Gray tight silty; last 8" gravelly clay to 48' (TD) |
| 50 | | | |
| 75 | | | |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.

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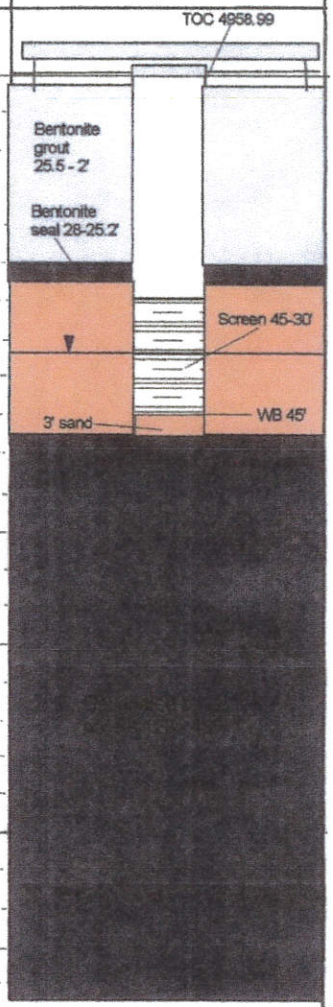
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 4/16/07 Boring: MW-11

Driller: Rodgers Env. Services Rig: CME-75 (MR) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Cuttings) |
|---|---|---|---|
| 0 | | N/A | Asphalt surface ~ 4" |
| | | | sand |
| | | | clay |
| | | | gravelly sand |
| 25 | | | |
| | | | GW @ ~ 36 ft bgs in wet, gravelly sand |
| | | | gravelly sand |
| 50 | | | |
| | | | fine silty sand w/minor gravelly sands |
| | | | silty clayey sand ? |
| 75 | | | fine silty sand |
| | | | fine silty sand |
| 100 | | | |
| | | | fine silty sand |
| 125 | | | |

Monitoring Well Const.




Comments: JetWest down-hole geophysics logs run prior to MW installation

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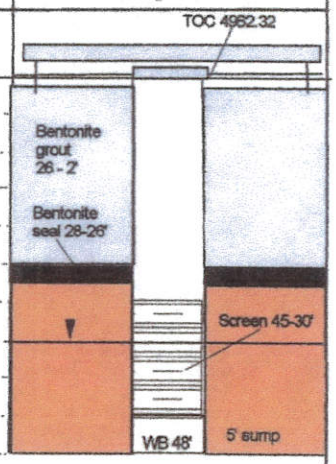
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 4/23/07 Boring: MW-12

Driller: Rodgers Eriv. Services Rig: CME-75 (HSA) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | Asphalt surface underlain by gravel and loamy soil |
| | | 0.08 | interlayered sand and thin clays to 18' |
| | | 0.25 | |
| | | 0.10 | |
| 25 | | 0.06 | loose gravelly sand 18' - 28' |
| | | 2.08 | coarse gravel 28- 30' |
| | | 1.21 | GW @ ~ 35 ft bgs in wet, gravelly sand |
| | | 1.70 | gravelly sand 30 - 38' |
| 50 | | | fine silty flowing sands to 38 - 53' (TD) |
| 75 | | | |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.



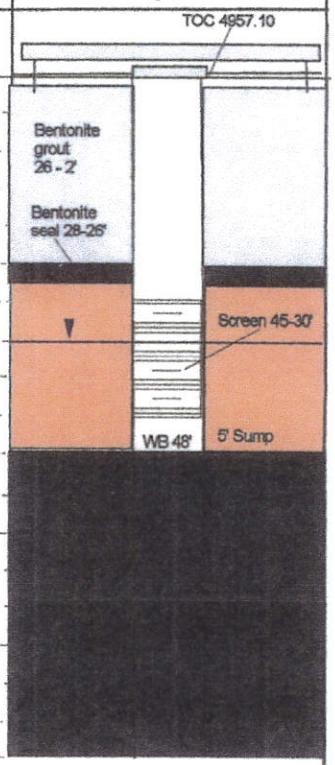
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation  Date: 4/19/07  Boring: MW-14S

Driller: Rodgers Env. Services  Rig: CME-75 (HSA)  Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | |
| | | 3.39 | Dk loamy soil at surface to 3.5' |
| | | 2.33 | interlayered sand and thin clays to 12.5' |
| | | 2.76 | |
| | | ns | gravelly sand 12.5 - 25' |
| 25 | | 2.76 | |
| | | 1.24 | coarse gravelly sand 25-28' |
| | | 4.43 | |
| | | 3.38 | |
| | | 54.25 | GW @ ~ 35 ft bgs in wet, gravelly sand |
| | | 17.60 | |
| | | 4.25 | |
| | | 4.05 | fine silty flowing sands w/minor gravelly sands |
| 50 | | 8.46 | |
| | | 7.47 | |
| | | 12.49 | fine silty flowing sands |
| | | 14.60 | |
| | | 10.45 | |
| | | 12.58 | |
| | | 12.77 | |
| 75 | | 6.26 | silty gravelly sand |
| | | | fine silty flowing sands to TD @ 88 ft |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.




Comments: Drilled to 88' to try to set 14D. Hole failed at depth. Completed as MW-14S



*Excellence . . .The exceptional drive to exceed expectations*

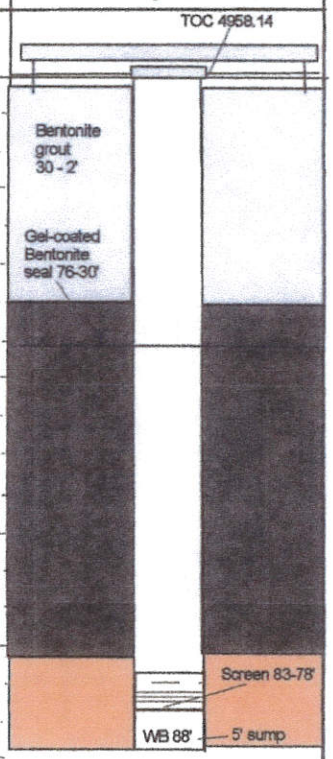
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 4/19/07 Boring: MW-14D

Driller: Rodgers Env. Services Rig: CME-75 (HSA) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (HSA Cuttings) |
|---|---|---|---|
| 0 | | N/A | Dirt surface underlain by fine loose sand |
| | | | loose gravelly sand to 10' |
| | | | dk brn tight clay 10 - 13' |
| 25 | | | fine - med loose gravelly sands 13 - 45' |
| | | | GW @ ~ 36 ft bgs in wet silty gravelly sand |
| 50 | | | |
| | | | fine, silty sand (heaving sands) 45 - 88' |
| 75 | | | |
| | | | TD @ 88 ft bgs |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.




Comments: MW-14D drilled with bit plug to TD; no samples retrieved.

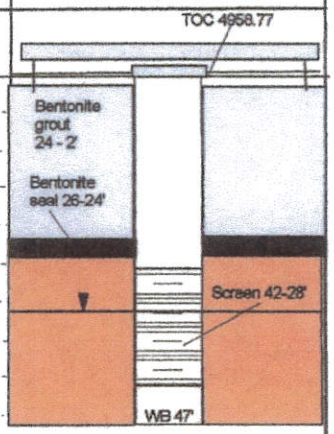
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation  Date: 4/24/07  Boring: MW-15S

Driller: Rodgers Env. Services  Rig: CME-75 (HSA)  Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (Continuous Sampler) |
|---|---|---|---|
| 0 | | | Dirt surface underlain by clay |
| | | 0.87 | dk brn tight clay to 3' |
| | | 0.61 | loose sand 3' - 18' |
| | | 0.63 | |
| | | 0.46 | gravelly sand 18-48' |
| 25 | | 7.98 | |
| | | 1.15 | 1" thick coarse gravel @ 28' |
| | | 3.06 | GW @ ~ 32 ft bgs in wet, gravelly sand |
| | | | gravelly sand 18-48' |
| 50 | | | |
| 75 | | | |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.

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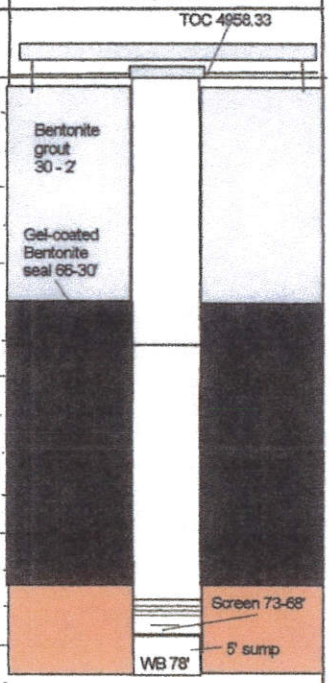
## Soil Boring Log/Monitoring Well Completion Diagram

Site: LD P2S1AP Investigation Date: 5/8/07 Boring: MW - 15D

Driller: Rodgers Env. Services Rig: CME-75 (HSA) Project Manager: W. Mansker/INEX

| Depth (ft bgs) | Strat | FID ppm | Lithologic Description (HSA Cuttings) |
|---|---|---|---|
| 0 | | N/A | Dirt surface underlain by fine loose sand |
| | | | loose gravelly sand to 8' |
| | | | dk brn tight clay 8 -10' |
| 25 | | | fine - med loose gravelly sands 10 - 45' |
| | | | GW @ ~ 36 ft bgs in wet silty gravelly sand |
| 50 | | | |
| | | | fine, silty sand (heaving sands) 45 - 78' |
| 75 | | | TD @ 78 ft bgs |
| 100 | | | |
| 125 | | | |

Monitoring Well Const.




Comments: MW-15D drilled with bit plug to TD; no samples retrieved.

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# BORING/WELL CONSTRUCTION LOG

EA Engineering, Science, and Technology, Inc.

| | | | |
|---|---|---|---|
| Project: | Laun-Dry Supply Co. | Project Number: | 1506901.03 |
| Drilling Company: | Enviro-Drill | Start Time/Date: | 9/4/2013 1445 |
| Drilling Rig/Bit: | HSA 8.625" OD 4.25" ID | Completion Time/Date: | 9/4/2013 1800 |
| Driller: | Jason Pottroff | Final Depth: | 40 feet |
| Boring/Well ID: | SVE-1 | Logged By: | David Werth Page 1 of 1 |

| Sample Type | Sample Recovery (in) | Sample Interval | PID Reading | USCS Soil Type | Depth, ft bgs | Soil Description (soil type, color, density/consitency, plasticity, moisture, grain size, angularity/minerology, other) | Boring and/or Well Details |
|---|---|---|---|---|---|---|---|
| | | | | | 1 | | Bentonite |
| | | | | | 2 | | |
| | | | | | 3 | | |
| | | | | | 4 | | |
| SS | 10 | | 15.6 | SC | 5 | (4'-6') Sandy clay, very dark grayish brown (10YR 3/2), | |
| | | | | | 6 | medium stiff, plastic, moist, very fine grained | |
| | | | | | 7 | | 2" Schedule 40 PVC |
| | | | | | 8 | | |
| | | | | | 9 | | 10/20 Silica Sand |
| SS | 16 | | 15.2 | SP | 10 | (9'-11') Poorly graded sand, light yellowish brown (10YR 6/4), loose, | |
| | | | | | 11 | moist, very fine to fine grained | |
| | | | | | 12 | | |
| | | | | | 13 | | |
| | | | | | 14 | | |
| SS | 10 | | 15.7 | SP | 15 | (14'-16') Same as above, fine to medium grained | |
| | | | | | 16 | | |
| | | | | | 17 | | |
| | | | | | 18 | | |
| | | | | | 19 | | |
| SS | 18 | | 5.9 | SW | 20 | (19'-21') Well graded sand, light yellowish brown (10YR 6/4), loose, | |
| | | | | | 21 | moist, fine to coarse grained | |
| | | | | | 22 | | |
| | | | | | 23 | | |
| | | | | | 24 | | |
| SS | 2 | | 11.5 | SW | 25 | (24'-26') Same as above, trace gravel, low recovery due to gravel | |
| | | | | | 26 | stuck in the shoe | |
| | | | | | 27 | | |
| | | | | | 28 | | |
| | | | | | 29 | | |
| SS | 19 | LAB | 44.6 | SW | 30 | (29'-31') Same as above, wet at 30 feet bgs | |
| | | | | | 31 | | |
| | | | | | 32 | | |
| | | | | | 33 | | |
| | | | | | 34 | | |
| SS | 3 | | 29.3 | SW | 35 | (34'-36') Same as above, poor recovery due to flowing sands | |
| | | | | | 36 | | |
| | | | | | 37 | (30') Could not recover sample | |
| | | | | | 38 | Screen - 0.020 slot Schedule 40 PVC from 10 to 40 feet bgs | |
| | | | | | 39 | Sand 10/20 Silica sand from 8 to 40 feet bgs | |
| | | | | | 40 | Bentonite hole plug 3/8" chips from 0 to 8 feet bgs | Bentonite |

SS = Split Spoon Cut = Cuttings NA = Not Analyzed

# BORING/WELL CONSTRUCTION LOG

EA Engineering, Science, and Technology, Inc.

| | | | |
|---|---|---|---|
| Project: | Laun-Dry Supply Co. | Project Number: | 1506901.03 |
| Drilling Company: | Enviro-Drill | Start Time/Date: | 9/6/2013 0830 |
| Drilling Rig/Bit: | HSA 8.625" OD 4.25" ID | Completion Time/Date: | 9/6/2013 1130 |
| Driller: | Chris Ortiz | Final Depth: | 39 feet |
| Boring/Well ID: | SVE-2 | Logged By: | David Werth Page 1 of 1 |

| Sample Type | Sample Recovery (in) | Sample Interval | PID Reading | USCS Soil Type | Depth, ft bgs | Soil Description (soil type, color, density/consitency, plasticity, moisture, grain size, angularity/minerology, other) | Boring and/or Well Details |
|---|---|---|---|---|---|---|---|
| | | | | | 1 | | Bentonite / 2" Schedule 40 PVC / Bentonite |
| | | | | | 2 | | |
| | | | | | 3 | | |
| | | | | | 4 | | |
| SS | 13 | | 9.0 | CL | 5 | (4'-6') Sandy clay, dark brown (10YR 3/3), medium dense, moist | |
| | | | | | 6 | slightly plastic | |
| | | | | | 7 | | |
| | | | | | 8 | | 10/20 Silica Sand / 10/20 Silica Sand |
| | | | | | 9 | | |
| SS | 6 | | 2.5 | SP | 10 | (9'-11') Poorly graded sand,brownish yellow (10YR 6/6), loose, | |
| | | | | | 11 | moist, medium grained, trace gravel, 2-3 cm | |
| | | | | | 12 | | |
| | | | | | 13 | | |
| | | | | | 14 | | |
| SS | 8 | | 4.3 | SP | 15 | (14'-16') Same as above | |
| | | | | | 16 | | |
| | | | | | 17 | | |
| | | | | | 18 | | |
| | | | | | 19 | | |
| SS | 14 | | 8.9 | SP | 20 | (19'-21') Same as above | |
| | | | | | 21 | | |
| | | | | | 22 | | |
| | | | | | 23 | | |
| | | | | | 24 | | |
| SS | 20 | | 45 | SP | 25 | (24'-26') Poorly graded sand, brownish yellow (10YR 6/6), loose, | |
| | | | | | 26 | moist, fine to medium grained, no gravel | |
| | | | | | 27 | | |
| | | | | | 28 | | |
| | | | | | 29 | | |
| SS | 22 | LAB | 92 | SP | 30 | (29'-31')Poorly graded sand, brownish yellow (10YR 6/6), loose, | |
| | | | | | 31 | wet at 30 feet, medium grained, trace gravel, 2-3 cm | |
| | | | | | 32 | | |
| | | | | | 33 | | |
| | | | | | 34 | | |
| SS | 5 | | 7.3 | SW | 35 | (34'-36') Well graded sand, brown (10YR 4/3), loose, wet, fine to | |
| | | | | | 36 | coarse grained, trace gravel, 1-2 cm | |
| | | | | | 37 | (39') Could not recovery sample | |
| | | | | | 38 | Screen - 0.020 slot Schedule 40 PVC from 9 to 39 feet bgs | |
| | | | | | 39 | Sand 10/20 Silica sand from 7 to 39 feet bgs | |
| SS | 0 | | | | 40 | Bentonite hole plug 3/8" chips from 0 to 7 feet bgs | Slough |

SS = Split Spoon Cut = Cuttings NA = Not Analyzed

# BORING/WELL CONSTRUCTION LOG

EA Engineering, Science, and Technology, Inc.

| | | | |
|---|---|---|---|
| Project: | Laun-Dry Supply Co. | Project Number: | 1506901.03 |
| Drilling Company: | Enviro-Drill | Start Time/Date: | 9/4/2013 0845 |
| Drilling Rig/Bit: | HSA 8.625" OD 4.25" ID | Completion Time/Date: | 9/4/2013 1400 |
| Driller: | Jason Pottroff | Final Depth: | 40 feet |
| Boring/Well ID: | SVE-3 | Logged By: | David Werth Page 1 of 1 |

| Sample Type | Sample Recovery (in) | Sample Interval | PID Reading | USCS Soil Type | Depth, ft bgs | Soil Description (soil type, color, density/consitency, plasticity, moisture, grain size, angularity/minerology, other) | Boring and/or Well Details |
|---|---|---|---|---|---|---|---|
| Cut | | | | SP | 1 | (0'-4') Poorly graded sand, dark yellowish brown (10YR 4/4), loose, | Bentonite |
| | | | | | 2 | moist, very fine to fine grained | |
| | | | | | 3 | | |
| | | | | | 4 | | |
| SS | 24 | LAB | 45.6 | SP | 5 | (4'-6') Same as above with a trace amount of clay | |
| | | | | | 6 | | |
| | | | | | 7 | | 2" Schedule 40 PVC |
| | | | | | 8 | | |
| | | | | | 9 | | 10/20 Silica Sand |
| SS | 20 | | 37.8 | SP | 10 | (9'-9.5') Same as above | |
| | | | | | 11 | (9.5'-11) Poorly graded sand, light yellowish brown (10YR 6/4), loose, | |
| | | | | | 12 | moist, fine to medium grained, some orange mottling | |
| | | | | | 13 | | |
| | | | | | 14 | | |
| SS | 12 | | 29.6 | SP | 15 | (14'-15') Poorly graded sand, dark yellowish brown (10YR 4/4), loose, | |
| | | | | | 16 | moist, very fine to fine grained, trace amount of clay | |
| | | | | | 17 | (15'-16') Poorly graded sand, light yellowish brown (10YR 6/4), loose, | |
| | | | | | 18 | moist, medium grained, trace gravel, 1-2 cm | |
| | | | | | 19 | | |
| SS | 14 | | 11.2 | SP | 20 | (19'-21') Same as above | |
| | | | | | 21 | | |
| | | | | | 22 | | |
| | | | | | 23 | | |
| | | | | | 24 | | |
| SS | 15 | | 9.1 | SP | 25 | (24'-26') Same as above | |
| | | | | | 26 | | |
| | | | | | 27 | | |
| | | | | | 28 | | |
| | | | | | 29 | | |
| SS | 14 | | 3.2 | SW | 30 | (29'-30') Well graded sand, light yellowish brown (10YR 6/4), loose, | |
| | | | | SP | 31 | wet, fine to coarse grained | |
| | | | | | 32 | (30'-31') Poorly graded sand, light yellowish brown (10YR 6/4), loose | |
| | | | | | 33 | wet, medium grained, trace gravel, 1-2 cm | |
| | | | | | 34 | | |
| SS | 11 | | 0.4 | SW | 35 | (34'-36') Well graded sand, lighty yellowish brown (10YR 6/4), loose, | |
| | | | | | 36 | wet, fine to coarse grained, heaving sands | |
| | | | | | 37 | (39') could not recover sample | |
| | | | | | 38 | Screen - 0.020 slot Schedule 40 PVC from 10 to 40 feet bgs | |
| | | | | | 39 | Sand 10/20 Silica sand from 8 to 40 feet bgs | |
| SS | 0 | | | | 40 | Bentonite hole plug 3/8" chips from <1 to 8 feet bgs | Bentonite |

SS = Split Spoon Cut = Cuttings NA = Not Analyzed

| Soil Boring Log | Page 1 of 1 |
|---|---|
| Site Name: GW Plume/ 4th and Haines | Map of Location |
| Boring Number: MW-4H06 | South side of Haines east of 5th Street |
| Drilling Method: Hollow Stem Auger | Well Construction |
| Drilling Contractor: Rodgers | Seal: 28 feet |
| Driller: Harvey Reihert | Top of Sand: 33 feet |
| Helper: Arturo Bwarza | Top of Screen: 38 feet |
| Date Started: June 28, 2000 | Total Depth: 58 feet Depth to Water: 43 feet |

| DEPTH | SAMPLE | | | | | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | |
| | 0 | 3 | | 50% (1.5'- 3') | 0.0 to 1.0 | | Very fine light brown sand |
| | 3 | 8 | FGP14 @ 7 feet | 50% (5' - 8') | 0.2 to 0.6 | | 5' to 7.9' well sorted fine light brown sand<br>7.9' to 8' poorly sorted medium sand with pebbles; whitish grey |
| | 8 | 13 | | 40% (11'- 13') | 0 to 0.1 | | 11' to 12.5' poorly sorted medium sand with 5% 1" pebbles<br>12.5' to 13' fine-grained well sorted sand (pinkish white) |
| | 13 | 18 | | 100% | 0.0 to 0.2 | | Top 2" fine sand the rest 13.2' to 18' brown clay except for 5" at 16.5' of silty clay |
| | 18 | 23 | | 60% (21'- 23') | 0.0 to 0.2 | | 21' to 21.10' brown clay, wet (may be from decon)<br>21.1' to 22.2' very fine silty sand brown (yellow orange) very well sorted<br>22.2 to 23 well-sorted fine sand |
| | 23 | 28 | | 60% (25.5' - 28') | | | 25.5' to 26.3' well sorted medium fine sand<br>26.3' to 27.8' coarse medium sand with signs of iron oxidation ad 1-1.5' pebbles<br>27.8' to 28' fine well sorted sand |
| | 28 | 33 | | 60% (30' - 33') | 0.1 to 0.2 off sand 0.1 to 0.3 off clay | | 30' to 31.4' grey medium sand poorly sorted with 10% pebbles (0.5 to 2")<br>31.4' to 33' olive grey sand with white (calcareous ?) nodules approximately 1 cm |
| | 33 | 38 | FGP15 and duplicate | 100% (33.5' - 38') | 1.3 off clay 1.6 to 3.3 off sand | | 35' to 36' friable green clay<br>36' to 36.6' silty brown clay<br>36.6' to 38' green gray sand |
| | 38 | 43 | | 0% | | | Empty core (sand?) |
| | 42.5 | 44.5 | | 50% (43.5' to 44.5') | 0.1 to 0.4 | | poorly sorted coarse to medium sand with 30 to 40% gravelly pebbles<br>Water at 43' |

Documented by Dana Bahar
Transcribed by Dana Bahar

| Soil Boring Log | Page 1 of 1 |
|---|---|
| Site Name: GW Plume/ 4th and Haines | Map of Location |
| Boring Number: MW-4H05 | On 5th Street north of railroad tracks south of Haines in front of Pattin Auction |
| Drilling Method: Hollow Stem Auger | Well Construction |
| Drilling Contractor: Rodgers | Seal: 28 feet |
| Driller: Harvey Reihert | Top of Sand: 33 feet |
| Helper: Arturo Bwarza | Top of Screen: 38 feet |
| Date Started: June 29, 2000 | Total Depth: 58 feet Depth to Water: 43 feet |

| DEPTH | SAMPLE | | | | | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | |
| | 0 | 3 | | | | | hand dug -no sample |
| | 3 | 8 | | 70% (4.2' - 8') | 0.0 to 0.3 (0.3 at 7.5') | | 4.2' to 6.2' brown clay (silty clay -lumpy)<br>6.2 to 8 fine sand, starts brown silty, sand and grades to very fine grey sand |
| | 8 | 13 | | 50% | 0.0 to 0.1 | | 10.9'- 13' medium fine, poorly sorted fines downward; 5-10% <1"pebbles; granitic |
| | 13 | 18 | | 50% (14'- 18') | | | 14' to 14.9' sand with clay clumps<br>14.9 to 18 brown clay |
| | 18 | 23 | FGP19 @ 22 feet | 50% (19.2'- 23') | | | 19.2' to 20.85' brown clay<br>20.85 to 23 silty clay t o brown/yellow brown |
| | 23 | 28 | FGP20 @ 27 feet | 50% (25.3' - 28') | 0.7 to 1.0 | | (PID failed background on 2000 Rea is 0.7)<br>25.3' to 25.10' brown clay<br>25.1' to 27' gray, poorly sorted medium sand with gravel<br>27' to 28' medium fine silty sand with a clay pocket at 27' to 27.2' |
| | 28 | 33 | | 40% | 0.8 to 1.0 | | Grey medium sand with 2-5%gravel; medium to well sorted; |
| | 33 | 38 | | 90% (33.1' - 38') | 0.7 to 1.1 | | 33.1 to 37 grev clav<br>37 to 38 well-sorted grey-green sand |
| | 38 | 43 | FGP21 @ 42 feet | 60% (40' -43') | 0.7 to 1.1 | | 40.5 - 42 wet greenish gray fine sand, well sorted (gray when dry)<br>42 - 43 greenish well sorted medium to coarse sand (gray when dry)<br><br>Water 43.3 |

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| Soil Boring Log | Page 1 of 1 |
|---|---|
| Site Name: GW Plume/ 4th and Haines | Map of Location |
| Boring Number: MW-4H04 | On 7th Street in front of Instrument Service Lab |
| Drilling Method: Hollow Stem Auger | Well Construction |
| Drilling Contractor: Rodgers | Seal: 25 feet |
| Driller: Harvey Reihert | Top of Sand: 30 feet |
| Helper: Arturo Bwarza | Top of Screen: 35 feet |
| Date Started: June 27, 2000 | Total Depth: 55 feet Depth to Water: 40 feet |

| DEPTH | SAMPLE | | | | | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | |
| | 0 | 3 | | 20% (2'- 3') | 8.6 @2.5' rest 0.2 to 1.2 | | medium well sorted sand |
| | 3 | 8 | FGP11 @ 6 feet | 60% (5.5' - 8') | 3.2 @ 6' | | medium well sorted sand above silty clay |
| | 8 | 13 | | 40% (11'- 13') | 0.2 - 0.8 1.1 @ 12' | | medium to coarse yellow felsic sand with 20% gravel and 1% 1"pebbles |
| | 13 | 18 | FGP12 @ 17.5 feet | 50% (15.5'- 18') | 0.8 @17.5' | | 13' to 17' Very well sorted medium fine sand<br>at 17.5 see transition into poorly sorted fine greyish sand |
| | 18 | 23 | | 50% (20.5'- 23') | 0.4 - 0.6 (0.6 @ 22.5') | | well sorted medium yellow sand with 2% pebbles (<1")<br>medium to coarse sand increases with depth<br>23' poorly sorted sand; medium to coarse (20%) sand, 1% <1" pebbles |
| | 23 | 28 | | 50% (25.5' - 28') | 0.4 - 0.5 | | Very well sorted fine sand |
| | 28 | 33 | | 50% (30.5' - 33') | 0.3 all core | | 30.5' to 31.8' medium fine sand<br>31.8' to 32' clayey silty sand<br>32' to 33' poorly sorted medium to coarse sand with 1% pebbles and clay clumps (10% clay) |
| | 33 | 38 | | 90% (33.5' - 38') | | | 33.5' to 34' coarse to medium yellow felsic sand<br>34' to 37.9' clay (note: greenish clay vs. brown clay below)<br>37.9' to 38' fine sand |
| | 38 | 43 | FGP13 @ 42.5 | 50% (40.5' -43') | 0.2 | | 40.5 - 42 wet greenish gray fine sand, well sorted (gray when dry)<br>42 - 43 greenish well sorted medium to coarse sand (gray when dry) |

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**Soil Boring Log** 

**Site Name:** GW Plume/ 4th and Haines

**Boring Number:** MW-4H03

**Drilling Method:** Hollow Stem Auger

**Drilling Contractor:** Rodgers

**Driller:** Harvey Reihert

**Helper:** Arturo Bwarza

**Date Started:** June 26, 2000

**Map of Location**

COA Los Tomases Yard NW corner

**Well Construction**

**Seal:** 26 feet

**Top of Sand:** 31 feet

**Top of Screen:** 36 feet

**Total Depth:** 56 feet **Depth to Water:** 41 feet

| DEPTH | SAMPLE | | | | | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | |
| | 0 | 3 | | 100% | | | 2" gravel (20%) coarse sand (80%) |
| | 3 | 8 | FGP01 @ 5 feet FGP02 @ 7 feet | 100% | | | Well sorted medium fine sand with 2" gravel lenses |
| | 8 | 13 | FGP03 @ 12 feet | 50% (8' to 9' and 11' to 13') | | | 8' to 9' well-sorted, light colored quartz rich sand<br>11' ro 13' medium fine sand; light colored |
| | 13 | 18 | | 50% (15' to 17') | | | medium-fine yellow-gray sand very well sorted |
| | 18 | 23 | | 50% (20' to 23') | | | medium sand (a little coarser than above) rare 1' cobbles randomly dispersed |
| | 23 | 28 | | 60% (25' to 28') | | | 25' very coarse sand (90%) with 10%clay very well sorted; more felsic with random 1" cobbles<br>27' Same as above; some moisture |
| | 28 | 33 | FGP04 @ 32 feet | 50% (32' to 33') | | | very homogenous medium sand with 1" cobble 5% |
| | 33 | 38 | FGP05 @ 36 feet | 80% ( 33' to 33.5') | | | 34' to 35' medium coarse sand with 50% clayey silt<br>36- 37.5 silty clay<br>37.5 ½' clay lense |
| | 38 | 43 | | 60% | | | Medium sand, start seeing moisture at 40'<br>Very wet at 43' |

Documented by Dana Bahar
Transcribed by Dana Bahar

**Soil Boring Log** 

| | |
|---|---|
| **Site Name:** GW Plume/ 4th and Haines | **Map of Location** |
| **Boring Number:** MW-4H02 | Northeast Corner of Aspen and Los Tomases |
| **Drilling Method:** Hollow Stem Auger | **Well Construction** |
| **Drilling Contractor:** Rodgers | **Seal:** 26 feet |
| **Driller:** Harvey Reihert | **Top of Sand:** 31 feet |
| **Helper:** Arturo Bwarza | **Top of Screen:** 36 feet |
| **Date Started:** June 26, 2000 | **Total Depth:** 56 feet **Depth to Water:** 41 feet |

| DEPTH | SAMPLE From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | 3 | 8 | | 100% | | | 3 - 4.5 Fine Sand<br>4.5 - 6.5 20% Clay; Dark Brown; Moist;<br>80% Very fine sand; Cohesive |
| | 8 | 13 | FGP09 @ 11 feet | 60% (10' to 13) | bottom 2' 0.1 to 0.2 | | Fine (sand some moisture); Light gray |
| | 13 | 18 | | 50% Sluff | 0.0 | | Top 6" Fine to medium sand<br>2' Coarse to medium sand 90% with gravel 10% up to 1.5" diameter (hornblende 15%, quartz 50% Feldspar 35% |
| | 18 | 23 | | 60% Sluff | 0.1 @ 23' | | Top 1.5' same as above<br>0.5' 5% very fine sand; 30% silt; 60% dark brown clay<br>1.0' 95% fine sand; 5 %medium sand |
| | 23 | 28 | | 60% | 0.0 | | 1.0' 95% fine sand; 5 %medium sand<br>1.0' 70% medium to 10% coarse sand with 10% clay stringers and 10% gravel; light yellowish gray<br>1' bottom fine sand; light gray<br>(70% quartz, 20% feldspar, 10% felsic (hornblende) |
| | 28 | 33 | | 50% | | | 1' fine sand; light gray (70% quartz, 20% feldspar, 10% felsic (hornblende)<br>2' medium (70%) to coarse (10%) sand with pebbles (5%) and cobbles @1" diameter (5%); light yellowish gray |
| | 33 | 38 | FGP10 @ 35 feet | 60% (35' tp 38') | 0.1 to 0.2 | | PID 0.1 to 0.2 for all of the core<br>Top 2' damp, somewhat cohesive, fine sand, silty 30%, fine sand 70%; Dark brown<br>Bottom 1' cobbles (50%) to 2"diameter broken up with gravel (30%) and medium sand (20%) |
| | 38 | 43 | | 40% (41' to-43') | 0.0 | | Wet; fine sand<br>Bottom 6" medium to coarse sand (20%) ; pebbles (50%) with cobbles to 1.5" (30%) |

Documented by Robin Brown
Transcribed by Dana Bahar

| Soil Boring Log | Page 1 of 1 |
|---|---|
| Site Name: GW Plume/ 4th and Haines | Map of Location |
| Boring Number: MW-4H01 | 6th h Street Yard (1717 6th Street) |
| Drilling Method: Hollow Stem Auger | Well Construction |
| Drilling Contractor: Rodgers | Seal: 26 feet |
| Driller: Harvey Reihert | Top of Sand: 31 feet |
| Helper: Arturo Bwarza | Top of Screen: 36 feet |
| Date Started: June 28, 2000 | Total Depth: 56 feet Depth to Water: 41 feet |

| DEPTH | SAMPLE | | | | | | LITHOLOGIC DESCRIPTION |
|---|---|---|---|---|---|---|---|
| | From ft bgs | To ft bgs | CLP Sample | Rec % | PID ppm | | |
| | 3 | 8 | | 70% (4' - 8') | 0.1 | | 4' to 5.5' black top in silty brown clay<br>5.5' to 7.9' brown very fine sand with silt<br>7.9' to 8' well-sorted, light brown, fine sand |
| | 8 | 13 | FGP17 @ 12 feet | 40% (10.9'- 13') | 0.0 to 0.1 | | 10.9' to 12.5' very well sorted, light brown, fine sand<br>12.5' to 13' medium fine sand; medium well sorted with 20% silt and 5% coarse sand |
| | 13 | 18 | | 40% (15.1'- 18') | 0.1 | | 15.1' to 18 medium well sorted sand with 1-5 % gravel; greyish brown with feldspar, and quartz and 10% mafic |
| | 18 | 23 | | 60% (20.5'- 23') | 0.1 to 0.2 | | 20.2' to 20.3' coarse sand in brown clay<br>20.3' to 20.7' brown clay<br>20.7' to 21.1' silt fine sand (brown) with 20% silt |
| | 23 | 28 | | 50% (25.5' - 28') | 0.5 @ 23'<br>1.0 @ 27' | | poorly sorted medium sand with 5-10% gravel<br>Top 5" evidence of oxidation and 2 - 3" cobbles between 25.5' to 26.5' and 27' to 27.5' |
| | 28 | 33 | FGP18 @ 30 feet | 60% (29.5' - 33') | 0.0 - 0.1 | | 29.5' to 32' Brown clay<br>32' to 32.2' oxidized gravelly zone<br>32.3' to 33' poorly sorted sand with 10-20% gravel |
| | 33 | 38 | | 60% (35' - 38') | 0.0 - 0.5 | | 33.5' to 37.3' poorly sorted medium fine sand (white-gray) 20-30% gravel ("river gravel")<br>37.3' to 38' very fine, well sorted sand (olive gray); moist–"capillary fringe" according to Harvey |

Documented by Dana Bahar
Transcribed by Dana Bahar

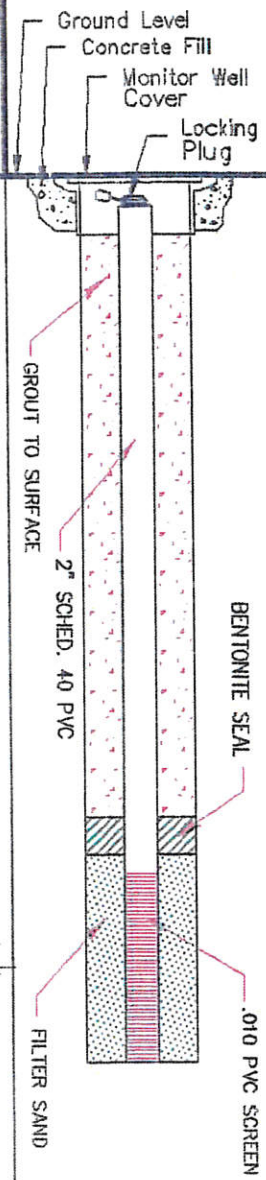
# MONITOR WELL NO. MW-1

| DEPTH, FT. | SYMBOL(USCS) | SAMPLE DESCRIPTION | SAMPLE NO. | SAMPLING INTERVAL | MOISTURE | CONTAMINATION ORGANIC VAPOR CONC. (PPM) | CONTAMINATION VISIBLE Y=Yes N=No |
|---|---|---|---|---|---|---|---|
| | MMF | 0-6" ASPHALT, 6" TO 3' MIXED FILL | | | D | | N |
| 5 | SW | 3-13' SAND, fine to medium grain, dry, tan, some gray staining | 5 | 4' TO 6' | D | 96.0 | N |
| 10 | | | 10 | 9' TO 11' | D | 137.0 | Y |
| 15 | ML | 13-18' SILT, clayey, moist, gray, low plasticity. | 15 | 14' TO 16' | M | 721.0 | Y |
| 20 | CL | 18-23' CLAY, trace silt, moist, brown with gray staining, medium plasticity. | 20 | 19' TO 21' SAMPLE COLLECTED | M | 816.0 | Y |
| 25 | SW | 23-38' SAND, medium to coarse grain, trace gravel, dry, tan to brown, gray staining. | 25 | 24' TO 26' | D | 687.0 | Y |
| 30 | | | 30 | 29' TO 31' | D | 455.0 | Y |
| 35 | | | 35 | 34' TO 36' | D | 227.0 | Y |
| 40 | SP | 38-43' SAND, medium grained, dry tan. | 40 | 39' TO 41' | D | 307.0 | Y |
| 45 | SW | 43-47' SAND, trace gravel, trace cobbles, saturated, tan to white | 45 | 44' TO 46' | S | N/A | N |
| 50 | | TD=47' | | | | | |
| 55 | | | | | | | |
| 60 | | | | | | | |

STRATIGRAPHY

WATER LEVEL

MONITOR WELL DETAILS




Client: NMED/GWPA Job No.: 8557-114-BA-PROJ Date Drilled: 11/4/92 Well No. MW-1

Site: BREWER GASCARD/FOURTH AND HAINES STREETS, ALBUQ. Top of Casing Elevation: 4959.61

Total Depth: 47' Casing Type & Size: 2" SCHED. 40 PVC Slot Size: .010 Drilling Method: HSA

Comments: SCREENED 37' TO 47'

Driller: HITCHCOCK/RODGERS & CO. Logged by: KW KADING

**MONITOR WELL AND COMPLETION DETAIL MW-1**

CDM environmental engineers, scientists planners, & management consultants

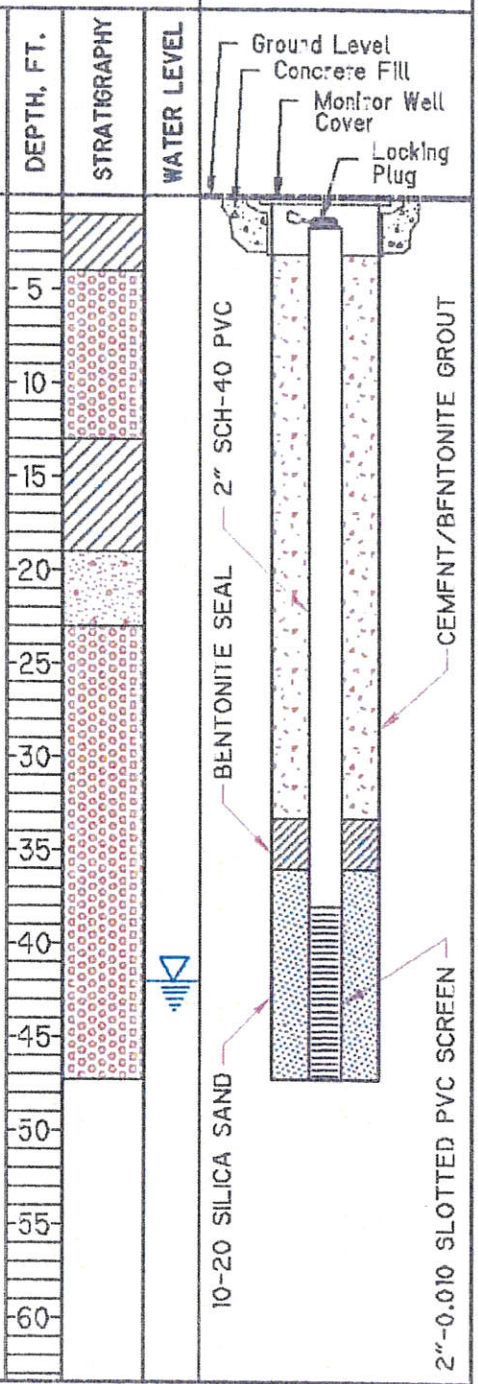
**NMED/GWPA SITE BREWER GASCARD FOURTH ST. & HAINES ALBUQ., NEW MEXICO**

Figure No. **B-1**

GMWSCHA1.DWG 11/23/92 EAC 8557-114-BA-PROJ

# MONITOR WELL MW-8

| DEPTH, FT. | SYMBOL(USCS) | SAMPLE DESCRIPTION | SAMPLE NO. | SAMPLING INTERVAL | MOISTURE | ORGANIC VAPOR CONC. (PPM) |
|---|---|---|---|---|---|---|
| | MMF | Manmade fill - crushed rock | MW-8 @ 40' | | | |
| | CL | CLAY, sandy, moderate P.I. moist, dark brown | | 3-5 | M | 0 |
| 5 | | | | | | |
| | SW | SAND, medium - course grained with gravel, well graded, moist feldspathic, pinkish-light tan | | 8-10 | M | 0 |
| 10 | | | | | | |
| | | | | 13-15 | W | 0 |
| 15 | CL | CLAY, sandy with silt and mica flakes, moderate P.I., saturated, dark brown | | | | |
| | | | | 18-20 | M | 60 |
| 20 | SP | SAND, fine grained, poorly graded, feldspathic, moist, light tan | | | | |
| | SW | SAND, medium - course grained with gravel, well graded, moist, feldspathic, pinkish-light tan | | 23-25 | M | 141 |
| 25 | | | | | | |
| | SW | with gravel size increasing | | 28-30 | M | 62 |
| 30 | | | | | | |
| | | with gravel and cobbles | | 33-35 | M | 877 |
| 35 | | | | | | |
| | SW | | | 38-40 | M | 379 |
| 40 | | | | | | |
| 45 | | | | | | |
| | | Total Depth = 47.15' | | | | |
| 50 | | | | | | |
| 55 | | | | | | |
| 60 | | | | | | |




Client: BREWER OIL COMPANY Job No.: 8557-114-BAB-PROJ Date Drilled: 7/28/93 Well No.: MW-8

Site: BREWER GAS CARD - THIRD AND HAINES Top of Casing Elevation: 4959.02

Total Depth: 47.15' Casing Type & Size: 2"Ø SCHED. 40 PVC Slot Size: .010 Drilling Method: HSA

Comments:

Driller: RODGERS AND COMPANY Logged by: JIM KRISS

| MONITOR WELL AND BORING LOG DETAILS | CDM | BREWER GAS CARD THIRD AND HAINES ALBUQUERQUE, NM | Figure No. B |
|---|---|---|---|

MW-8.DWG 8/4/93 JJK 8557-114-BAB-REPT

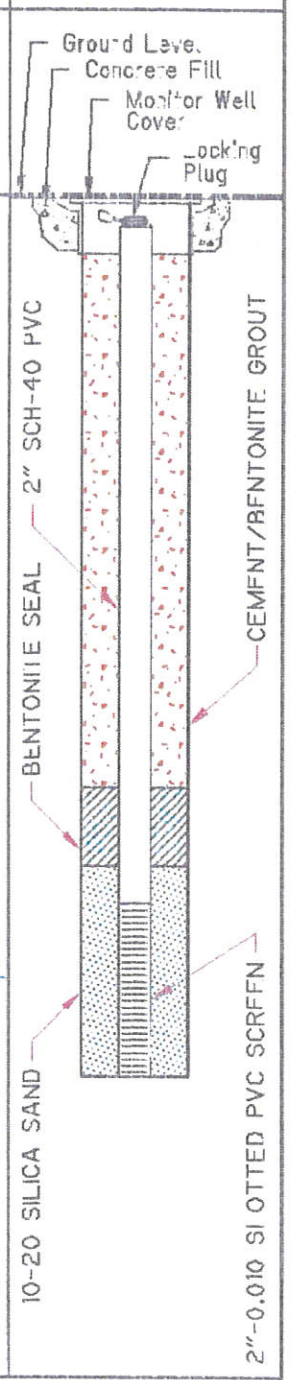
# MONITOR WELL MW-9

| DEPTH, FT. | SYMBOL (USCS) | SAMPLE DESCRIPTION | SAMPLE NO. | SAMPLING INTERVAL | MOISTURE | ORGANIC VAPOR CONC. (PPM) |
|---|---|---|---|---|---|---|
| | AVE | Varmade fill - asphalt | MW-9 @ 40' | | | |
| | CL | CLAY, sandy, moderate P.I. moist, dark brown | | 3-5 | M | 0 |
| 5 | SC | SAND, fine grained, clayey, moist, light tan | | | | |
| 10 | SW | SAND, medium - course grained with gravel, well graded, moist feldspathic, pinkish-light tan | | 8-10 | M | 0 |
| 15 | | | | 13-15 | M | 0 |
| | CL | CLAY, sandy with silt and mica flakes, moderate P.I., saturated, dark brown | | 18-20 | W | 0 |
| 20 | SW | SAND, medium - course grained with gravel, well graded, moist, feldspathic, pinkish-light tan | | 23-25 | M | 391 |
| 25 | | | | | | |
| 30 | SW | with gravel size increasing | | 28-30 | M | 234 |
| 35 | SW | with gravel and cobbles | | 33-35 | M | 861 |
| 40 | | | | 38-40 | M | 1200 |
| 45 | | | | | | |
| 50 | | Total Depth = 47.23' | | | | |
| 55 | | | | | | |
| 60 | | | | | | |

STRATIGRAPHY

WATER LEVEL

## MONITOR WELL DETAILS




Client: BREWER OIL COMPANY Job No.: 8557-114-BAB-PROJ Date Drilled: 7/29/93 Well No.: MW-9

Site: BREWER GAS CARD - THIRD AND HAINES Top of Casing Elevation: 4958.94

Total Depth: 47.23' Casing Type & Size: 2"Ø SCHED. 40 PVC Slot Size: .010 Drilling Method: HSA

Comments:

Driller: RODGERS AND COMPANY Logged by: JIM KRISS

| MONITOR WELL AND BORING LOG DETAILS | CDM environmental engineers, scientists planners, & management consultants | BREWER GAS CARD THIRD AND HAINES ALBUQUERQUE, NM | Figure No. C |
|---|---|---|---|

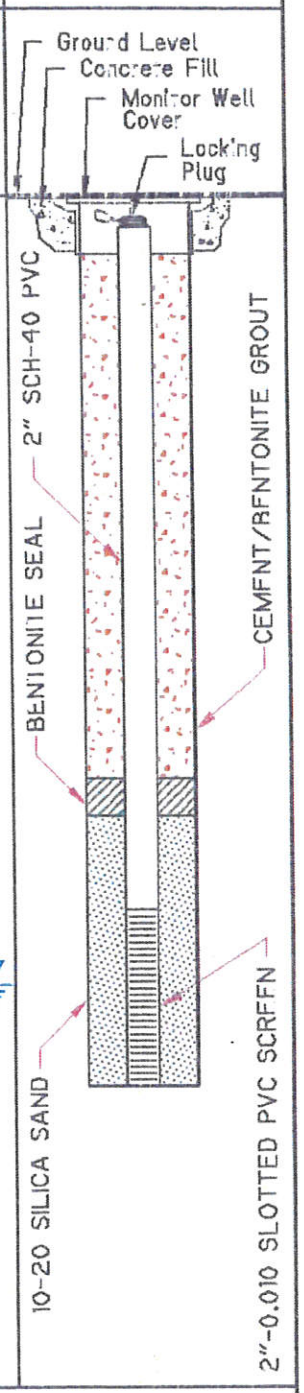
MW-9.DWG 8/4/93 JJK 8557-114-BAB-REPT

# MONITOR WELL MW-12

| DEPTH, FT. | SYMBOL(USCS) | SAMPLE DESCRIPTION | SAMPLE NO. | SAMPLING INTERVAL | MOISTURE | ORGANIC VAPOR CONC. (PPM) |
|---|---|---|---|---|---|---|
| | MMF | Manmade fill - asphalt | | | | |
| | CL | CLAY, sandy, moderate P.I. moist, dark brown | | 3-5 | M | 66 |
| 5 | | | | | | |
| | SW | SAND, medium - course grained with gravel, well graded, moist feldspathic, pinkish-light tan | | 8-10 | M | 448 |
| 10 | | | | | | |
| | CL | CLAY, sandy with silt and mica flakes, moderate P.I., saturated, dark brown | | 13-15 | W | 238 |
| 15 | | | | | | |
| | SW | SAND, medium - course grained with gravel, well graded, moist, feldspathic, pinkish-light tan | MW-12 @ 20' | 18-20 | M | 282 |
| 20 | | | | | | |
| 25 | | | | 23-25 | M | 988 |
| | SW | with gravel size increasing | | 28-30 | M | 993 |
| 30 | | | | | | |
| | SW | with gravel and cobbles | MW-12 @ 35' | 33-35 | M | 327 |
| 35 | | | | | | |
| 40 | | | | | | |
| 45 | | | | | | |
| | | Total Depth = 47.31' | | | | |
| 50 | | | | | | |
| 55 | | | | | | |
| 60 | | | | | | |

DEPTH, FT. | STRATIGRAPHY | WATER LEVEL

## MONITOR WELL DETAILS




Client: BREWER OIL COMPANY Job No.: 8557-114-BAB-PROJ Date Drilled: 8/3/93 Well No.: MW-12

Site: BREWER GAS CARD - THIRD AND HAINES Top of Casing Elevation: 4959.50

Total Depth: 47.31' Casing Type & Size: 2"Ø SCHED. 40 PVC Slot Size: .010 Drilling Method: HSA

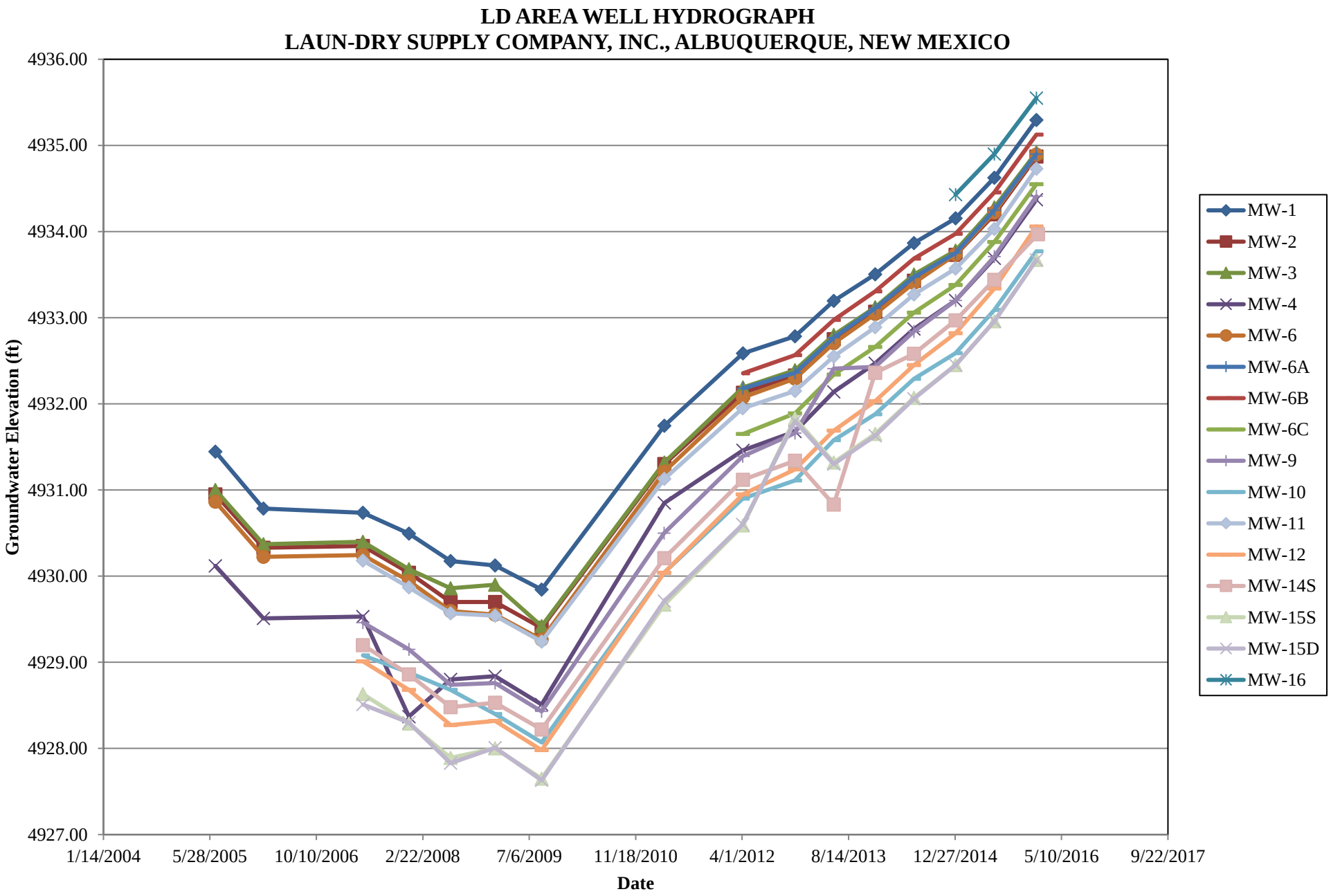
Comments:

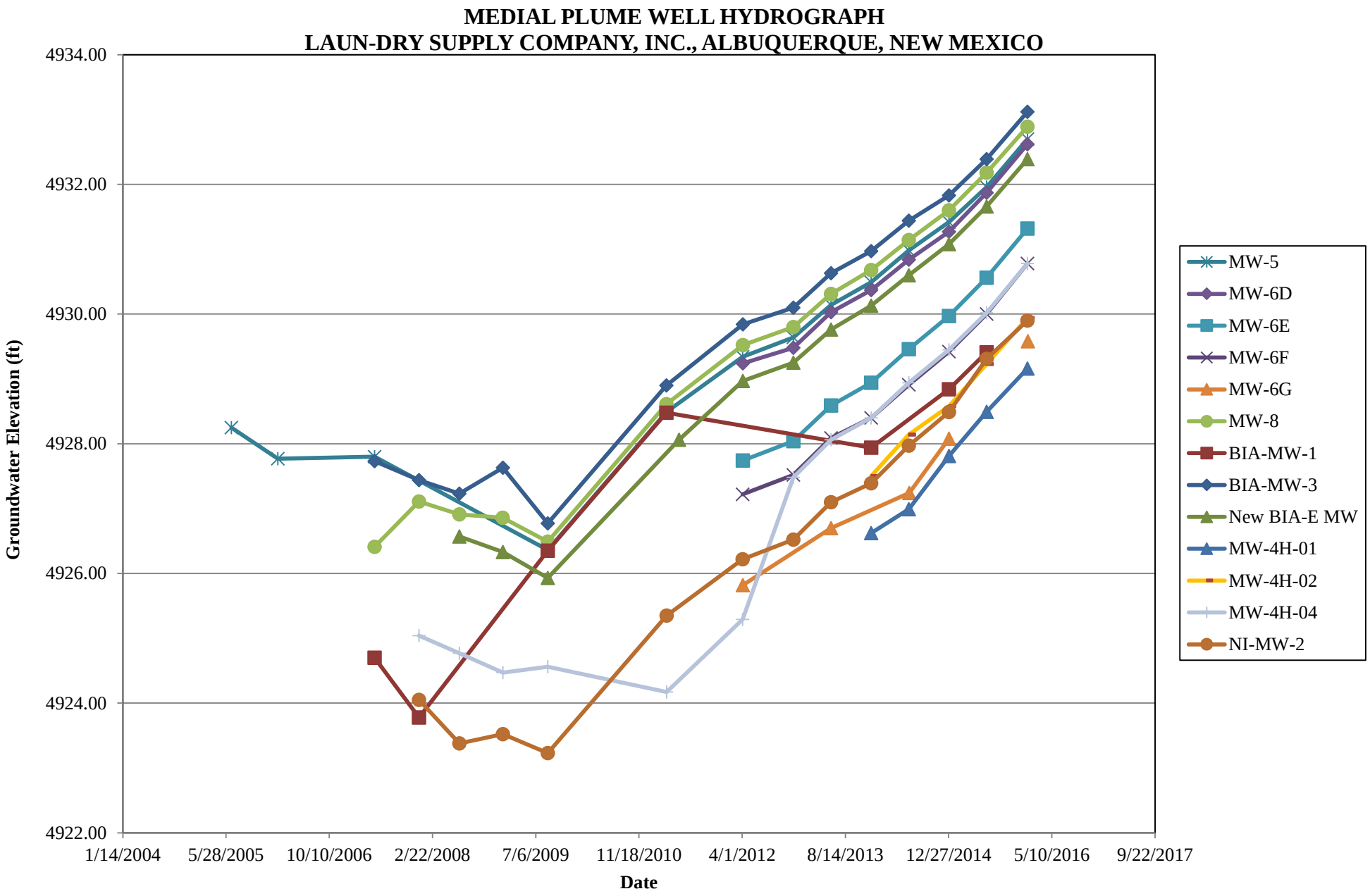
Driller: RODGERS AND COMPANY Logged by: JIM KRISS

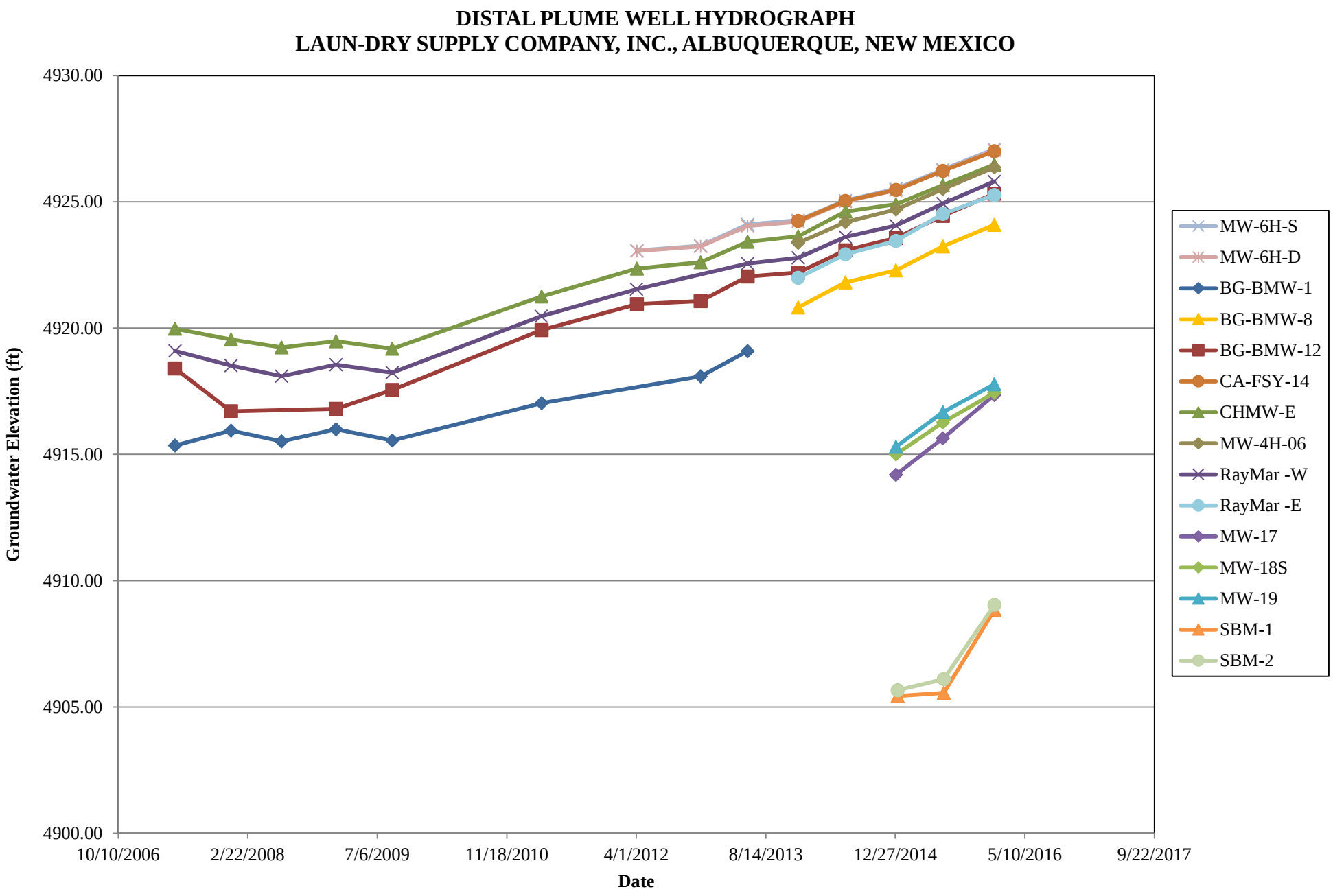
| MONITOR WELL AND BORING LOG DETAILS | CDM environmental engineers, scientists planners, & management consultants | BREWER GAS CARD THIRD AND HAINES ALBUQUERQUE, NM | Figure No. F |
|---|---|---|---|

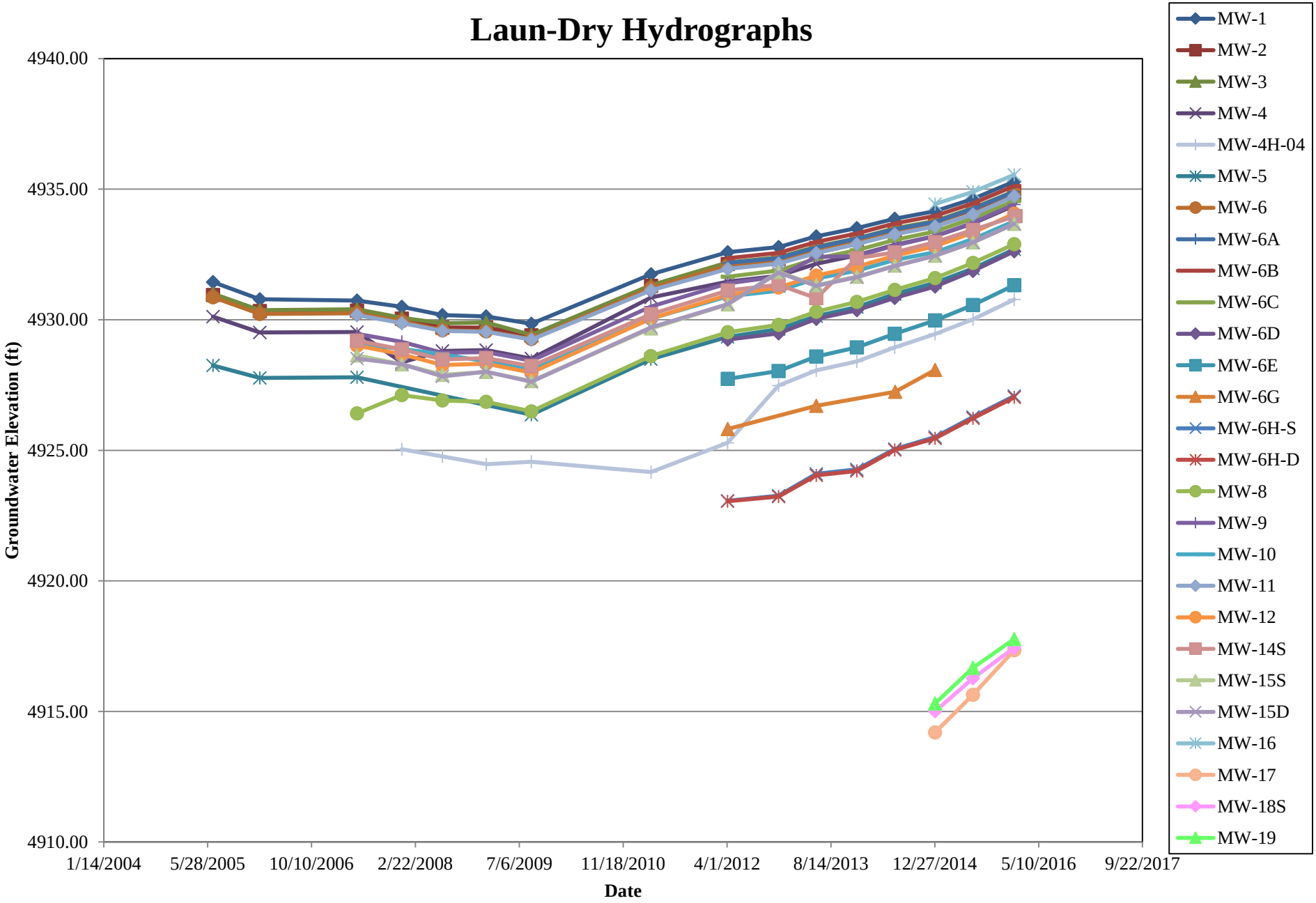
MW-12.DWG 8/4/93 JJK 8557-114-BAB-REPT

# APPENDIX B
# HYDROGRAPHS

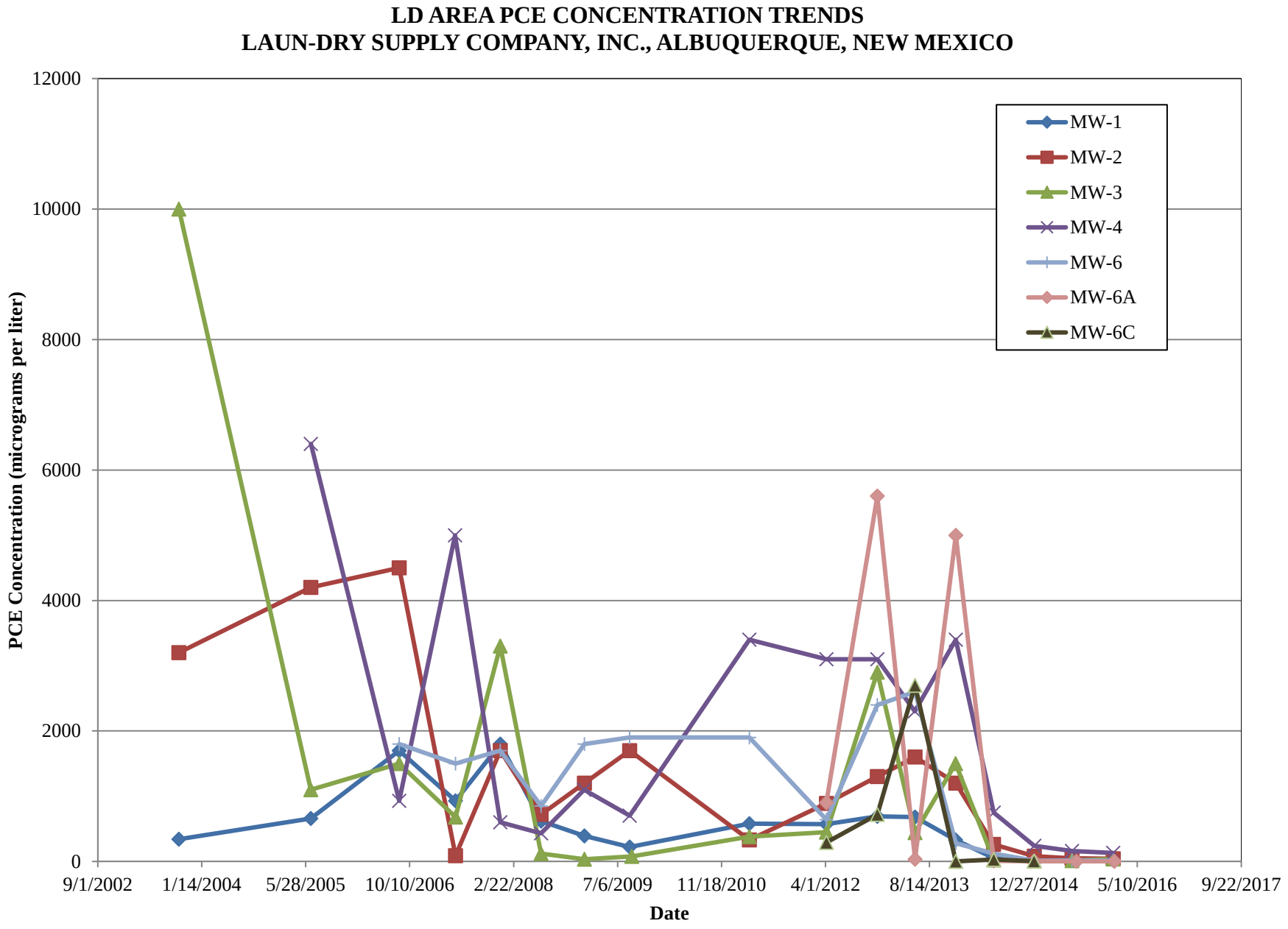

LD AREA WELL HYDROGRAPH
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Groundwater Elevation (ft)
4936.00
4935.00
4934.00
4933.00
4932.00
4931.00
4930.00
4929.00
4928.00
4927.00
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-1
MW-2
MW-3
MW-4
MW-6
MW-6A
MW-6B
MW-6C
MW-9
MW-10
MW-11
MW-12
MW-14S
MW-15S
MW-15D
MW-16

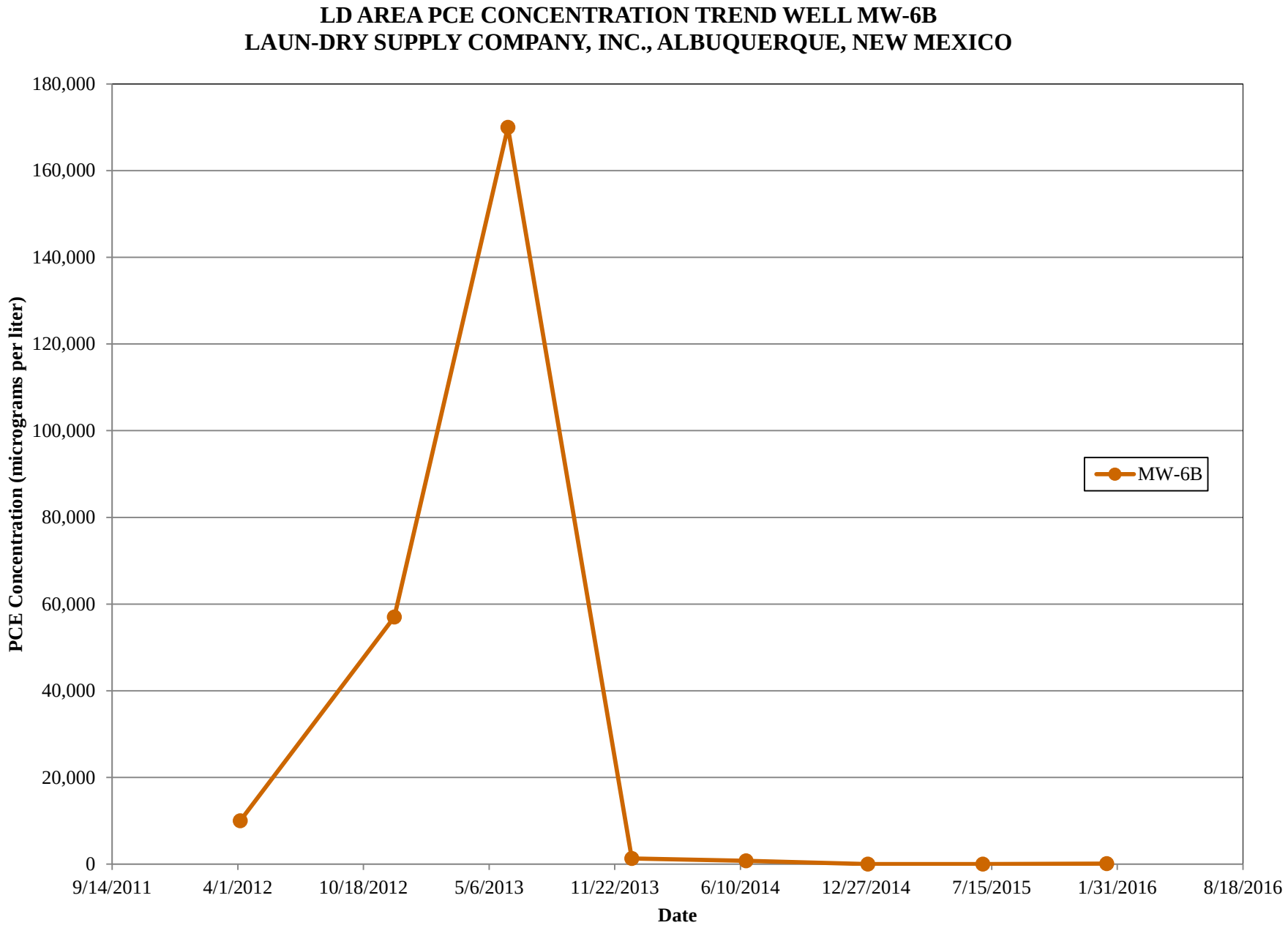

MEDIAL PLUME WELL HYDROGRAPH
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Groundwater Elevation (ft)
4934.00
4932.00
4930.00
4928.00
4926.00
4924.00
4922.00
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-5
MW-6D
MW-6E
MW-6F
MW-6G
MW-8
BIA-MW-1
BIA-MW-3
New BIA-E MW
MW-4H-01
MW-4H-02
MW-4H-04
NI-MW-2


DISTAL PLUME WELL HYDROGRAPH
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Groundwater Elevation (ft)
4930.00
4925.00
4920.00
4915.00
4910.00
4905.00
4900.00
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-6H-S
MW-6H-D
BG-BMW-1
BG-BMW-8
BG-BMW-12
CA-FSY-14
CHMW-E
MW-4H-06
RayMar -W
RayMar -E
MW-17
MW-18S
MW-19
SBM-1
SBM-2


Laun-Dry Hydrographs
Groundwater Elevation (ft)
4940.00
4935.00
4930.00
4925.00
4920.00
4915.00
4910.00
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-1
MW-2
MW-3
MW-4
MW-4H-04
MW-5
MW-6
MW-6A
MW-6B
MW-6C
MW-6D
MW-6E
MW-6G
MW-6H-S
MW-6H-D
MW-8
MW-9
MW-10
MW-11
MW-12
MW-14S
MW-15S
MW-15D
MW-16
MW-17
MW-18S
MW-19

# APPENDIX C
# CONCENTRATION TREND GRAPHS


LD AREA PCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
PCE Concentration (micrograms per liter)
12000
10000
8000
6000
4000
2000
0
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-1
MW-2
MW-3
MW-4
MW-6
MW-6A
MW-6C


LD AREA PCE CONCENTRATION TREND WELL MW-6B
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
PCE Concentration (micrograms per liter)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
9/14/2011
4/1/2012
10/18/2012
5/6/2013
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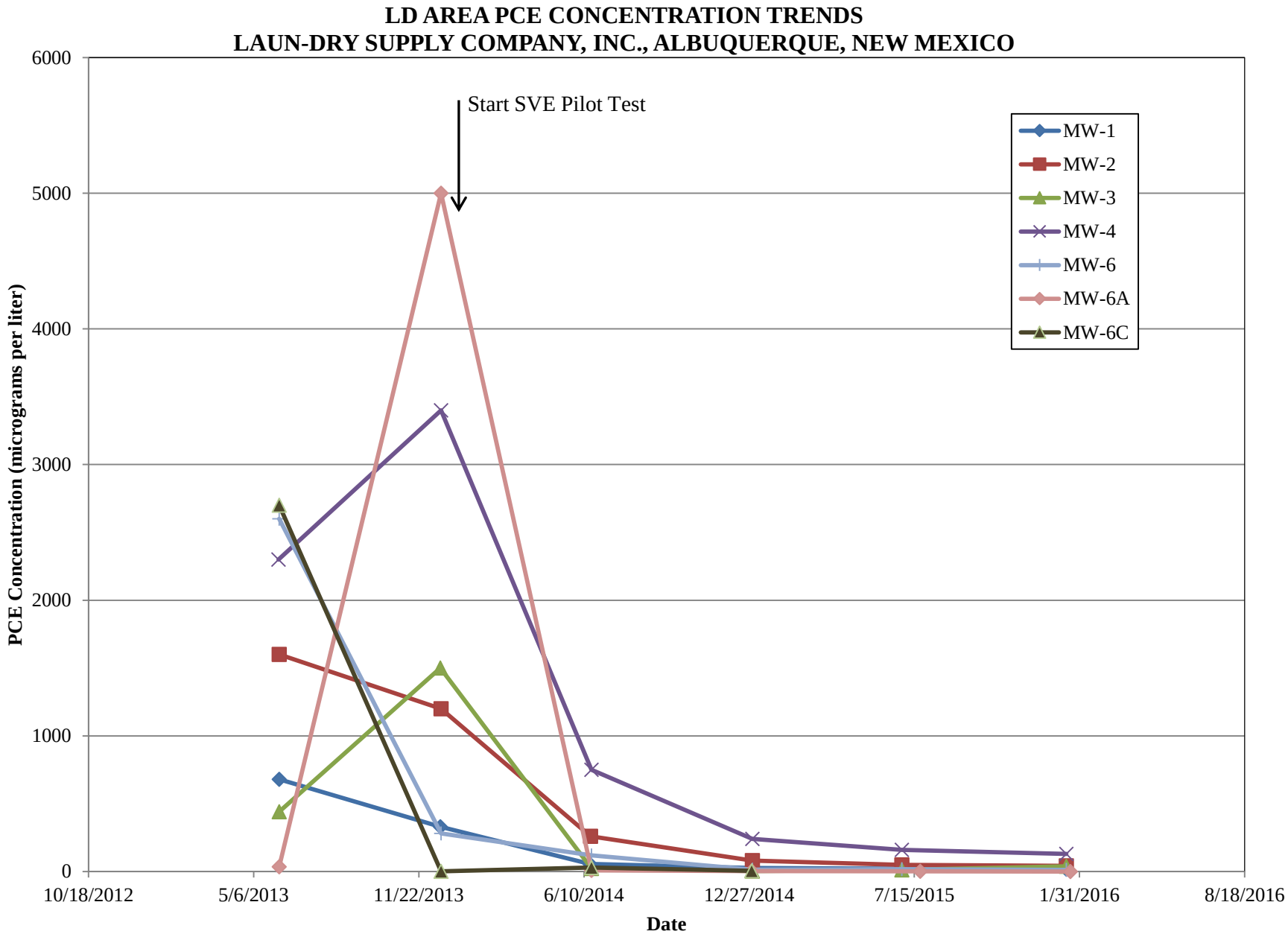
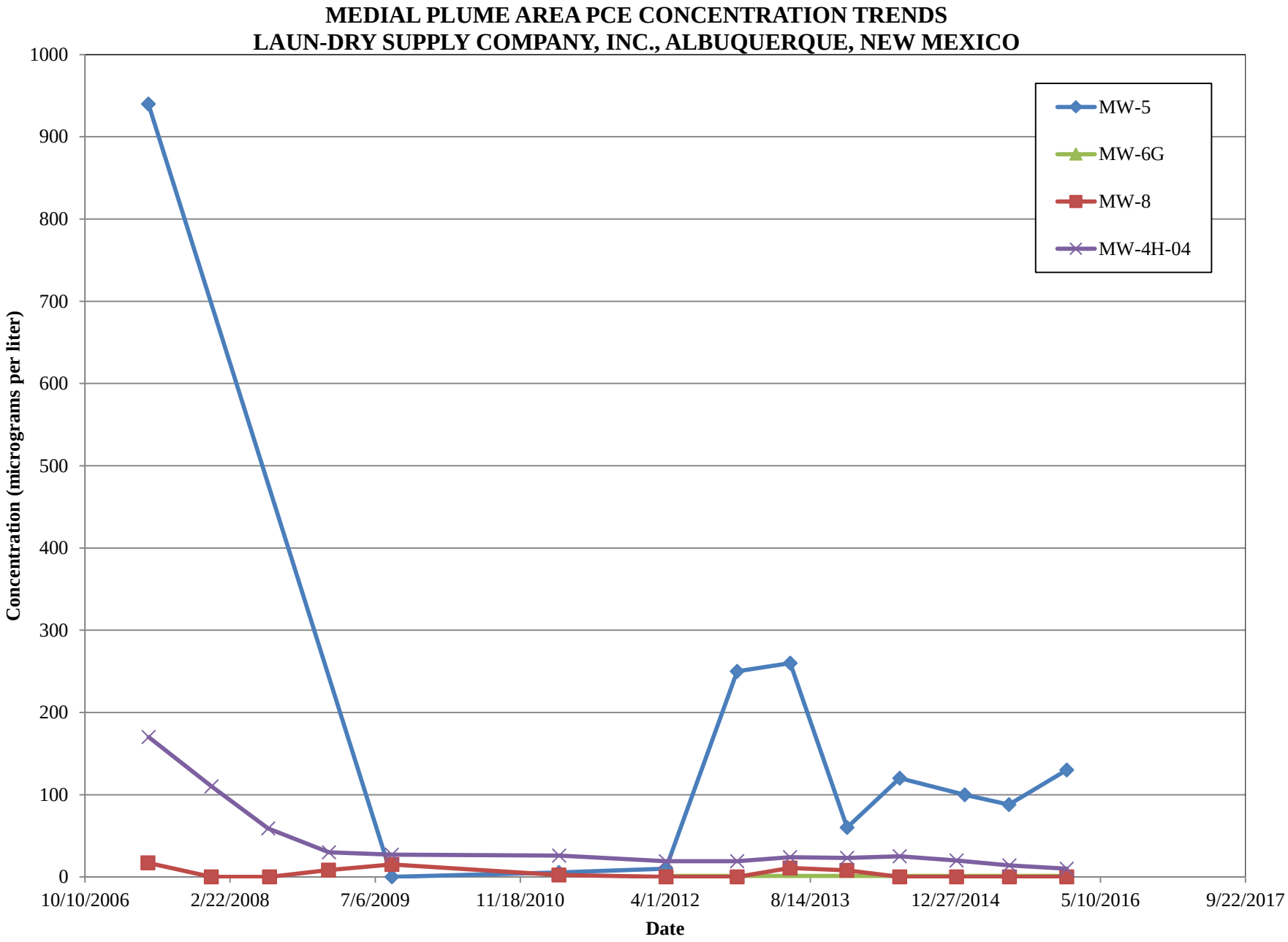
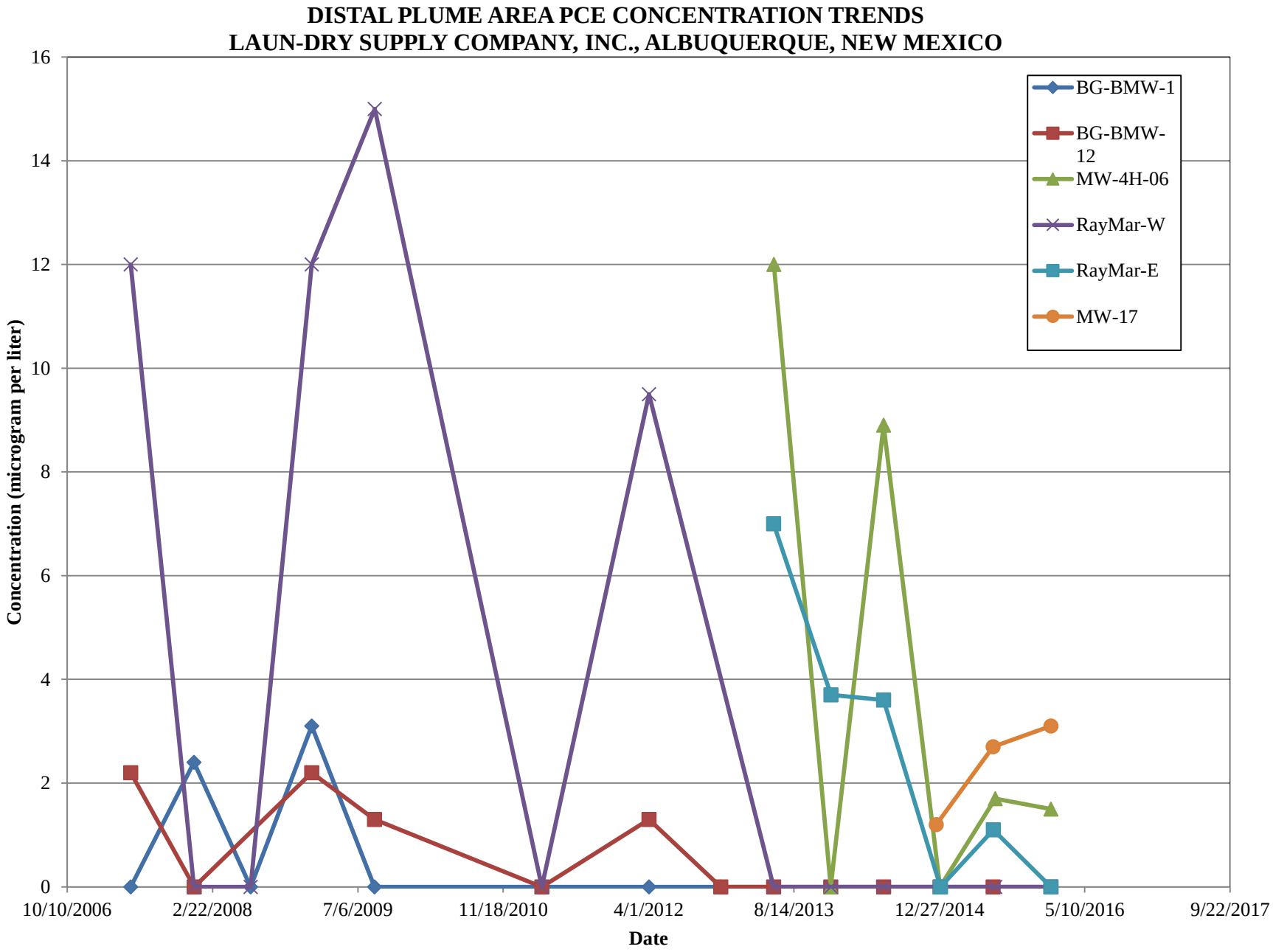
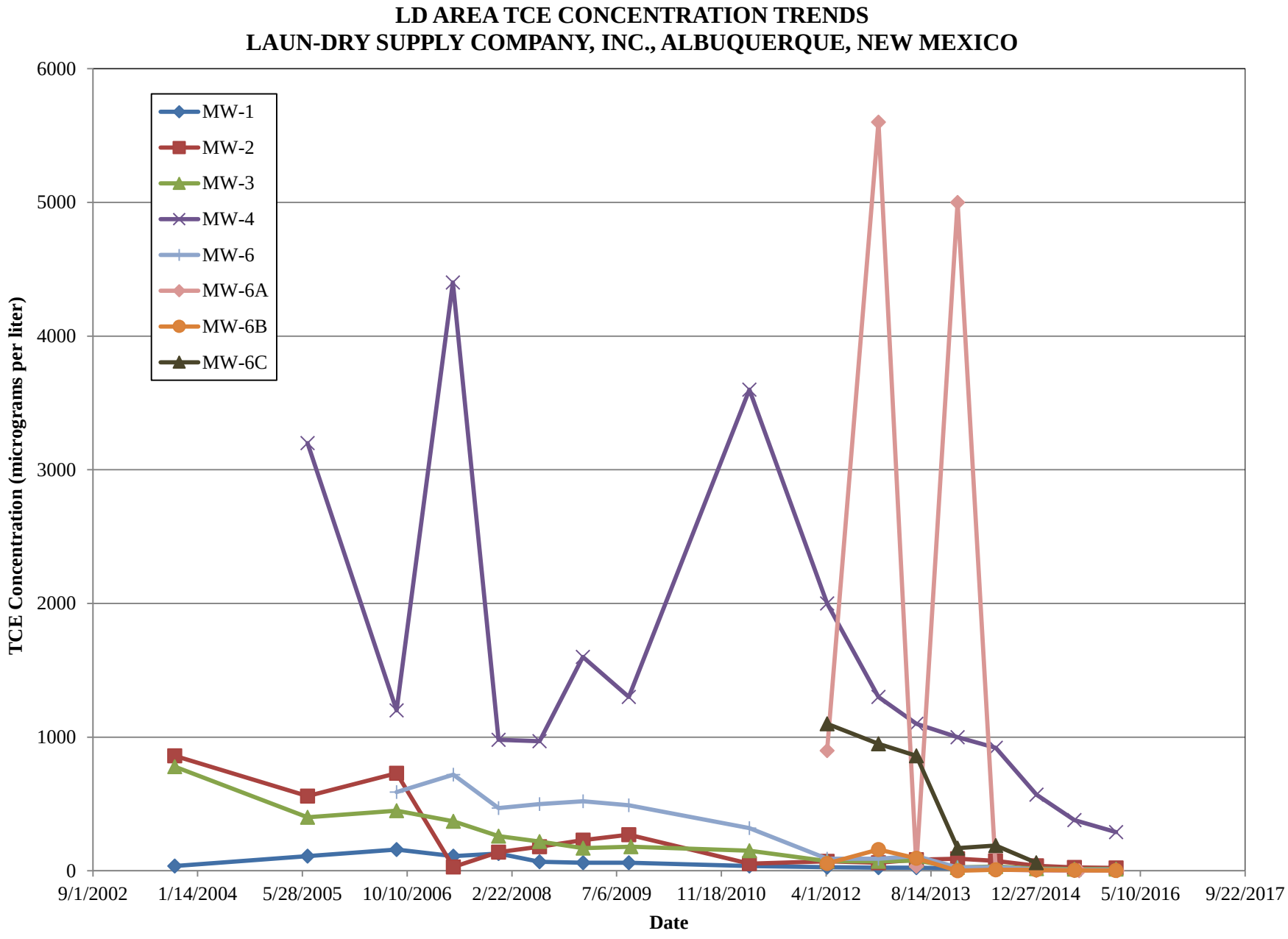
6/10/2014
12/27/2014
7/15/2015
1/31/2016
8/18/2016
Date
MW-6B


LD AREA PCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Start SVE Pilot Test
MW-1
MW-2
MW-3
MW-4
MW-6
MW-6A
MW-6C
PCE Concentration (micrograms per liter)
6000
5000
4000
3000
2000
1000
0
10/18/2012
5/6/2013
11/22/2013
6/10/2014
12/27/2014
7/15/2015
1/31/2016
8/18/2016
Date


MEDIAL PLUME AREA PCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Concentration (micrograms per liter)
1000
900
800
700
600
500
400
300
200
100
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-5
MW-6G
MW-8
MW-4H-04


DISTAL PLUME AREA PCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Concentration (microgram per liter)
16
14
12
10
8
6
4
2
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
BG-BMW-1
BG-BMW-12
MW-4H-06
RayMar-W
RayMar-E
MW-17


LD AREA TCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
TCE Concentration (micrograms per liter)
6000
5000
4000
3000
2000
1000
0
MW-1
MW-2
MW-3
MW-4
MW-6
MW-6A
MW-6B
MW-6C
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
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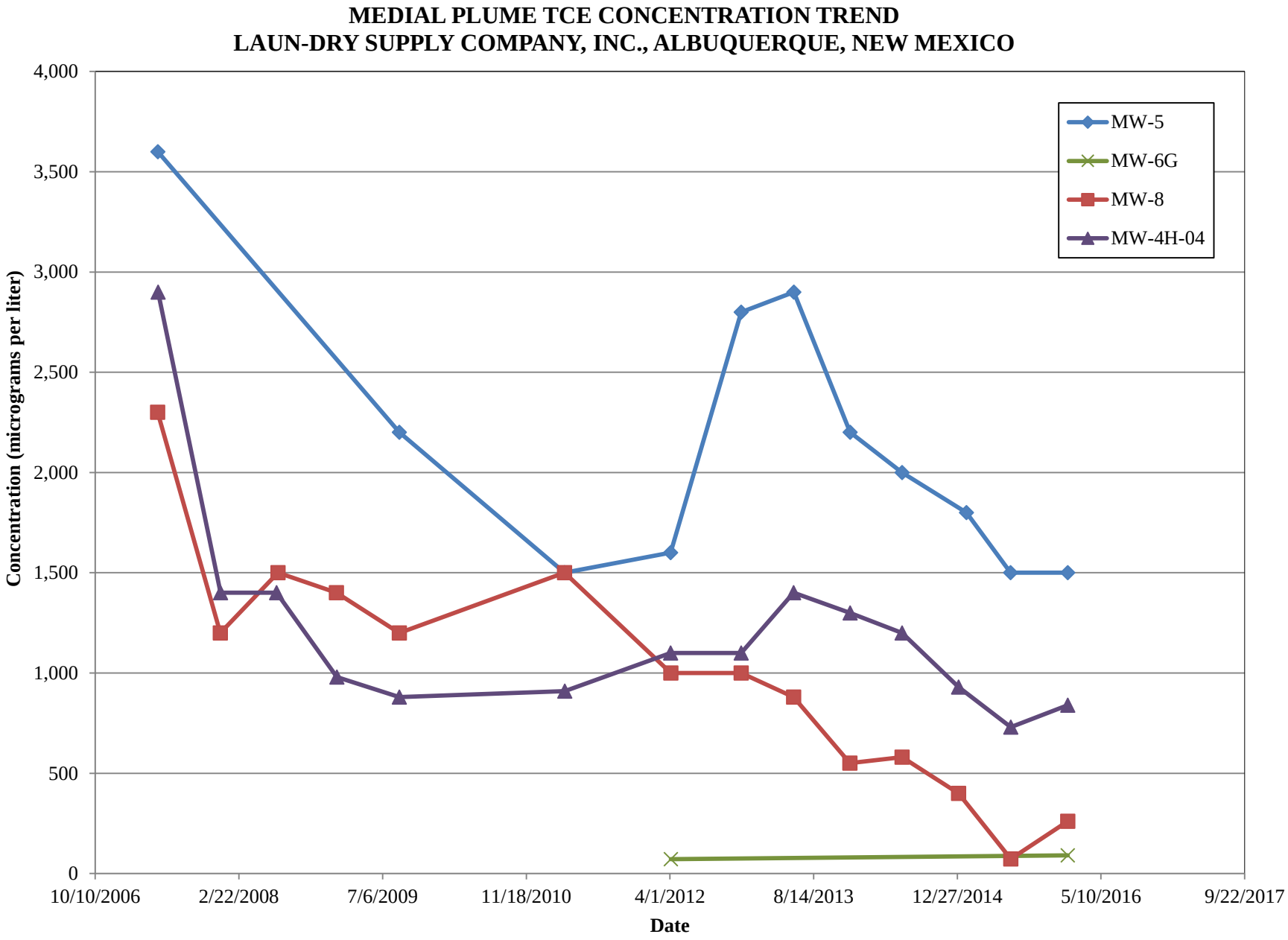
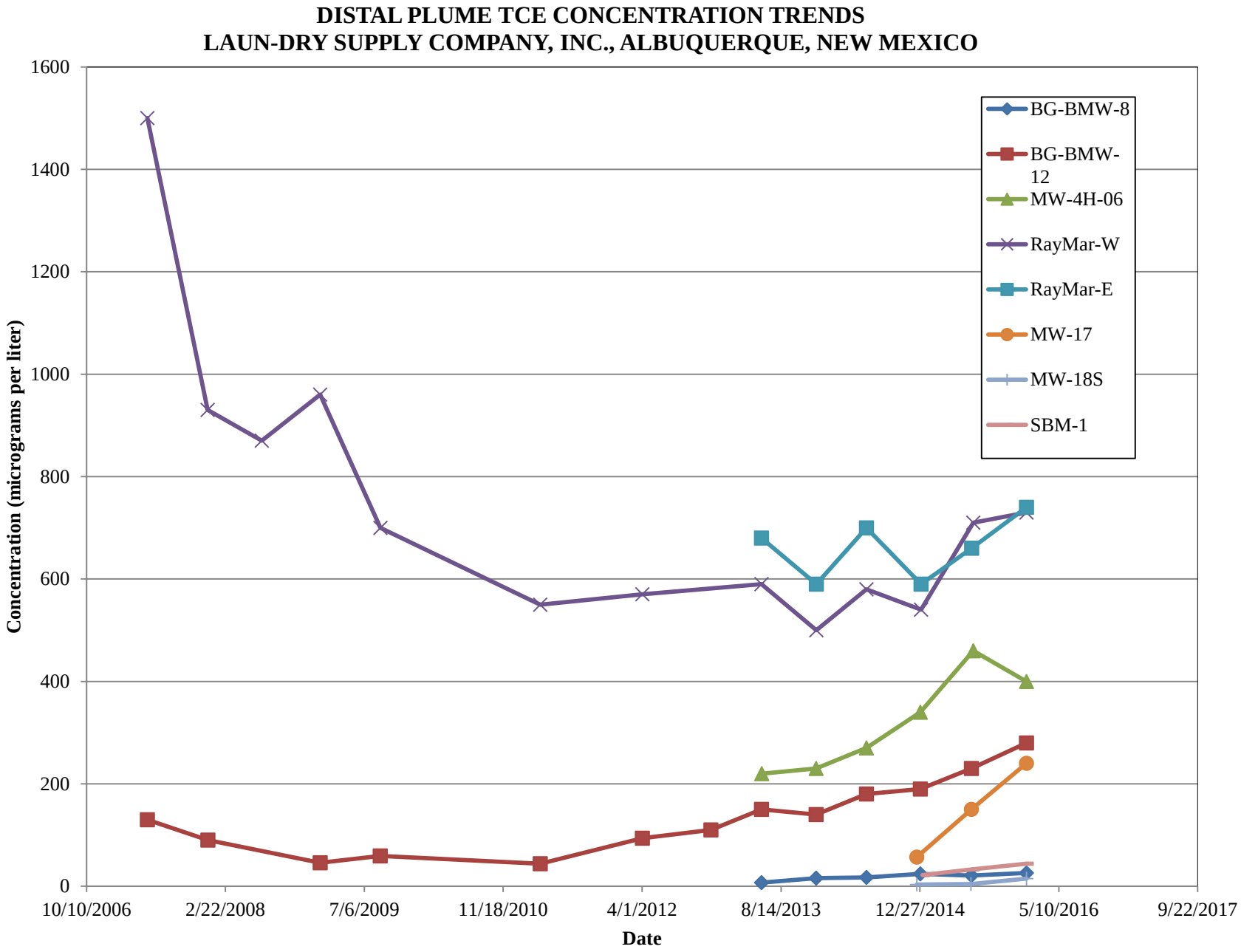
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date


MEDIAL PLUME TCE CONCENTRATION TREND
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Concentration (micrograms per liter)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
MW-5
MW-6G
MW-8
MW-4H-04


DISTAL PLUME TCE CONCENTRATION TRENDS
LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO
Concentration (micrograms per liter)
1600
1400
1200
1000
800
600
400
200
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
Date
BG-BMW-8
BG-BMW-12
MW-4H-06
RayMar-W
RayMar-E
MW-17
MW-18S
SBM-1

# APPENDIX D
# IN-SITU GROUNDWATER TREATMENT PILOT TEST RESULTS YEAR 1
# (on compact disc)

EA Engineering, Science, & Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
Albuquerque, New Mexico 87102
Phone: (505) 224-9013

March 17, 2016

Mr. Justin Ball
New Mexico Environment Department
Ground Water Quality Bureau
Remediation Oversight Section
121 Tijeras Ave. NE, Suite 1000
Albuquerque, New Mexico 87102

**RE: *IN-SITU* GROUNDWATER TREATMENT PILOT TEST 1-YEAR RESULTS, LAUN-DRY SUPPLY COMPANY, ALBUQUERQUE, NEW MEXICO**

Dear Mr. Ball:

On behalf of Laun-Dry Supply Company, Inc. (LD), EA Engineering, Science, and Technology, Inc., PBC is submitting this Letter Report documenting the 1-year progress of the *in-situ* groundwater treatment pilot test. The report was completed in accordance with the *Additional Site Investigation Work Plan* dated June 4, 2014 and approved by the New Mexico Environment Department (NMED) on June 27, 2014.

## SCOPE OF WORK

The in-situ groundwater treatment pilot tests were initiated by injecting three different amendments (Wilclear Plus® lactate with Accelerite® [hereafter termed "Wilclear Plus"], EHC-L® [hereafter termed EHC-L], and EHC-L combined with powdered activated carbon [PAC]) into groundwater by direct push methods to enhance the biotic and abiotic reductive dechlorination (RDC) and/or adsorption of the chlorinated ethenes, depending upon the injectate in the aquifer at the Site. The chlorinated ethenes in the groundwater consisted of perchloroethene (PCE), trichloroethene (TCE), and dichloroethene (DCE). The pilot tests were conducted in three locations as shown on Figure 1 using three amendments as listed in Table 1. The effectiveness of each amendment was evaluated by collecting groundwater samples and measuring field parameters in the observation wells at one month, three months, six months and one year after the injection.

## SAMPLING AND INJECTION FIELD ACTIVITIES

Prior to the injection on December 30 and 31, 2014, baseline groundwater samples were collected from wells MW-6A, MW-6C, SVE-1, SVE-2, OB-1, and OB-2 in order to establish a baseline of constituents and field parameters. However, after the baseline analytical results were received, it was noted that PCE and TCE concentrations in both SVE-2 and OB-1 had decreased to levels that were unsuitable for pilot testing. As a result, this injection location was moved to the vicinity of wells MW-14S and OB-3 (Figure 1). NMED was notified of this change and agreed to the change. Due to the change in location of the third injection location, well MW-14S

was sampled on January 22, 2015, and well OB-3 was installed and sampled approximately one week after the injection event on January 28, 2105. Groundwater samples were analyzed for volatile organic compounds (VOCs) by EPA Method 8260B, dissolved metals (manganese and arsenic) by EPA Method 6010B, total organic carbon (TOC) by SM 5310B, and sulfate and nitrate by EPA Method 300.0. Field parameters measured were pH, dissolved oxygen (DO) oxidation reduction potential (ORP), specific conductance, temperature using an YSI water quality meter and ferrous iron using a HACH test kit. Baseline results are presented in Tables 2 through 5.
On January 20 through 22, 2015 the injection of the amendments was completed at three locations as follows:

> Location 1—On January 20, 2015, a combination of 55 gallons of JRW Bioremediation LLC's Wilclear Plus (consisting primarily of sodium lactate that rapidly promotes anaerobic conditions and serves as a source of electron donor needed for RDC) and 495 gallons of water were injected at INJ-1. Wells MW-6A and SVE-1 are designated as the observation wells for this injection location.

Locations 2 and 3 featured PeroxyChem EHC-L, a lecithin-based food grade substrate with organic carbon and organic iron components that promotes both biotic and abiotic (i.e., direct chemical reduction) RDC of chlorinated solvents. For Location 3, powdered activated carbon (PAC) was injected in concert with EHC-L to act as a plume retardant via sorption, and to provide surface for bacterial growth to enhance the biotic RDC.

> Location 2— On January 21, 2015, a combination of 249 gallons of EHC-L, 2250 gallons of water, 123 pounds of iron, and 204 pounds of bicarbonate were injected at INJ-2. Wells MW-6C and OB-2 are designated as the observation wells for this injection location.

> Location 3— On January 22, 2015, a combination of 252 gallons of EHC-L, 2247 gallons of water, 126 pounds of iron, 126 pounds of bicarbonate, and 1680 pounds of PAC were injected at INJ-3. Wells MW-14S and OB-3 are designated as the observation wells for this injection location.

The injection data sheet and sampling field forms are included as Attachment 1.

Four post-injection sampling events were conducted at approximately 1, 3, 6 and 12 months using the low-flow sampling method. Accordingly, sampling was conducted on February 25, 2015, April 23, 2015, July 22, 2015, and January 20, 2016. The analytical suite used to assess the performance of the pilot test is listed on Table 1 and analytical reports are included in Attachment 2.

On September 24 and 25, 2015, three wells (MW-6A, MW-6C and MW-14S) were sampled using the low flow sampling method and groundwater samples were collected and submitted to Microbial Insights located in Knoxville, Tennessee for CENSUS analysis. The CENSUS analysis enumerates the dechlorinating microbial population in the groundwater sample. Attachment 3 provides information regarding the CENSUS sample analysis and the results.

## PILOT TEST PERFORMANCE ASSESSMENT

The performance indicator parameters including field parameter measurements and laboratory analytical data were reviewed to determine if subsurface conditions were favorable for the RDC reactions.

To evaluate if conditions remained favorable for RDC, the TOC, ORP, DO, and pH levels were considered, and the following criteria were used:

- For the purpose of performance assessment, TOC concentrations above 20 milligrams per liter (mg/L) are considered favorable for RDC. TOC concentrations below 20 mg/L are considered low, between 20 mg/L and 200 mg/L moderate, and above 200 mg/L high.

- ORP values below 50 millivolts (mV) are considered slightly reducing and indicative of conditions where RDC may occur. ORP values below -100 mV are considered reductive and indicative of conditions where RDC is likely to occur.

- DO concentrations below 0.5 mg/L are considered favorable for RDC. RDC was considered possible at DO concentration levels between 0.5 and 1.0 mg/L. RDC is considered unlikely to occur at DO concentration levels above 1.0 mg/L.

- pH values between 6 and 8 are considered to be within the acceptable range for RDC.

Analytical results are presented in Tables 2 through 4 and groundwater field parameter measurements are presented in Table 5. Table 6 presents the microbial CENSUS results. Trend plots are provided as Figures 2 through 11. Plots with chlorinated ethenes concentrations expressed on molar basis are shown on Figures 12 through 17.

The molar ratios of chlorinated ethenes plotted over time provide indication of success of the RDC process. By plotting molar ratios of PCE, TCE, DCE and vinyl chloride (VC), shifts from PCE to TCE, TCE to DCE, then DCE to VC over time can be observed. These molar plots provide a strong indication that contaminant destruction with attendant daughter product creation is occurring. This is important, because the magnitude of VOCs can change over time due to desorption resulting from the injection process (typically an increase in concentrations) or advection-dispersion (decreasing concentrations). But the transformation from PCE to TCE to DCE to VC and on to ethene or ethane provides evidence the RDC is ongoing irrespectively of solute concentrations from a given sampling event. The molar representation also allows evaluation of mass balance by assuming all daughter products are derived from the parent contaminant mass. Finally, molar representation clearly shows if the RDC process is complete, or if stalls at DCE or VC are occurring, with attendant undesirable accumulation of daughter products.

The Microbial Insights CENSUS analysis provides insight to the presence of bacterial populations known to dechlorinate solvents. For the chlorinated ethenes, *Dehalococcoides* sp. (DHC) is desirable, and the following criteria apply: strong evidence for RDC for populations > 10,000 cells/ml, possible RDC pathways for 10 to 10,000 cells/ml, and unlikely RDC for < 10 cells/ml.

***Baseline (Pre-Injection) Results***

VOC concentrations varied based on the injection location as follows:

- At Injection Location 1, baseline PCE concentrations were 3.2 micrograms per liter (µg/L) in well MW-6A and 510 µg/L in well SVE-1. The TCE concentrations were 6.3 µg/L in well MW-6A and 56 µg/L in well SVE-1. Low level concentrations from below method detection limit to 6.6 µg/L of cis-1,2-DCE and trans-1,2-DCE were present as shown in Table 3.

- At Injection Location 2, the baseline PCE concentration in well MW-6C was 4.1 µg/L and in well OB-2 it was 37 µg/L. The TCE concentration in well MW-6C was 61 µg/L and in well OB-2 it was 130 µg/L. Concentrations of cis-1,2-DCE and trans-1,2-DCE in well MW-6C was 11 µg/L and 4.1 µg/L, respectively, and in well OB-2 it was 26 µg/L and 5.1 µg/L, respectively.

- At Injection Location 3, the baseline concentrations in well MW-14S of PCE and TCE were <10 µg/L and 850 µg/L, respectively. In well OB-3, which was installed approximately one week after injection, concentrations of PCE and TCE were <1.0 µg/L and 440 µg/L, respectively. Concentrations of cis-1,2-DCE and trans-1,2-DCE in well MW-14S were 200 µg/L and 77 µg/L, respectively, and in well MW-OB-3 were 84 µg/L and 13 µg/L, respectively.

Baseline concentrations of nitrate and sulfate in observation wells were generally consistent at each injection location. Nitrate concentrations ranged from <0.10 mg/L to 2.5 mg/L and sulfate concentrations ranged from 240 mg/L to 430 mg/L (Table 4).

The baseline TOC measurements in all observation wells (MW-6A, SVE-1, MW-6C, OB-2, MW-14S, and OB-3) were below concentrations considered favorable for RDC at less than 10 mg/L (Table 4).

Baseline metal results in observation wells were generally consistent at each injection location. Baseline dissolved manganese results ranged from 0.17 mg/L in well MW-14S to 3.4 mg/L in well MW-6A. The dissolved arsenic concentrations ranged from 0.0030 mg/L to 0.0073 mg/L (Table 2). Ferrous iron was measured in the field using a HACH kit and ranged from 2.0 mg/L to 3.0 mg/L (Table 5).

Baseline DO concentrations ranged from 0.19 mg/L in well OB-3 to 1.04 in well MW-6C. The baseline ORP concentrations ranged from 33.1 to -62.2 mV. DO and ORP measurements indicate that baseline conditions were slightly reducing. DO and ORP measurements are presented in Table 5.

***Injection Location 1 Results***

The PCE concentrations decreased over the 1-year period in both observation wells MW-6A and SVE-1 (Figure 9). Concentrations decreased from 510 µg/L during the baseline event to 190

µg/L in January 2016 in well SVE-1. PCE concentrations in well MW-6A decreased from 3.2 µg/L to <1.0 µg/L. TCE concentrations have fluctuated in well SVE-1 between 56 µg/L and 33 µg/L and decreased slightly in well MW-6A from 6.3 µg/L to 5.1 µg/L (Figure 10).

The molar ratios of chlorinated ethenes for Injection Location 1 are shown on Figures 12 and 13 for MW-6A and SVE-1, respectively. The ratios of the contaminants indicate that little if any RDC is occurring.

Dissolved metals (manganese and arsenic) levels remained relatively the same in wells MW-6A and SVE-1 over the monitoring period (Figures 6 and 7). Ferrous iron concentrations were slightly higher than baseline in well MW-6A, increasing from 2.0 mg/L to 2.5 mg/L, and in well SVE-1, concentrations returned to baseline conditions (Figure 5).

Nitrate concentrations in the observation well MW-6A was below the method detection limit during the 1-year test period, whereas in well SVE-1, it varied within a narrow range of 1.8 mg/L to 2.7 mg/L. Sulfate concentrations increased slightly in both observation wells (Table 4).

TOC increased to concentrations considered favorable for RDC during the first month after injection in well SVE-1, then decreased back to concentrations less than background (Figure 8). This may be a result of the high groundwater velocity and the high water solubility of the sodium lactate.

DO measurements increased 1-month after injection and then decreased to 0.17 mg/L in MW-6A and 0.77 mg/L in SVE-1 (Figure 3). ORP measurements were variable with no discernable trend (Figure 2). The pH concentrations decreased over the monitoring period but returned to slightly higher than baseline conditions (Figure 4).

The September 2015 CENSUS sampling indicated low levels (8.2 cells/ml) of DHC culture indicating that adequate bacteria are not present to carry out RDC; full scale implementation should strongly consider bioaugmentation in the injection design.

Based on the analytical laboratory data and the field measurements it appears that some RDC may have occurred as a result of the injection of Wilclear Plus. However, RDC was not sustained over the 1- year monitoring period, and microbial populations were not sufficiently established to continue the process. The high solubility of lactate combined with a high groundwater velocity conditions indicates that this treatment would be ineffective. The decline in PCE and TCE groundwater concentrations may have been a result of the soil vapor extraction system or increase in water levels.

***Injection Location 2 Results***

PCE concentrations decreased to below baseline concentrations in both observation wells MW-6C and OB-2 (Figure 9). In well MW-6C the baseline PCE concentration was 4.1 µg/L and decreased to 2.3 µg/L in January 2016, and in well OB-2 the baseline PCE concentration was 37 µg/L and decreased to 28 µg/L in January 2016. TCE concentrations significantly decreased from baseline concentrations in both wells MW-6C and OB-2, decreasing from 61 µg/L and 130 µg/L to 1.2 µg/L and 38 µg/L (Figure 10). Concentrations of cis-1,2-DCE increased in well MW-6C while trans-1,2-DCE concentration decreased, and concentrations of cis-1,2-DCE

decreased in well OB-2 while trans-1,2-DCE concentration slightly increased.

The molar ratios of chlorinated ethenes for Injection Location 2 are shown on Figures 14 and 15 for MW-6C and OB-2, respectively. The ratios of the contaminants for this test indicate that RDC is occurring. For example, between the February and April 2015 sampling events, TCE is substantially reduced in molar concentration and cis,1-2,DCE is seen to increase substantially. By July 2015 and January 2016, the cis,1-2,DCE is substantially reduced in molar concentration. The Location 2 results appear to indicate the EHC-L had the desired effect.

Dissolved metals (manganese and arsenic) concentrations remained largely unchanged over the monitoring period with manganese concentrations increasing slightly in well MW-6C. Ferrous iron concentrations increased in both wells MW-6C from 2.0 at the baseline sampling event to 5.5 in July 2015 and OB-2 from 3.0 at the baseline event to 3.5 in January 2016, indicating that abiotic dechlorination maybe occurring.

Nitrate concentrations in the observation wells remained relatively unchanged and sulfate concentrations decreased significantly in MW-6C, indicating that sulfate reduction has occurred. Substantial sulfate reduction activity was observed in MW-6C along with promising RDC revealing the positive effect of EHC-L injection.

TOC increased significantly in well MW-6C during the first month after injection and remained in the range considered favorable for RDC during the third month after injection. In well OB-2 there was an increase in TOC during the first month after injection. TOC concentrations remained less than 20 mg/L in both wells beyond the 6-month sampling event.

DO and ORP measurements from observation wells MW-6C and OB-2 indicated that anaerobic conditions existed during the 1-month sampling event and remained in the range at which RDC may occur during the 1-year sampling event. The pH measurements decreased over the monitoring period but returned to slightly higher than baseline conditions.

The September 2015 CENSUS sampling indicated that DHC bacteria were present within the lower portion of the low to slightly moderate concentration range (13.5 cells/ml), indicating that it is possible if additional RDC criteria are satisfied that the complete pathway for RDC may occur. The data indicates that bioaugmentation (i.e., injecting dechlorinating bacteria along with the electron donor [EHC-L in this test]) should be considered during the full scale implementation.

Based on the DO and ORP measurements and the increase in TOC observed in observation wells, Injection Location 2 had favorable conditions for RDC. However, at the 6-month sampling event, PCE had not shown a decrease from baseline concentrations. After 1-year PCE and TCE concentrations showed a modest decrease. The low to slightly moderate level of chlorinated ethene reducing bacteria DHC may indicate why more significant RDC has not occurred.

***Injection Location 3 Results***

At Injection Location 3, PCE was not detected in baseline samples. However, TCE was present and concentrations decreased significantly in both wells; TCE in MW-14S decreased from 850

µg/L to 6.0 µg/L and OB-3 decreased from 440 µg/L to 130 µg/L (Figure 10). DCE concentrations also decreased in observation well MW-14S (Figure 11), but in OB-3 the trans-1,2-DCE concentration slightly increased.

The molar ratios of chlorinated ethenes for Injection Location 3 are shown on Figures 16 and 17 for MW-14S and OB-3, respectively. The ratios of the contaminants for this test indicate that RDC is not occurring. However, contaminant concentrations have decreased significantly, indicating depletion from solute by sorption onto the PAC that was injected.

Manganese concentrations in well MW-14S increased and then decreased to concentrations below baseline results. In well OB-3 manganese concentrations remained relatively unchanged. The arsenic concentrations remained relatively unchanged in both observation wells. In wells MW-14S and OB-3 the ferrous iron concentrations returned to baseline conditions after 1-year following the injection.

Nitrate concentrations decreased slightly in well MW-14S and remained unchanged in well OB-3. Sulfate concentrations in well MW-14S peaked during the 3-month event and decreased to slightly above baseline conditions. Sulfate concentrations in well OB-03 fluctuated during the monitoring events.

The TOC concentration remained relatively unchanged in wells MW-14S and OB-3. The PAC may have adversely affected the performance of the EHC-L.

Dissolved oxygen concentrations increased in well MW-14S and remained relatively unchanged in well OB-3. ORP values fluctuated in both wells from -65.4 to 291.9. DO values in well MW-14S appear to be inaccurate when compared to the ORP. The pH measurements decreased over the monitoring period but returned to slightly higher than baseline conditions.

The September 2015 CENSUS sampling indicated that DHC were present at a moderate concentration of 842 cells/ml; however, this location had the highest population of the three injection locations sampled. Although concentrations are not high it does indicate that it is possible if additional RDC criteria are present that the complete pathway for RDC may occur.

It appears the chlorinated ethenes have declined at Injection Location 3 as a result of the PAC that was injected and not as a result of the EHC-L, since there was no increase in the TOC or any other evidence of RDC. Chlorinated ethenes are apparently decreasing due to sorption and retardation as a result of the granular carbon.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the 1-year results of the groundwater treatment pilot tests, the following conclusions can be made:

- At Injection Location 1 where Wilclear Plus was injected, the high solubility of the lactate combined with the high groundwater velocity conditions at the Site indicates that this treatment would be ineffective. The decline in PCE and TCE groundwater

concentrations may have been a result of the soil vapor extraction system or an increase in water levels.

- At Injection Location 2, the injection of EHC-L created favorable anaerobic conditions (consistent negative ORP) promoting biological RDC and abiotic dechlorination with iron and sulfate reduction.

- At Injection Location 3, RDC conditions were not optimal with the combination of EHC-L and PAC with PAC appearing to make the EHC-L ineffective; however, PCE and TCE declined due to sorption and retardation as a result of the injection of the powdered activated carbon.

- The September 2015 CENSUS sampling data indicates that a bacterial population capable or promoting full RDC are not present. Bioaugmentation combined with a suitable electron donor would be beneficial for RDC.

- The injection of PAC or other plume retardant appears to show promise. However, it should not be injected directly with the carbon source, as it appears the PAC interferes with the carbon source. The EHC-L® appears to have adsorbed onto the PAC, rendering it unavailable to enhance RDC. Injection of plume retardant along a parallel transect either up- or downgradient from an EHC-L® transect may prove beneficial to achieving cleanup goals;

- The EHC-L appears to show promise based on Location 2 test. However, because of the high permeability and high seepage velocities, and attendant high oxygen flux in the aquifer, the predecessor product EHC® (or equivalent) may be more suitable. EHC® includes 50-200 umzero valent iron (ZVI) filings as its iron source versus the soluble organo-iron complex used in EHC-L. The high permeability at the site should render the ZVI readily injectable, as proven by the successful injection of the slurried solid phase PAC. The principal advantage of the EHC® is longer longevity (up to 5 years) compared to EHC-L® (2-3 years), and can be injected at closer spacing to serve as a reactive and biological barrier. Bioaugmentation is recommended as discussed above.

- The longevity of injected electron donor in the subsurface will be evaluated based on full scale data collection. TOC was depleted in these tests within 6 months of injection. Therefore, a higher initial dose of electron donor (i.e., greater injection volumes) may be advised for full scale design.

Please let us know if you have any questions regarding the information provided in this report.

Sincerely,

Teri McMillan
Project Manager

Jay Snyder
Senior Hydrogeologist

Attachments

Cc: Dan March, Laun-Dry Supply Co.
File

# TABLES

Table 1. Summary Scope of Work for *In-Site* Groundwater Treatment Pilot Test
Laun-Dry Supply Company, Inc. Albuquerque, New Mexico

| Monitoring Well/ Observation Well | Location/ Rational | Matrix | Sampling Method | Sample Frequency | Laboratory Analytical Test | | | | | | | Field Parameters | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOC | Total Organic Carbon | Nitrate | Sulfate | Arsenic | Manganese | Ferrous Iron[1] | Dissolved Oxygen | ORP | Conductivity | pH | Temperature |
| Injection Location 1 - Wilclear Plus® Lactate with Accelerite® | | | | | | | | | | | | | | | | |
| MW-6A | 15 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SVE-1 | 25 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Injection Location 2 - EHC-L® | | | | | | | | | | | | | | | | |
| MW-6C | 15 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| OB-2 | 25 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Injection Location 3 -EHC-L® and Powdered Activated Carbon | | | | | | | | | | | | | | | | |
| MW-14S | 15 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| OB-3 | 25 feet east of injection point | Water | Low Flow | Baseline | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Month | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 3 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 6 Months | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total Samples** | | | | | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

NOTES:
ORP = Oxidation reduction potential
VOC - Volatile organic compound
[1]Field Analysis using Hach Kit

Table 2. Groundwater Analytical Results for Dissolved Metals
Laun-dry Supply Company, Inc., Albuquerque, New Mexico

| Well Identification | Date Sampled | Manganese (mg/L) | Arsenic (mg/L) |
|---|---|---|---|
| **Injection Location 1** | | | |
| MW-6A | 12/30/2014 | 3.4 | 0.0071 |
| | 2/25/2015 | 3.9 | <0.020 |
| | 4/23/2015 | 3.5 | <0.020 |
| | 7/22/2015 | 3.6 | <0.020 |
| | 1/20/2016 | 3.6 | <0.020 |
| SVE-1 | 12/30/2014 | 0.95 | 0.0032 |
| | 2/25/2015 | 2.7 | <0.020 |
| | 4/23/2015 | 0.97 | <0.020 |
| | 7/22/2015 | 1.1 | <0.020 |
| | 1/20/2016 | 0.96 | <0.020 |
| **Injection Location 2** | | | |
| MW-6C | 12/30/2014 | 2.1 | 0.0073 |
| | 2/25/2015 | 2.3 | <0.020 |
| | 4/23/2015 | 2.6 | <0.020 |
| | 7/22/2015 | 3.6 | <0.020 |
| | 1/20/2016 | 3.0 | <0.020 |
| OB-2 | 12/30/2014 | 3.1 | 0.0030 |
| | 2/25/2015 | 3.1 | <0.020 |
| | 4/23/2015 | 2.1 | <0.020 |
| | 7/22/2015 | 2.7 | <0.020 |
| | 1/20/2016 | 3.1 | <0.020 |
| **Injection Location 3** | | | |
| MW-14S | 1/22/2015 | 0.17 | 0.0038 |
| | 2/25/2015 | 1.6 | <0.020 |
| | 4/23/2015 | 2.3 | <0.020 |
| | 7/22/2015 | 0.61 | <0.020 |
| | 1/20/2016 | 0.0069 | <0.020 |
| OB-3 | 1/28/2015 | 3.1 | <0.020 |
| | 2/25/2015 | 3.6 | <0.020 |
| | 4/23/2015 | 3.4 | <0.020 |
| | 7/22/2015 | 3.5 | <0.020 |
| | 1/20/2016 | 3.5 | <0.020 |
| NMWQCC Standard | | 0.2 | 0.1 |

**NOTES:**
mg/L = miligrams per liter
NMWQCC = New Mexico Water Quality Control Commission

Table 3. Groundwater Analytical Results for Volatile Organic Compounds
Laun-Dry Supply Company, Inc., Albuquerque, New Mexico

| Well Identification | Date Sampled | PCE | | TCE | | cis-1,2-DCE | | trans-1,2-DCE | | Vinyl Chloride | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (µg/L) | (µM/L) | (µg/L) | (µM) | (µg/L) | (µM) | (µg/L) | (µM) | (µg/L) | (µM) |
| **Injection Location 1** | | | | | | | | | | | |
| MW-6A | 12/30/2014 | 3.2 | 0.019 | 6.3 | 0.048 | 2.7 | 0.028 | 1.1 | 0.011 | <1.0 | - |
| | 2/25/2015 | <1.0 | - | 5.4 | 0.041 | 2.4 | 0.025 | <1.0 | - | <1.0 | - |
| | 4/23/2015 | <1.0 | - | 4.8 | 0.037 | 2.0 | 0.021 | <1.0 | - | <1.0 | - |
| | 7/22/2015 | 1.2 | 0.007 | 4.7 | 0.036 | 2.3 | 0.024 | 1.1 | 0.011 | <1.0 | - |
| | 1/20/2016 | <1.0 | - | 5.1 | 0.039 | 2.2 | 0.023 | <1.0 | - | <1.0 | - |
| SVE-1 | 12/30/2014 | 510 | 3.075 | 56 | 0.426 | 6.6 | 0.068 | <5.0 | - | <5.0 | - |
| | 2/25/2015 | 480 | 2.895 | 34 | 0.259 | <10 | - | <10 | - | <10 | - |
| | 4/23/2015 | 380 | 2.292 | 53 | 0.403 | 6.4 | 0.066 | 1.8 | 0.019 | <1.0 | - |
| | 7/22/2015 | 230 | 1.387 | 33 | 0.251 | 4.2 | 0.043 | 1.6 | 0.017 | <1.0 | - |
| | 1/20/2016 | 190 | 1.146 | 51 | 0.388 | 4.0 | 0.041 | <1.0 | - | <1.0 | - |
| **Injection Location 2** | | | | | | | | | | | |
| MW-6C | 12/30/2014 | 4.1 | 0.025 | 61 | 0.464 | 11 | 0.11 | 4.1 | 0.042 | <1.0 | - |
| | 2/25/2015 | 1.1 | 0.007 | 30 | 0.228 | 7.3 | 0.08 | 2.1 | 0.022 | <1.0 | - |
| | 4/23/2015 | 1.2 | 0.007 | 1.7 | 0.013 | 80 | 0.83 | 1.6 | 0.017 | <1.0 | - |
| | 7/22/2015 | 24 | 0.145 | 6.4 | 0.049 | 22 | 0.23 | <1.0 | - | <1.0 | - |
| | 1/20/2016 | 2.3 | 0.014 | 1.2 | 0.009 | 22 | 0.23 | 1.5 | 0.015 | <1.0 | - |
| OB-2 | 12/30/2014 | 37 | 0.223 | | 0.000 | 26 | 0.27 | 5.1 | 0.053 | <1.0 | - |
| | 2/25/2015 | 100 | 0.603 | 120 | 0.913 | 20 | 0.21 | 3.9 | 0.040 | <1.0 | - |
| | 4/23/2015 | 160 | 0.965 | 190 | 1.446 | 45 | 0.46 | 5.8 | 0.060 | <1.0 | - |
| | 7/22/2015 | 130 | 0.784 | 140 | 1.065 | 40 | 0.41 | 14 | 0.144 | <1.0 | - |
| | 1/20/2016 | 28 | 0.169 | 38 | 0.289 | 15 | 0.15 | 5.2 | 0.054 | <1.0 | - |
| **Injection Location 3** | | | | | | | | | | | |
| MW-14S | 12/31/2014 | <10 | - | 850 | 6.469 | 200 | 2.063 | 77 | 0.794 | <10 | - |
| | 2/25/2015 | 6.6 | 0.040 | 520 | 3.957 | 130 | 1.341 | 60 | 0.619 | <5.0 | - |
| | 4/23/2015 | 8.6 | 0.052 | 680 | 5.175 | 170 | 1.753 | 70 | 0.722 | <1.0 | - |
| | 7/22/2015 | 2.5 | 0.015 | 95 | 0.723 | 16 | 0.165 | 10 | 0.103 | <1.0 | - |
| | 1/20/2016 | <1.0 | - | 6.0 | 0.046 | 1.8 | 0.019 | 3.7 | 0.038 | <1.0 | - |
| OB-3 | 1/28/2015 | <1.0 | - | 440 | 3.349 | 84 | 0.866 | 13 | 0.134 | <1.0 | - |
| | 2/25/2015 | <1.0 | - | 240 | 1.826 | 67 | 0.691 | 13 | 0.134 | <1.0 | - |
| | 4/23/2015 | <1.0 | - | 320 | 2.435 | 94 | 0.970 | 19 | 0.196 | <1.0 | - |
| | 7/22/2015 | <1.0 | - | 220 | 1.674 | 75 | 0.774 | 17 | 0.175 | <1.0 | - |
| | 1/20/2016 | <1.0 | - | 130 | 0.989 | 68 | 0.701 | 17 | 0.175 | <1.0 | - |
| NMWQCC Standard | | 20 | - | 100 | - | Not Specified | - | Not Specified | - | 1.0 | - |

**NOTES:**
µg/L = micrograms per liter
µM = micromoles per liter
DCE = dichlorothene
NMWQCC = New Mexico Water Quality Control Commission
PCE = tetrachloroethene
TCE = trichloroethene

Table 4. Groundwater Analytical Geochemistry Results
Laun-Dry Supply Company, Inc., Albuquerque, New Mexico

| Well Identification | Date Sampled | Total Organic Carbon (mg/L) | Anions | |
|---|---|---|---|---|
| | | | Nitrate as N (mg/L) | Sulfate (mg/L) |
| **Injection Location 1** | | | | |
| MW-6A | 12/30/2014 | 1.7 | <0.10 | 430 |
| | 2/25/2015 | 3.1 | <0.10 | 460 |
| | 4/23/2015 | 1.7 | <0.10 | 470 |
| | 7/22/2015 | 1.7 | <0.10 | 480 |
| | 1/20/2016 | 2.0 | <0.10 | 500 |
| SVE-1 | 12/30/2014 | 2.2 | 2.5 | 610 |
| | 2/25/2015 | 86 | 2.7 | 590 |
| | 4/23/2015 | 2.3 | 2.2 | 610 |
| | 7/22/2015 | 1.9 | 1.8 | 630 |
| | 1/20/2016 | 2.3 | 2.5 | 730 |
| **Injection Location 2** | | | | |
| MW-6C | 12/30/2014 | 2.2 | <0.50 | 370 |
| | 2/25/2015 | 470 | <0.50 | 29 |
| | 4/23/2015 | 100 | <0.50 | <2.5 |
| | 7/22/2015 | 13 | <0.10 | 29 |
| | 1/20/2016 | 6.4 | <0.50 | <2.5 |
| OB-2 | 12/30/2014 | 2.3 | 0.10 | |
| | 2/25/2015 | 79 | <0.50 | 270 |
| | 4/23/2015 | 12 | 0.71 | 380 |
| | 7/22/2015 | 3.4 | <1.0 | 370 |
| | 1/20/2016 | 2.8 | <1.0 | 300 |
| **Injection Location 3** | | | | |
| MW-14S | 1/22/2015 | 9.6 | 1.9 | 240 |
| | 2/25/2015 | 4.5 | 0.18 | 380 |
| | 4/23/2015 | 3.4 | <0.10 | 410 |
| | 7/22/2015 | 5.3 | <0.10 | 210 |
| | 1/20/2016 | 9.0 | 1.8 | 270 |
| OB-3 | 1/28/2015 | 1.6 | <0.10 | 400 |
| | 2/25/2015 | 1.7 | <0.10 | 380 |
| | 4/23/2015 | 1.7 | <0.10 | 410 |
| | 7/22/2015 | 1.6 | <0.10 | 440 |
| | 1/20/2016 | 1.8 | <0.10 | 430 |

**NOTES:**
mg/L = milligram per liter

Table 5. Groundwater Field Parameter Measurements
Laun-Dry Supply Company, Inc., Albuquerque, New Mexico

| Well Identification | Date Sampled | pH | DO (mg/L) | ORP (mV) | Conductivity (mS/cm) | Temp (°C) | Ferrous Iron (mg/L) |
|---|---|---|---|---|---|---|---|
| **Injection Location 1** | | | | | | | |
| MW-6A | 12/30/2014 | 7.10 | 0.41 | -62.2 | 1.333 | 16.77 | 2.0 |
| | 2/25/2015 | 7.04 | 1.25 | -57.7 | 1.384 | 18.45 | 2.5 |
| | 4/23/2015 | 6.94 | 0.10 | 74.0 | 1.351 | 19.39 | 1.5 |
| | 7/22/2015 | 6.59 | 0.55 | -24.9 | 1.408 | 21.75 | 1.5 |
| | 1/20/2016 | 7.71 | 0.17 | -14.5 | 1.425 | 18.4 | 2.5 |
| SVE-1 | 12/30/2014 | 6.99 | 0.62 | 33.1 | 1.740 | 15.20 | 0.0 |
| | 2/25/2015 | 6.87 | 1.05 | -51.2 | 1.922 | 18.80 | 2.5 |
| | 4/23/2015 | 6.90 | 0.24 | 86.7 | 1.733 | 20.31 | 0.0 |
| | 7/22/2015 | 6.71 | 0.35 | 13.3 | 1.714 | 21.90 | 0.5 |
| | 1/20/2016 | 7.70 | 0.77 | 107.4 | 1.852 | 18.4 | 0.0 |
| **Injection Location 2** | | | | | | | |
| MW-6C | 12/30/2014 | 7.08 | 1.04 | -39.0 | 1.287 | 10.43 | 2.0 |
| | 2/25/2015 | 5.97 | 0.54 | -118.7 | 2.228 | 18.49 | 3.0 |
| | 4/23/2015 | 6.75 | 0.13 | -132.5 | 1.408 | 20.12 | 1.5 |
| | 7/22/2015 | 6.28 | 0.79 | -94.1 | 1.571 | 20.85 | 5.5 |
| | 1/20/2016 | 7.65 | 0.90 | -102.4 | 1.401 | 18.1 | NM |
| OB-2 | 12/30/2014 | 7.16 | 0.30 | -123.3 | 1.338 | 16.66 | 3.0 |
| | 2/25/2015 | 6.67 | 0.14 | | 1.656 | 18.49 | 0.5 |
| | 4/23/2015 | 6.96 | 0.05 | -102.6 | 1.481 | 20.61 | 1.0 |
| | 7/22/2015 | 6.67 | 0.17 | -81.8 | 1.486 | 21.98 | 3.0 |
| | 1/20/2016 | 7.70 | 0.45 | -88.5 | 1.339 | 19.0 | 3.5 |
| **Injection Location 3** | | | | | | | |
| MW-14S | 12/31/2014 | 7.36 | 0.83 | - | - | 18.4 | NA |
| | 1/22/2015 | 7.71 | 2.06 | - | 0.904 | 17.8 | 0.0 |
| | 2/25/2015 | 7.24 | 3.02 | -22.3 | 1.306 | 19.3 | 0.0 |
| | 4/23/2015 | 7.11 | 0.58 | 84.9 | 1.353 | 20.21 | 0.5 |
| | 7/22/2015 | 7.10 | 5.54 | -45.3 | 0.746 | 22.90 | 0.5 |
| | 1/20/2016 | 7.88 | 4.84 | 291.9 | 0.846 | 16.6 | 0.0 |
| OB-3 | 1/28/2015 | 7.31 | 0.19 | - | 1.302 | 19.0 | 3.0 |
| | 2/25/2015 | 7.09 | 0.16 | -42.7 | 1.301 | 19.28 | 2.5 |
| | 4/23/2015 | 7.07 | 0.13 | 21.4 | 1.307 | 20.03 | 2.5 |
| | 7/22/2015 | 6.86 | 0.26 | -65.4 | 1.330 | 22.11 | 2.0 |
| | 1/20/2016 | 7.93 | 0.36 | -40.5 | 1.324 | 16.5 | 3.0 |

**NOTES:**

Ferrous iron measured by field Hach Kit

DO = dissolved oxygen measured with YSI Model Professional Plus Water Quality Meter

mg/L = milligram per liter

mS/cm = millisiemens per centimeter

mV = millivolt

ORP = oxidation reduction potential measured with YSI Model Professional Plus Water Quality Meter

pH = log hydrogen ion activity measured with YSI Model Professional Plus Water Quality Meter

Temp = Temperature in degrees Celsius (°C)

Table 6. CENSUS Results
Laun-Dry Supply Company, Inc., Albuquerque, New Mexico

| Well | Sample Date | Dechlorinating Bacteria | | | |
|---|---|---|---|---|---|
| | | Dehalococcoides (cells/mL) | tceA Reductase (cells/mL) | BAV1 Vinyl Chloride Reductase (cells/mL) | Vinyl Chloride Reductase (cells/mL) |
| MW-6A | 9/24/2015 | 8.2 | 0.3 J | <0.5 | <0.5 |
| MW-6C | 9/24/2015 | 13.5 | <1.0 | <1.0 | <1.0 |
| MW-14S | 9/25/2015 | 842 | <0.6 | <0.6 | <0.6 |

Notes:
J = Estimated gene copies
mL = milliliter

# FIGURES

## LEGEND

- Direct Push Soil Boring
- Injection Point
- Monitoring Well
- Observation Well
- SVE Well
- Railroad Alignment
- Loading Dock

N

0 25 50 100 Feet

1 inch = 50 feet
*(11x17 print-out)*

LAUN-DRY SUPPLY CO.
1503 12TH STREET NW
ALBUQUERQUE, NEW MEXICO

# FIGURE 1
# SITE LOCATION MAP

| PROJECT #: | PROJECT PHASE: | PROJECT MANAGER: TM |
|---|---|---|

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
320 Gold Avenue, SW Suite 1210
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016

mullen Path: P:\gis\Projects\Laun-Dry\Dec2014 Sampling\Fig01 Site Map.mxd

**FIGURE 2. ORP TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

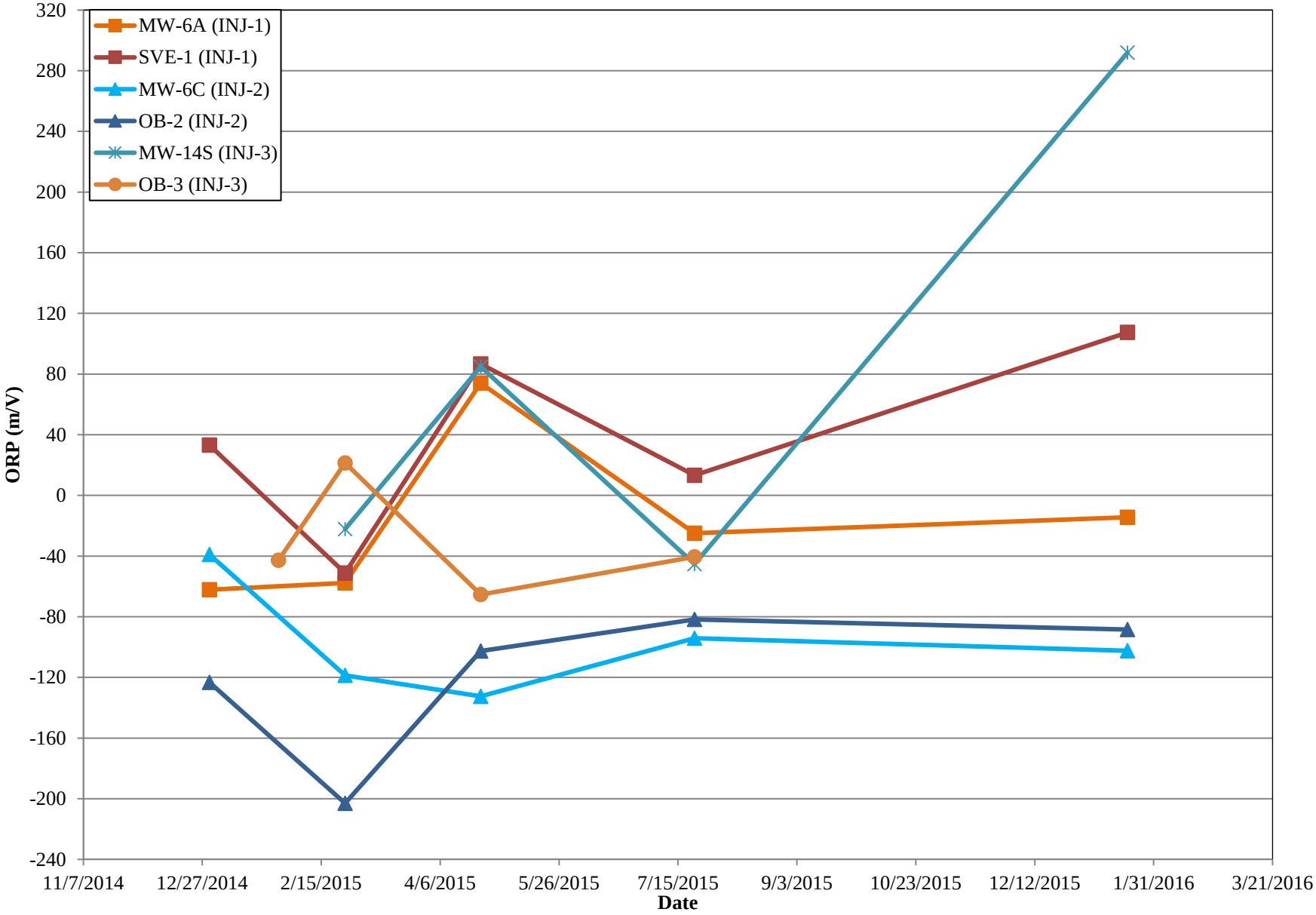


**FIGURE 3. DISSOLVED OXYGEN TRENDS**
**LAUN-DRY SUPPLY COMPANY INC., ALBUQUERQUE, NEW MEXICO**

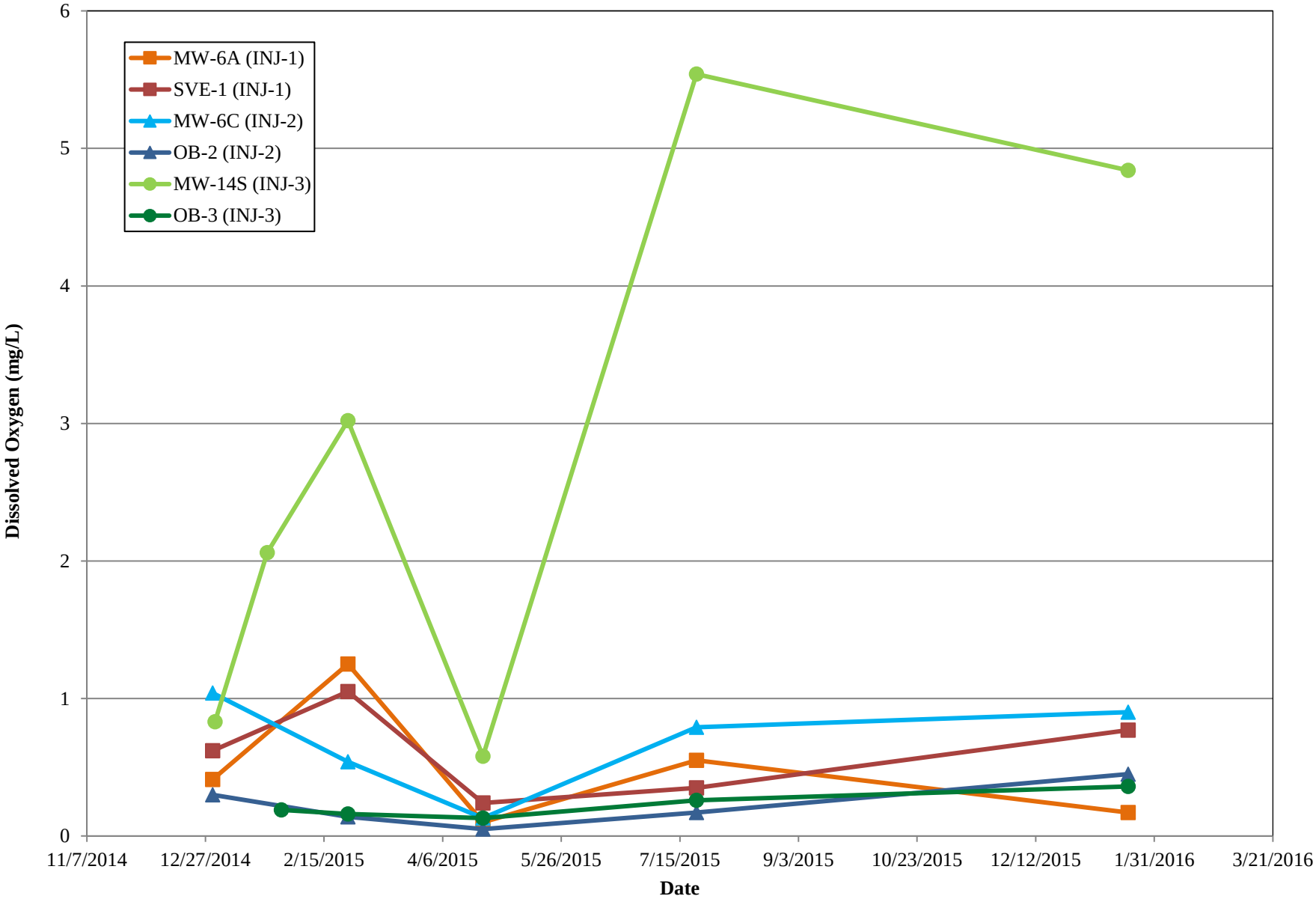


**FIGURE 4. pH TRENDS**
**LAUN-DRY SUPPLY COMPLANY INC., ALBUQUERQUE, NEW MEXICO**

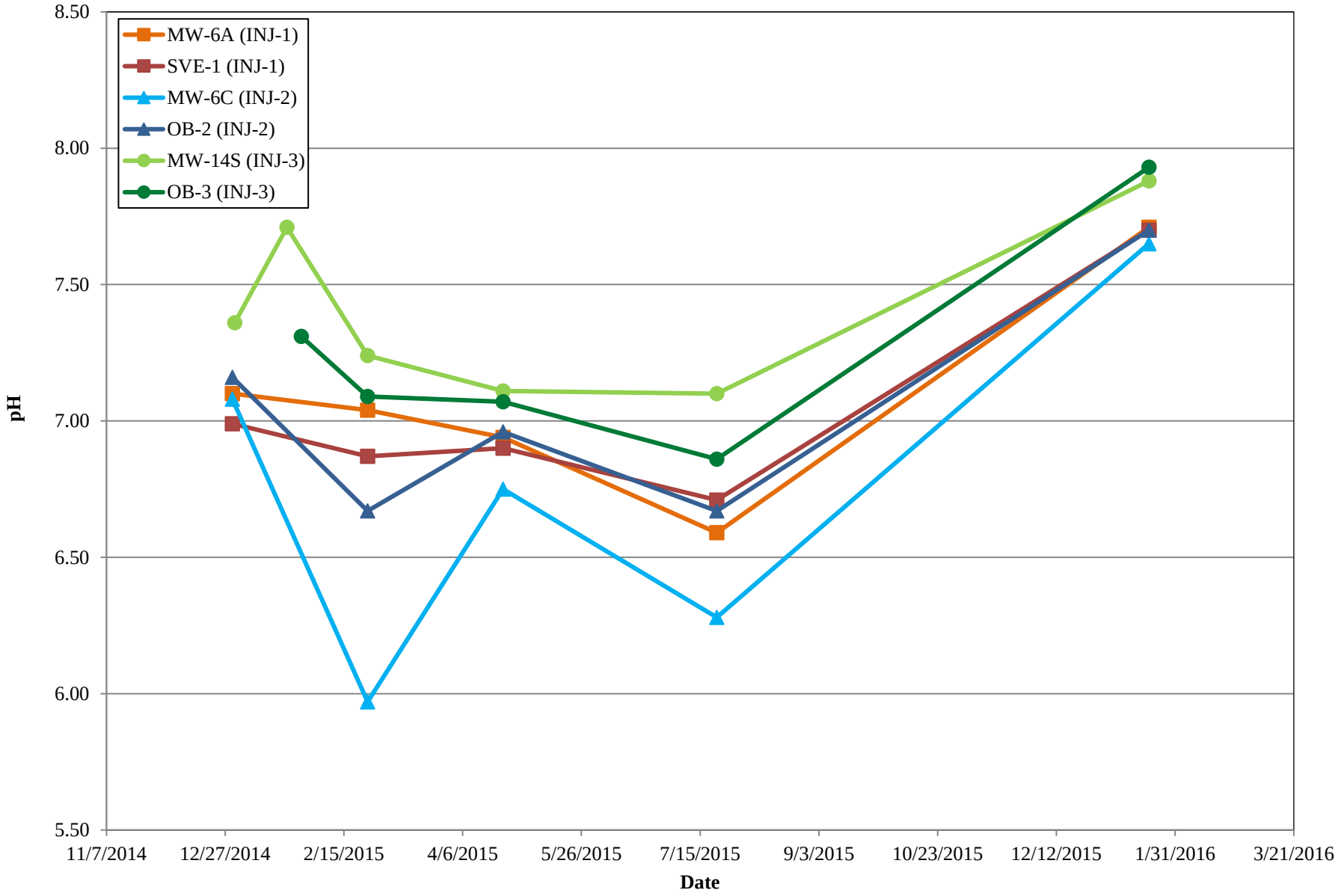


**FIGURE 5. FERROUS IRON CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

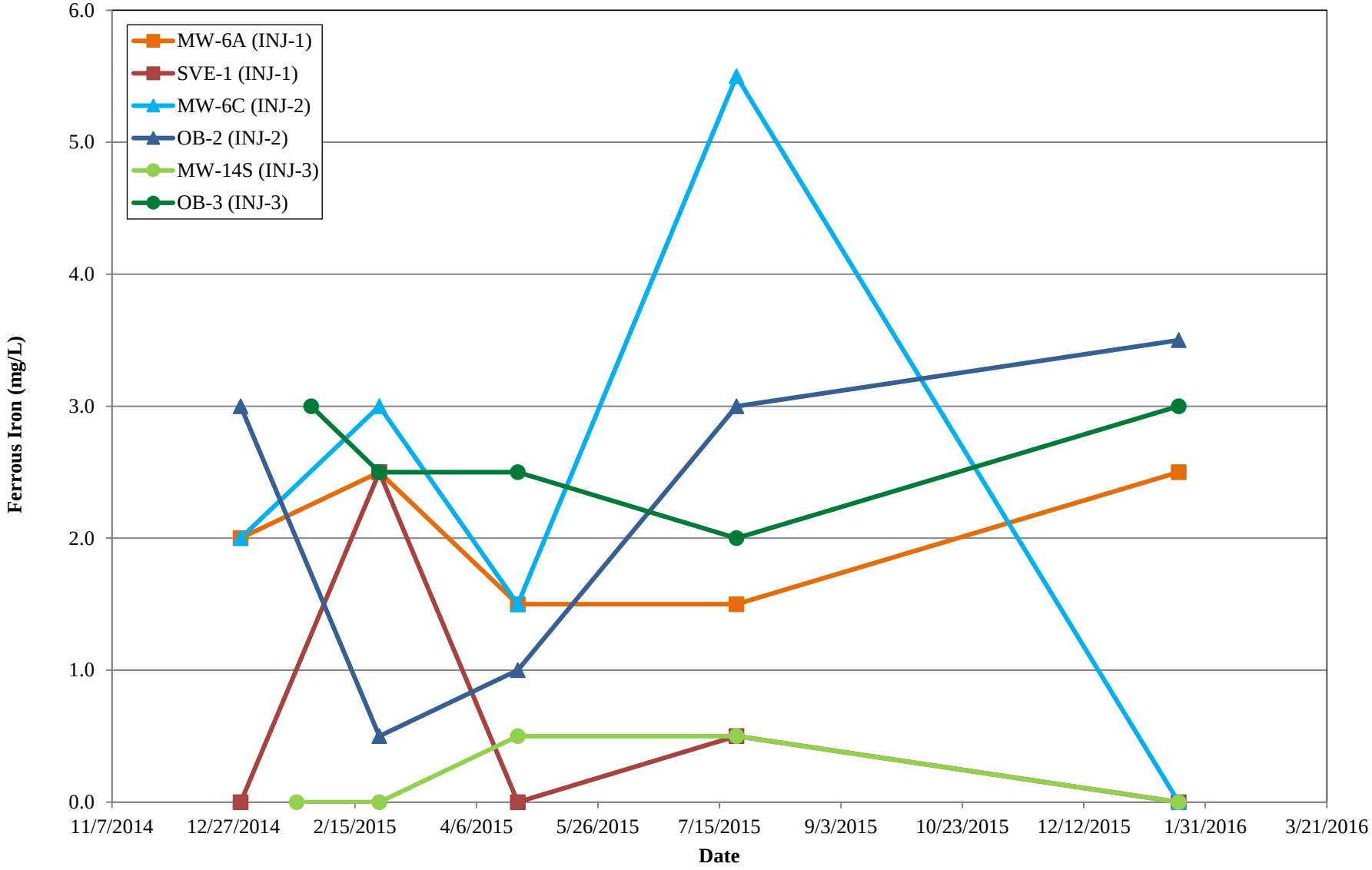


**FIGURE 6. MANGANESE CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

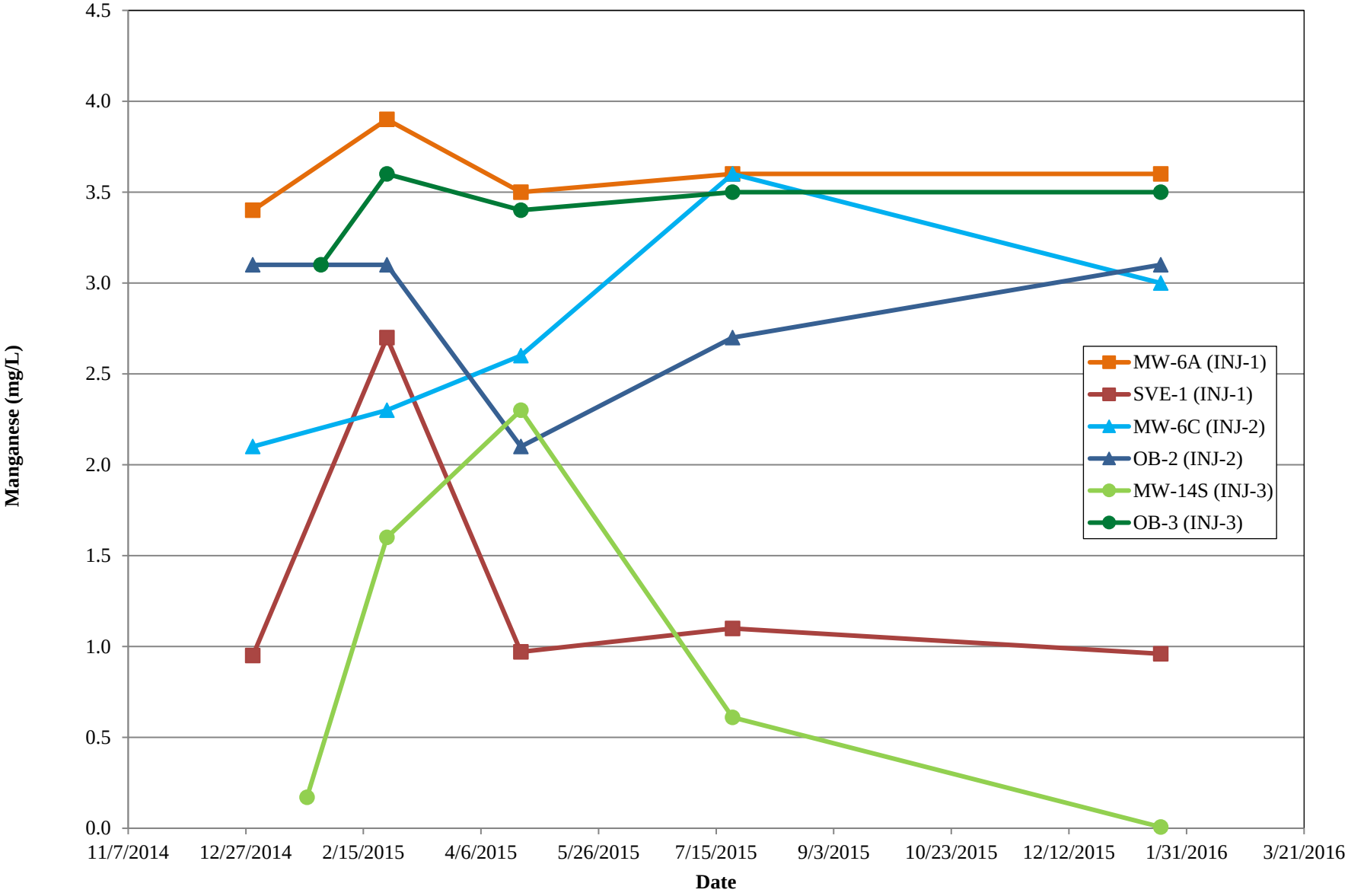


**FIGURE 7. ARSENIC CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

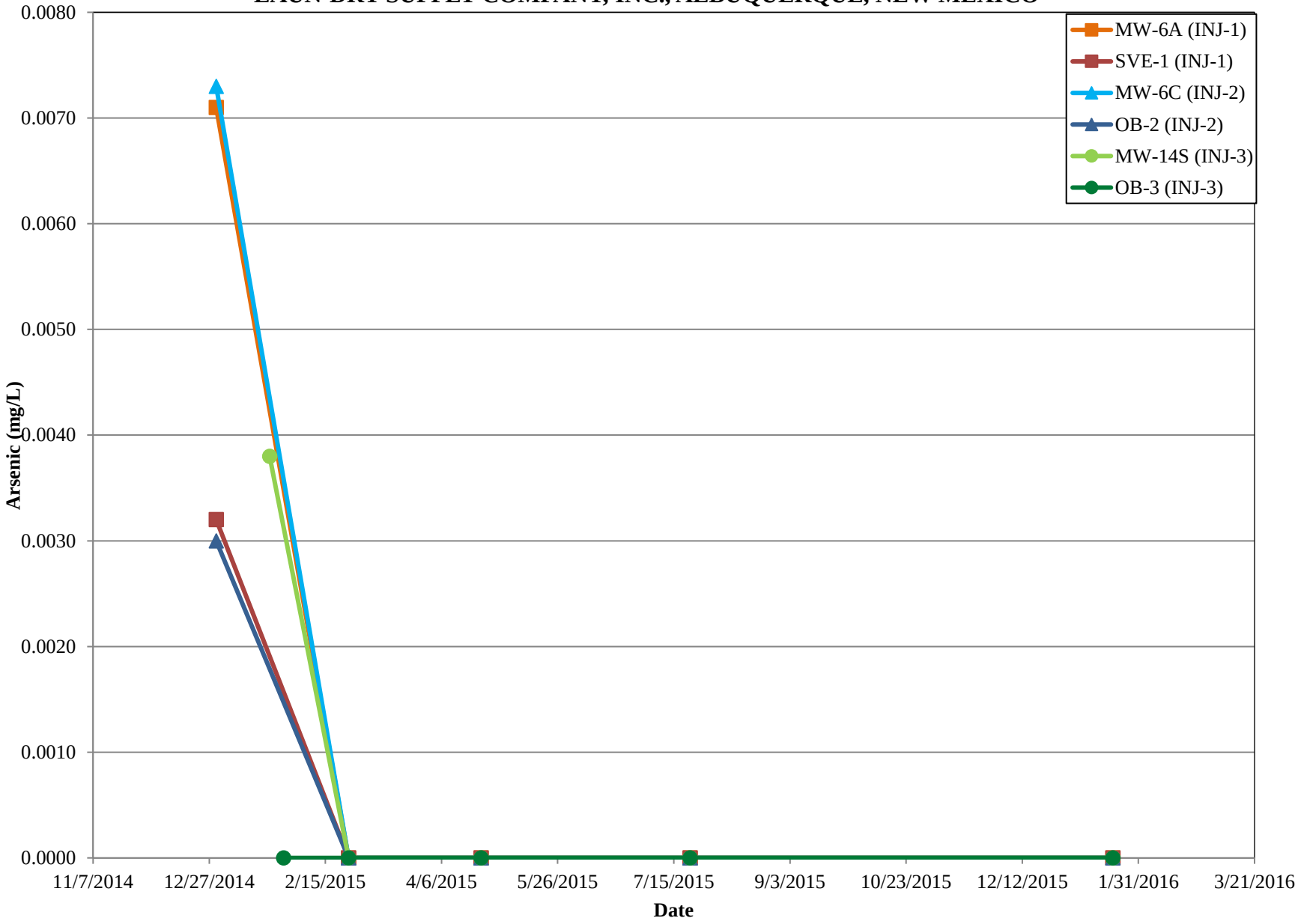


**FIGURE 8. TOC CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

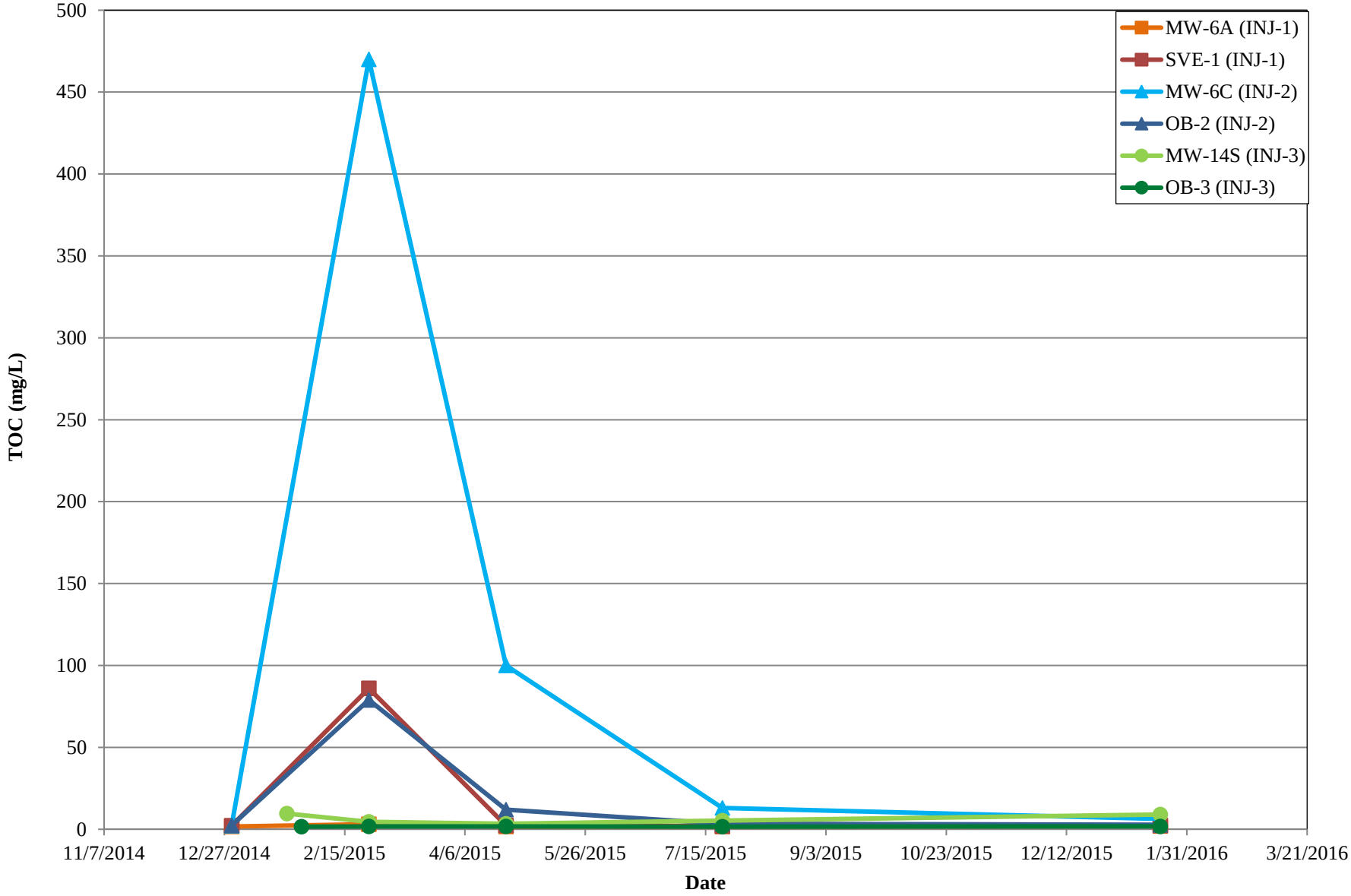


**FIGURE 9. PCE CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

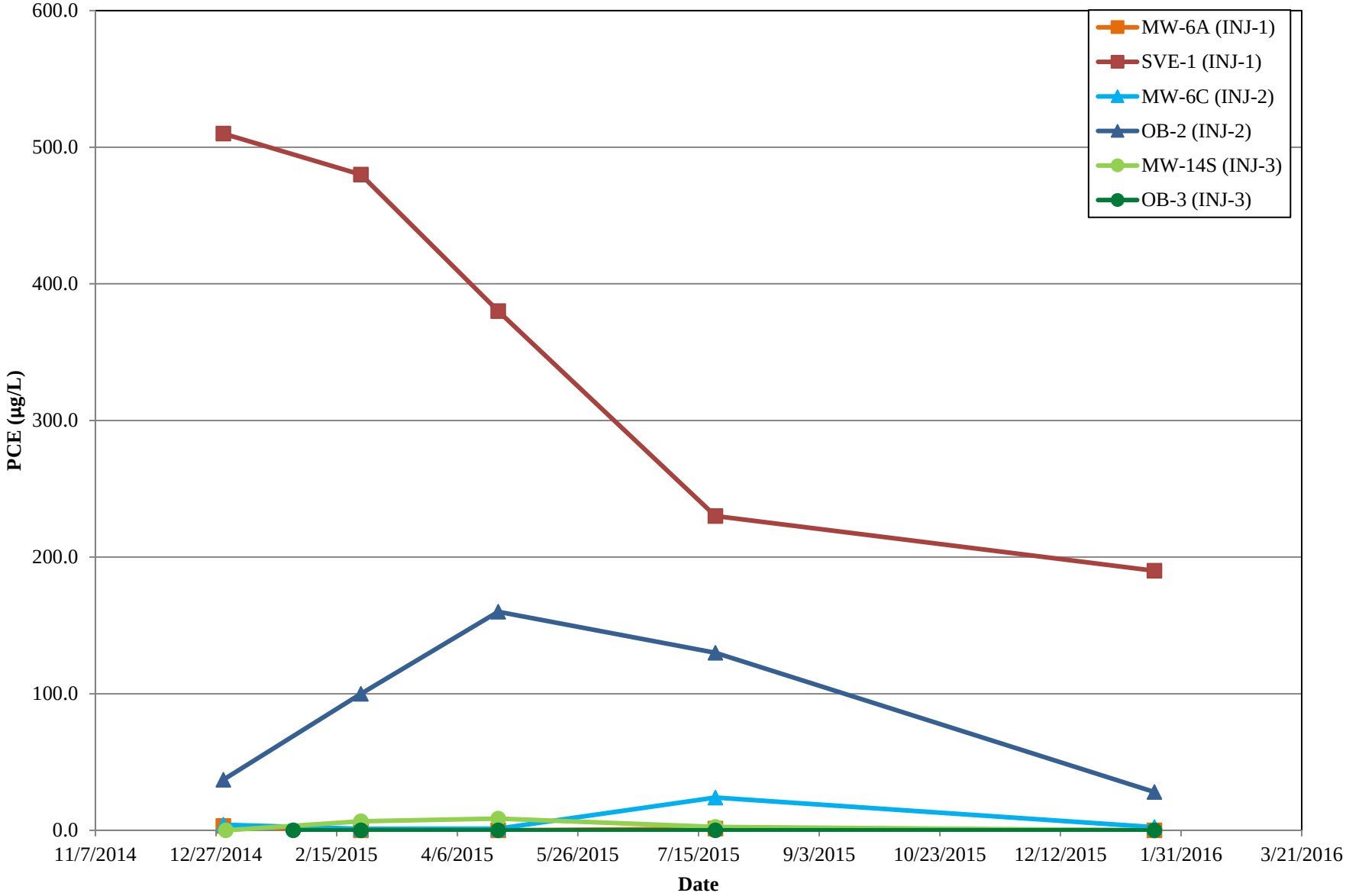


**FIGURE 10. TCE CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

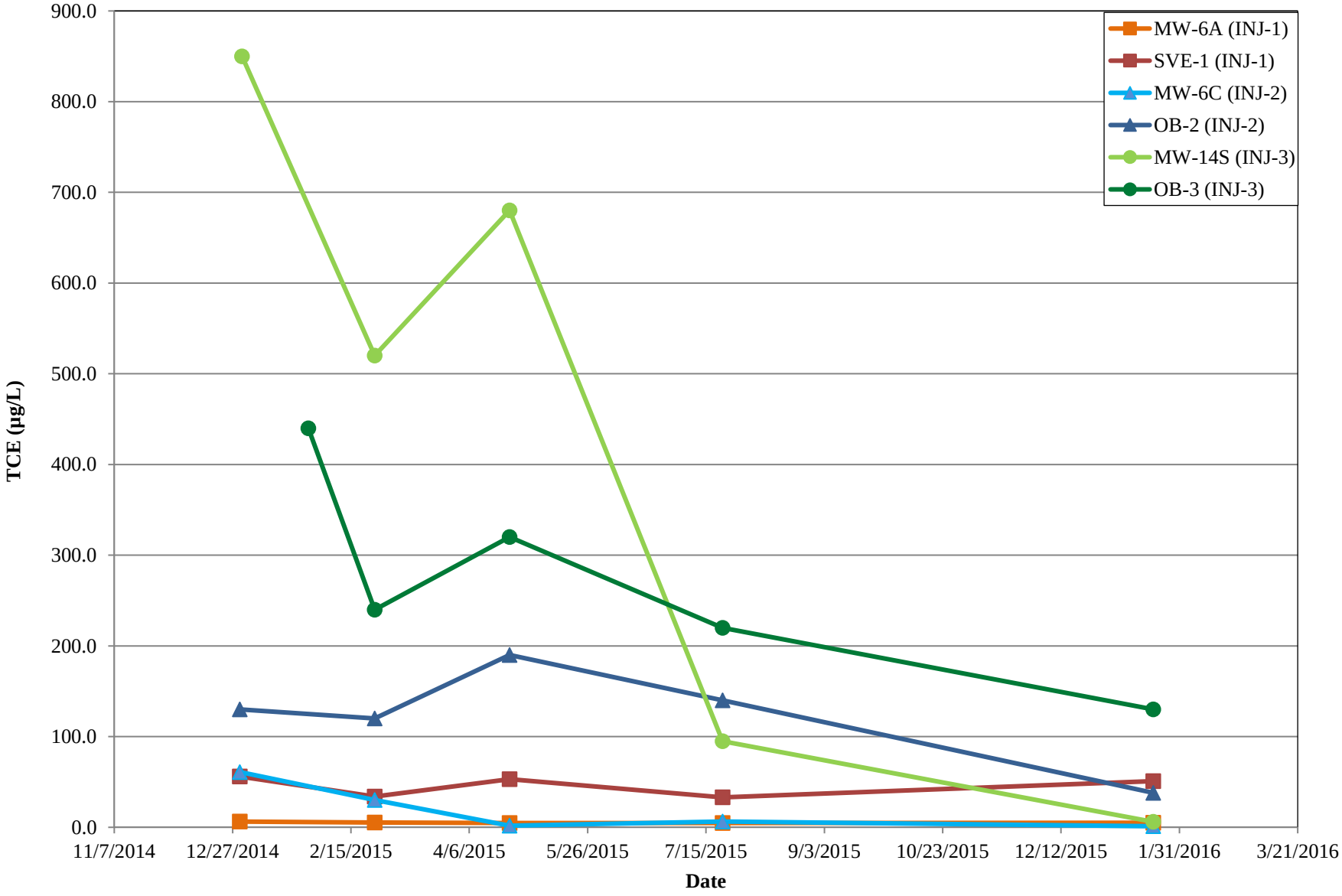


**FIGURE 11. CIS-1,2-DCE CONCENTRATION TRENDS**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE , NEW MEXICO**

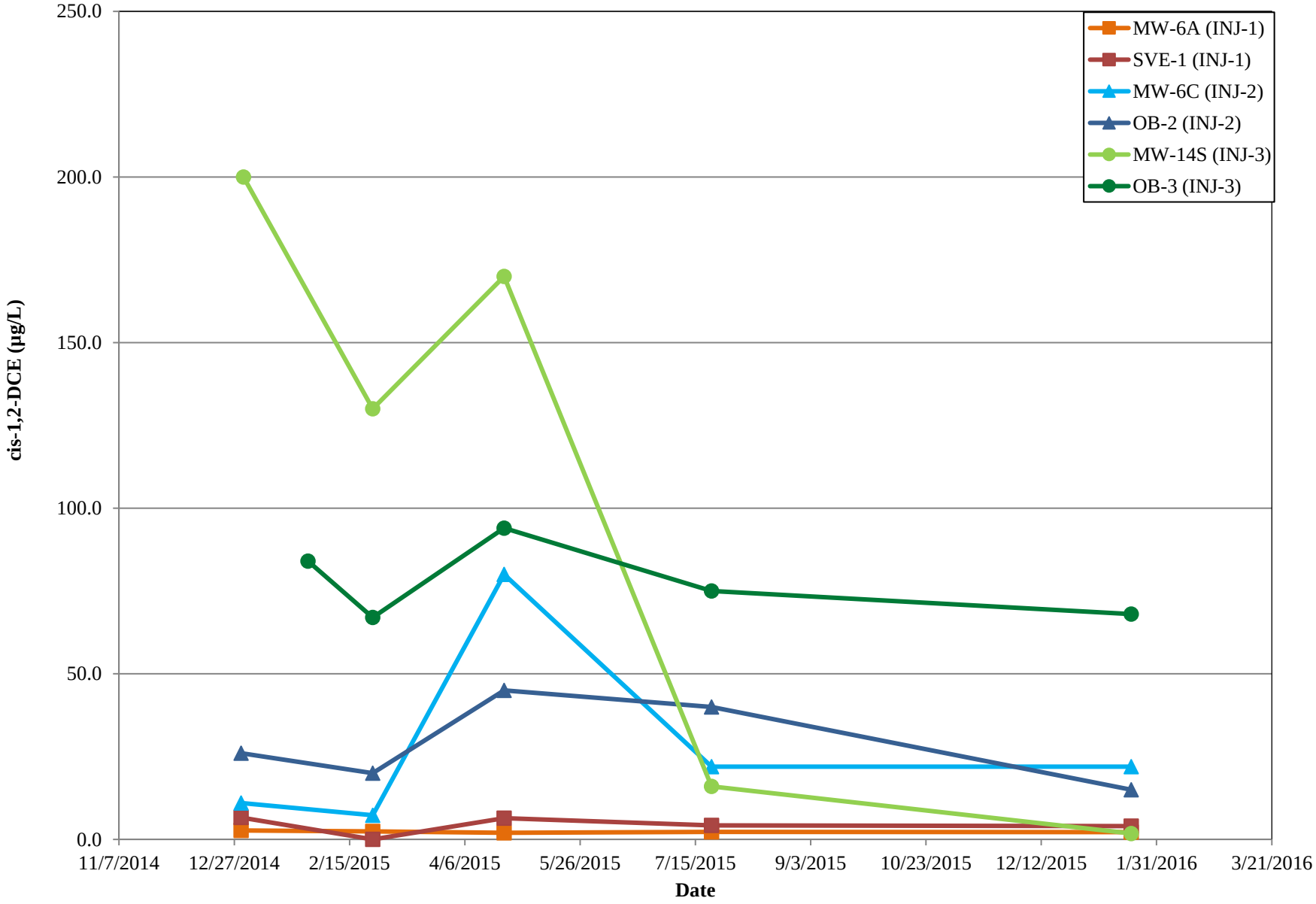


**FIGURE 12. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN MW-6A**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

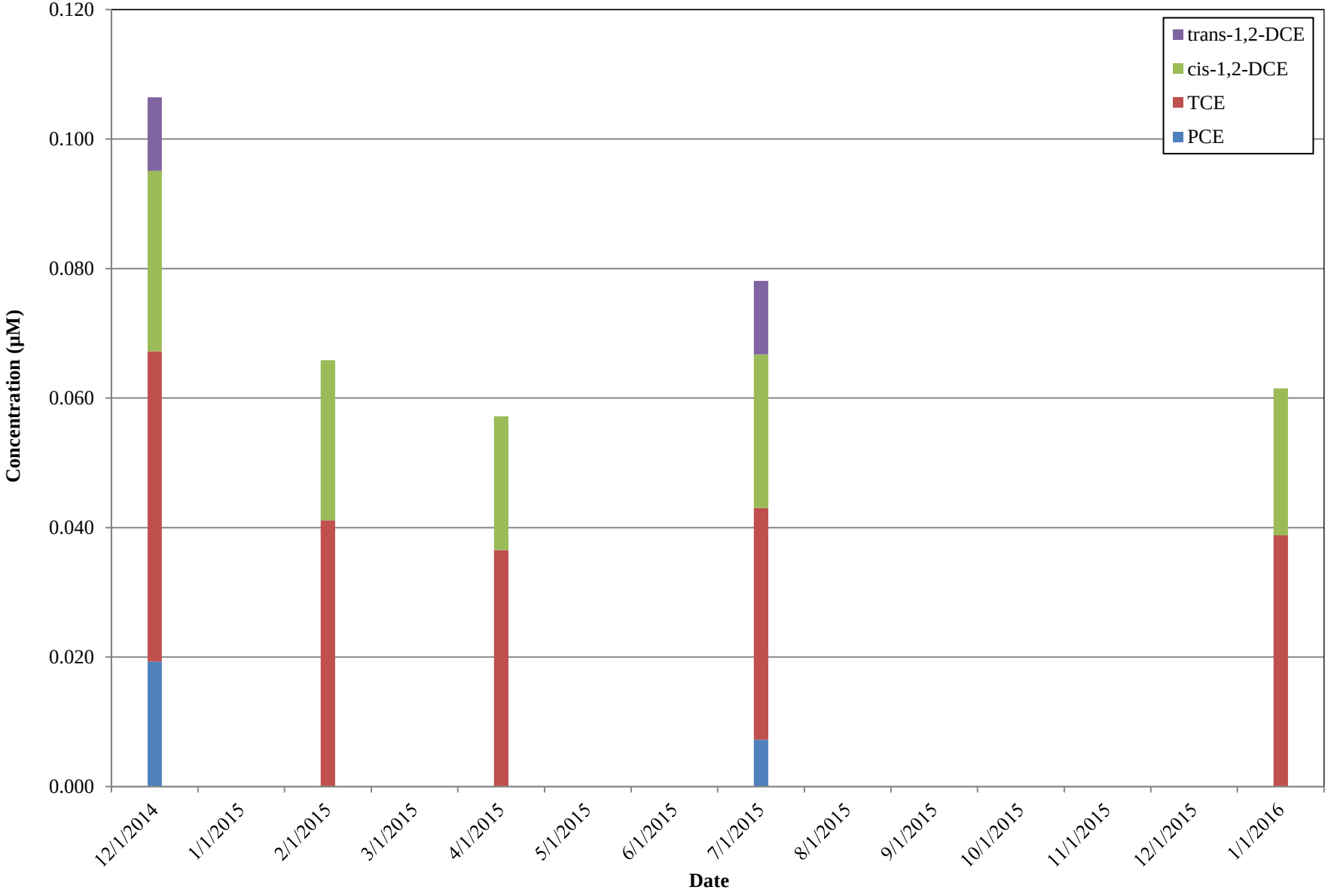


**FIGURE 13. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN SVE-1**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

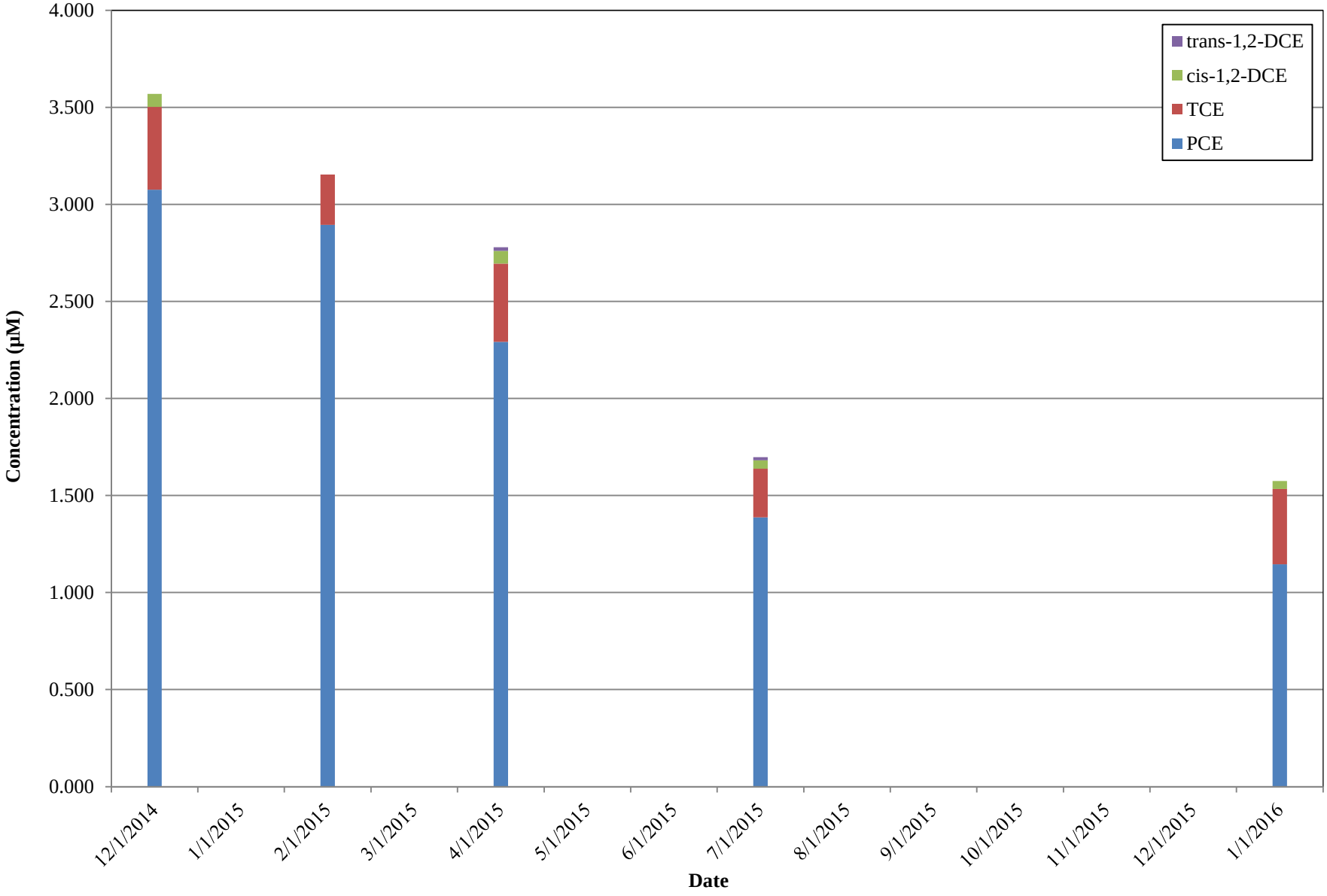


**FIGURE 14. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN MW-6C**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

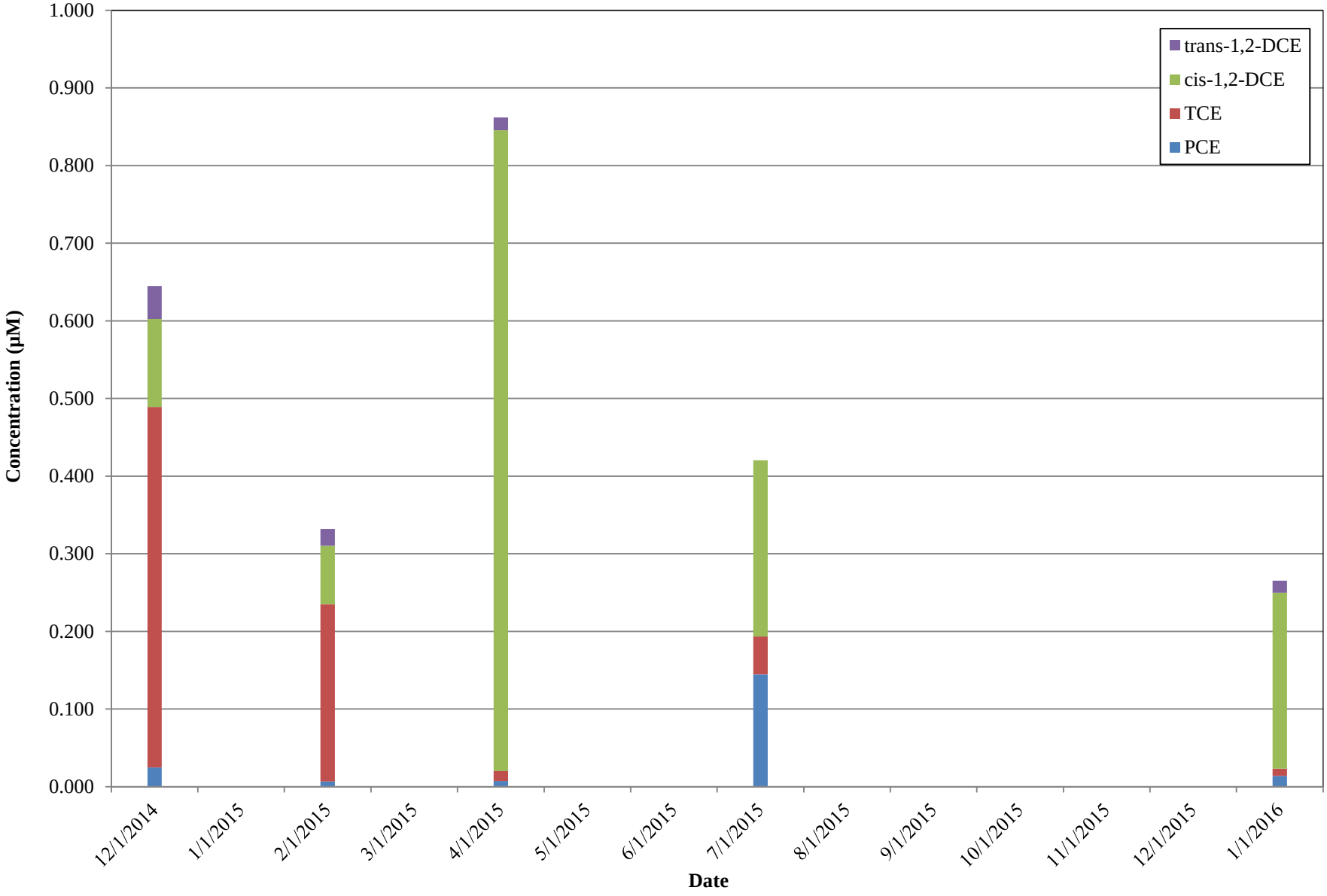


**FIGURE 15. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN OB-2**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

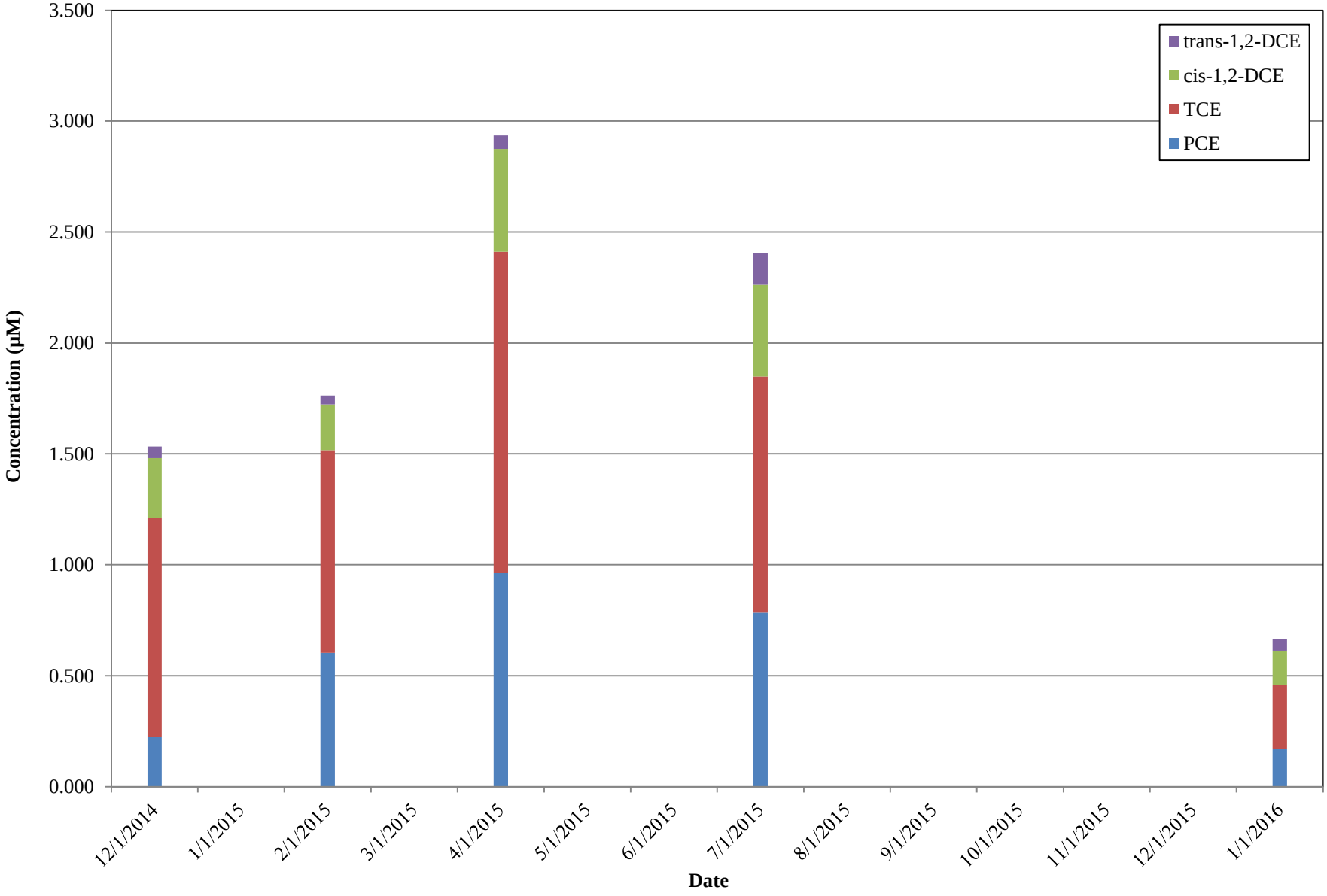


**FIGURE 16. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN MW-14S**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**

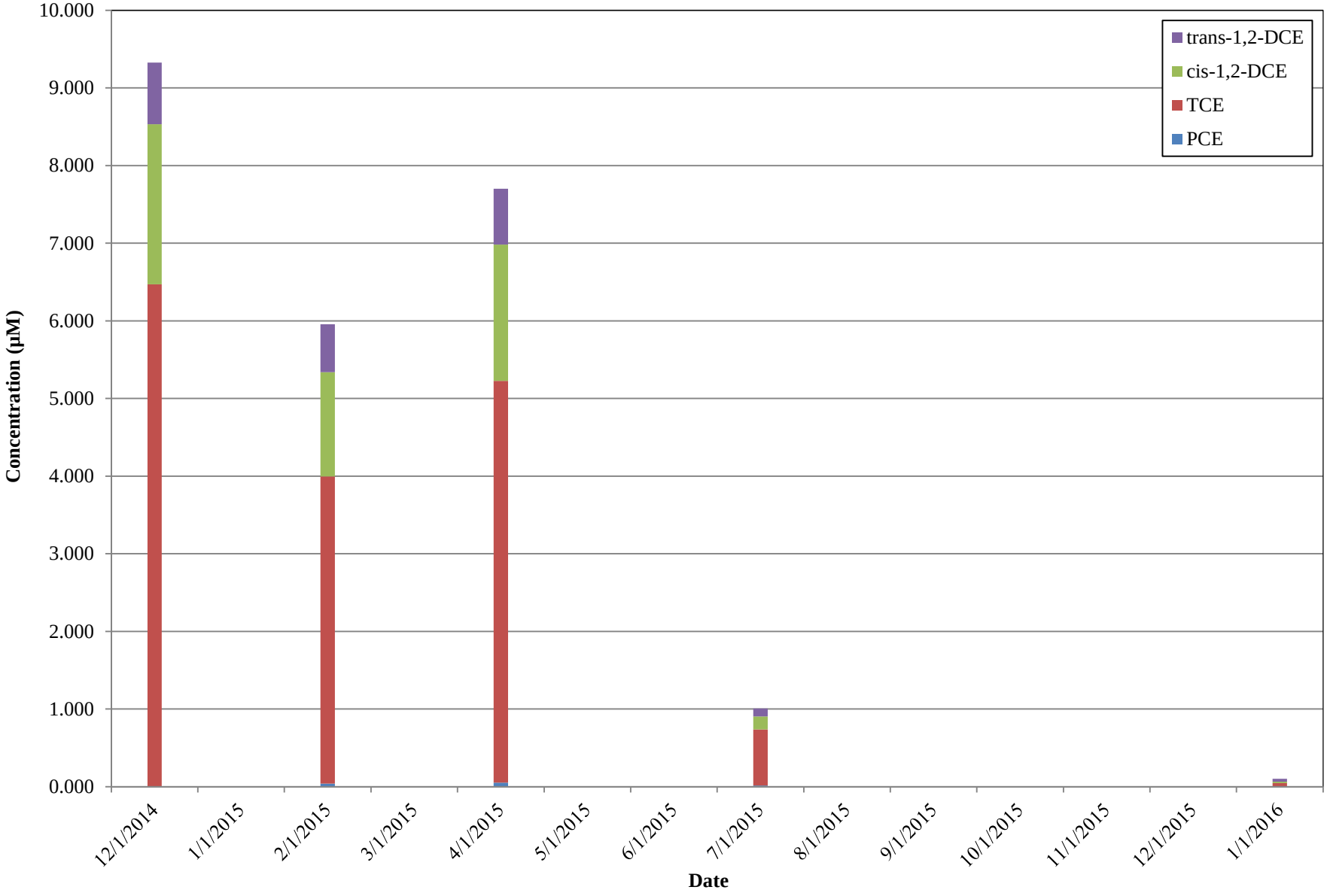
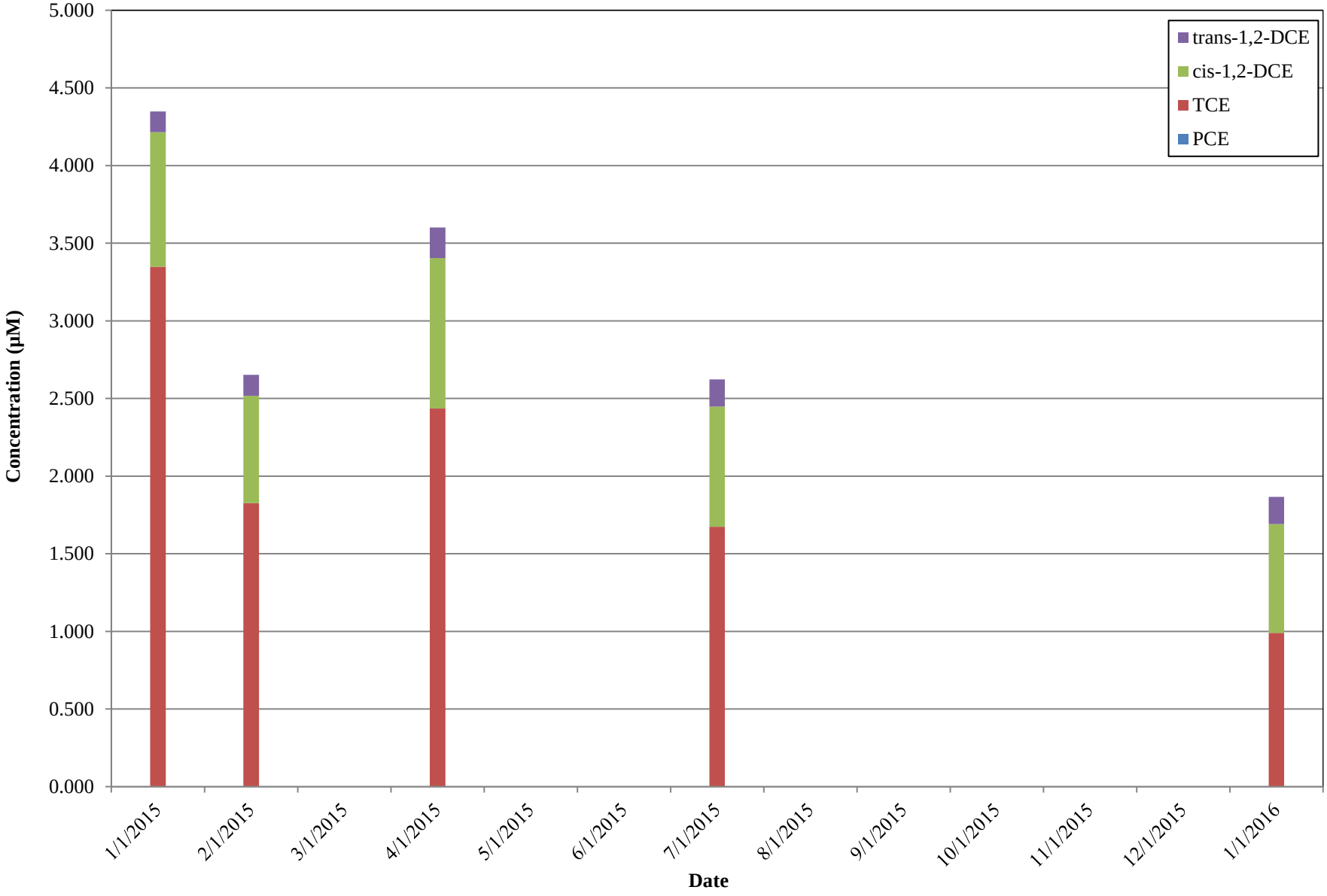


**FIGURE 17. MOLAR CONCENTRATIONS OF CHLORINATED ETHENES IN OB-3**
**LAUN-DRY SUPPLY COMPANY, INC., ALBUQUERQUE, NEW MEXICO**



# ATTACHMENT 1
# FIELD DATA AND INJECTION FORMS

Product Name: Wilclear Plus Lactate w/ Accelerite SITE: Laun-Dry Supply Co. DATE: 1-20-15

Design Inj. Vol.: _____ AREA: _____ Injection Well ID# INJ-1 (direct push boring)

PAGE: 1 of 1 CLIENT: EA Engineers TECH: DWerth

Note Each Batch Mixed

| Batch Number | Start Time | End Time | Volume Product (gal/lbs) | Volume Water (gal) | Interval Depth (FT) | Pump Time (Minutes) | Total Volume (Gallons) | Average Pressure (PSI) | Flow Rate (GPM) | COMMENTS (note variance in inj. rate or pressures; downtime and cause; break-through pressure; supplies consumed) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | — | — | 55 | 495 | 30-32 | — | — | — | — | 10% product |
| 1 | 1201 | 1213 | 25 gals | injectate | 30-32 | 12 | 25 gals | 100 | 2.1 | 2.5 gals product 22.5 gals water |
| 1 | 1220 | 1230 | 30 gals | injectate | 30-32 | 10 | 30 gals | | 3.0 | 3 gals product 27 gals water |
| 1 | 1248 | 1257 | 5.5 gals | 49.5 | 32-34 | 9 | 55 | 100 | 6.1 | |
| 1 | 1304 | 1320 | 5.5 | 49.5 | 34-36 | 16 | 55 | 100 | 3.4 | |
| 1 | 1327 | 1352 | 11.0 | 99.0 | 38-40 | 25 | 110 | 150 | 4.4 | |
| 1 | 1404 | 1406 | 5.5 | 49.5 | 40-42 | 2 | 55 | 10 | 27.5 | |
| 1 | 1410 | 1412 | 5.5 | 49.5 | 42-44 | 2 | 55 | 10 | 27.5 | |
| 1 | 1415 | 1417 | 5.5 | 49.5 | 44-46 | 2 | 55 | 10 | 27.5 | |
| 1 | 1419 | 1421 | 5.5 | 49.5 | 46-48 | 3 | 55 | 15 | 18.3 | |
| 1 | 1424 | 1426 | 5.5 | 49.5 | 48-50 | 2 | 55 | 5 | 27.5 | |

Product Name: EHC-L / reagent / $KHCO_3$ SITE: Laun-Dry Supply Co. DATE: 1-21-15

Design Inj. Vol.: AREA: Injection Well ID# INJ-2 (direct push boring)

PAGE: 1 of CLIENT: EA Engineers TECH: Duerth

Note Each Batch Mixed

| Batch Number | Start Time | End Time | Volume Product (gal/lbs) | Volume Water (gal) | Interval Depth (FT) | Pump Time (Minutes) | Total Volume (Gallons) | Average Pressure (PSI) | Flow Rate (GPM) | COMMENTS (note variance in inj. rate or pressures; downtime and cause; break-through pressure; supplies consumed) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0940 | 1008 | 35.7 | 321.3 | 30-32 | 28 | 357 | 15 | 12.75 | Batch 1 consists of ~ 71 gals of EHC-L |
| 1 | 1011 | 1026 | 35.8 | 321.3 | 33-35 | 15 | 358 | 10 | 23.87 | mixed with ~ 643 gals of water |
| 2 | 1122 | 1134 | 35.7 | 321.3 | 36-38 | 12 | 357 | 10 | 29.75 | then ~ 35 lbs of reagent were added |
| 2 | 1140 | 1151 | 35.7 | 321.3 | 39-41 | 11 | 357 | 40 | 32.45 | then ~ 75 lbs of $KHCO_3$ were added |
| 3 | 1301 | 1314 | 35.7 | 321.3 | 42-44 | 13 | 357 | 25 | 27.5 | Batch 2, same as batch 1 |
| 3 | 1318 | 1330 | 35.7 | 321.3 | 45-47 | 12 | 357 | 5 | 29.75 | Batch 3: ~643 gals $H_2O$, ~71 gals EHC-L, |
| 4 | 1357 | 1408 | 35.7 | 321.3 | 48-50 | 11 | 357 | 5 | 32.45 | ~35 lbs of reagent, ~36 lbs $KHCO_3$ |
| | | | | | | | | | | Batch 4: ~321 gal, $H_2O$, ~36 gals EHC-L, ~18 lbs |
| | | | | | | | | | | $KHCO_3$, ~18 lbs reagent |

Product Name: EHC-L + $NaHCO_3$ + Iron + Carbon SITE: Laun-Dry Supply Co. DATE: 1-22-15

Design Inj. Vol.: AREA: Injection Well ID# INJ-3 (direct push boring)

PAGE: 1 of 1 CLIENT: EA Engineers TECH: DWorth

Note Each Batch Mixed

| Batch Number | Start Time | End Time | Volume Product (gal/lbs) | Volume Water (gal) | Interval Depth (FT) | Pump Time (Minutes) | Total Volume (Gallons) | Average Pressure (PSI) | Flow Rate (GPM) | COMMENTS (note variance in inj. rate or pressures; downtime and cause; break-through pressure; supplies consumed) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0955 | 0957 | 16 | 24 | 30-32 | 2 | 40 | 5 | 20 | Batch 1: ~32 gal $H_2O$, ~3 Gal EHC-L, |
| 1&2 | 1012 | 1114 | 298 | 448 | 33-35 | 62 | 747 | 5 | 12 | ~18 lbs bicarb, ~18 lbs reagent, |
| 2 | 1124 | 1129 | 8 | 12 | 38-40 | 5 | 20 | 0 | 4 | ~240 lbs Carbon |
| 2&3 | 1217 | 1310 | 196 | 293 | 36-38 | 53 | 489 | 5 | 9.2 | Batch 2: same as batch 1 |
| 3&4 | 1315 | 1342 | 244 | 366 | 39-41 | 27 | 610 | 10 | 22.6 | injectate not taking 38'-40', hole "blown" |
| 5 | 1359 | 1514 | 214 | 322 | 42-44 | 75 | 536 | 10 | 9.1 | Move 3' west |
| 6 | 1555 | 1623 | 214 | 322 | 45-47 | 28 | 536 | 5 | 19.1 | start injection in new hole |
| 7 | 1629 | 1643 | 110 | 166 | 48-50 | 14 | 276 | 40 | 19.7 | Batch 3 same as 1 |
| 7 | 1656 | 1705 | 80 | 120 | 30-32 | 9 | 200 | 10 | 22.2 | Batch 4 " " |
| | | | | | | | | | | Batch 5 " " |
| | | | | | | | | | | Batch 6 " " |
| | | | | | | | | | | Batch 7 " " |
| | | | | | | | | | | After 48'-50', pulled up to 30'-32' |
| | | | | | | | | | | interval to inject more |
| | | | | | | | | | | in that interval. |

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 12-30-14

# Ground Water Sampling Data Sheet

Well ID: MW-6A  Sample ID: MW-6A  Sample Time: 1020

Casing diameter/type: 4"
Well location: Laun-Dry Supply Co.
Weather: Cold windy
Screened interval(s):
Sampling personnel: DW TC
Total depth: 42.70
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.90
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI
Measuring point: **North side of casing**
Pump depth setting: 35.8
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0952 | 14.44 | 1332 | 9.7 | 0.97 | 7.11 | -48.2 | 28.92 | 500 | | | Hach: 2.0 mg/L |
| 0957 | 14.06 | 1336 | 5.6 | 0.55 | 7.10 | -55.5 | 28.92 | 500 | | | |
| 1002 | 14.70 | 1331 | 5.0 | 0.50 | 7.10 | -57.3 | 28.91 | 425 | | | |
| 1007 | 15.10 | 1333 | 4.5 | 0.45 | 7.10 | -58.4 | 28.91 | 400 | | | |
| 1012 | 16.77 | 1333 | 4.2 | 0.41 | 7.10 | -62.2 | 28.91 | 650 | | | |

Recorded By: DWH

6/18/2014

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 12-30-14

# Ground Water Sampling Data Sheet

Well ID: SVE-1 Sample ID: SVE-1 Sample Time: 1110

Casing diameter/type: 2" Well location: Laun-Dry Supply Co. Weather: Cold windy

Screened interval(s): Sampling personnel: DW TC

Total depth: 38.80 Sampling method: **Low-flow**

Initial depth to water (w/o pump): 29.12 Water level indicator: **Solinst**

Final depth to water (w/o pump): Water quality meter: YSI

Measuring point: **North side of casing** Pump depth setting: 33.96 Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1037 | 14.49 | 1769 | 60.4 | 5.88 | 7.03 | 41.8 | 29.20 | 500 | | | HACH: 0.0 mg/L |
| 1042 | 12.88 | 1787 | 13.9 | 1.43 | 7.00 | 38.1 | 29.17 | 325 | | | |
| 1047 | 13.66 | 1771 | 8.6 | 0.88 | 6.99 | 37.4 | 29.16 | 325 | | | |
| 1052 | 13.01 | 1757 | 7.2 | 0.75 | 6.99 | 37.8 | 29.16 | 375 | | | |
| 1057 | 13.12 | 1745 | 7.3 | 0.77 | 7.00 | 37.2 | 29.16 | 325 | | | |
| 1102 | 15.20 | 1740 | 6.2 | 0.62 | 6.99 | 33.1 | 29.16 | 425 | | | |

Recorded By: [signature]

6/18/2014

Laun-Dry Supply Co.

# Ground Water Sampling Data Sheet

**Well ID:** MW-6C **Sample ID:** MW-6C **Sample Time:** 0825

Casing diameter/type: 4" Well location: Laun-Dry Supply Co. Weather: cold windy

Screened interval(s): Sampling personnel: Dwett Tierley

Total depth: 41.50' Sampling method: **Low-flow**

Initial depth to water (w/o pump): 27.40' Water level indicator: **Solinst**

Final depth to water (w/o pump): Water quality meter: YSI

Measuring point: **North side of casing** Pump depth setting: 34.45 Pump type/model: MegaMunsch

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0743 | 12.87 | 1272 | 25.3 | 2.70 | 7.06 | 53.0 | 27.44 | 400 | | | HACH 2.0 mg/L |
| 0748 | 13.82 | 1266 | 18.3 | 1.86 | 7.05 | 18.5 | 27.44 | 400 | | | |
| 0753 | 15.91 | 1269 | 12.5 | 1.22 | 7.06 | -11.2 | 27.47 | 400 | | | |
| 0758 | 14.66 | 1272 | 10.5 | 1.06 | 7.06 | -20.9 | 27.45 | 450 | | | |
| 0803 | 15.65 | 1283 | 9.0 | 0.89 | 7.07 | -35.5 | 27.46 | 550 | | | |
| 0808 | 14.33 | 1288 | 8.5 | 0.87 | 7.07 | -41.1 | 27.45 | 425 | | | |
| 0813 | 9.93 | 1282 | 10.0 | 1.11 | 7.07 | -37.5 | 27.44 | 450 | | | |
| 0818 | 10.43 | 1287 | 9.5 | 1.04 | 7.08 | -39.0 | 27.44 | 450 | | | |

Recorded By: DWett

6/18/2014

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 12-30-14

# Ground Water Sampling Data Sheet

Well ID: OB-2 Sample ID: OB-2 Sample Time: 0925

Casing diameter/type: 2
Well location: Laun-Dry Supply Co.
Weather: Cold windy
Screened interval(s):
Sampling personnel: DWerth TCurly
Total depth: 49.45
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.49
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI
Measuring point: **North side of casing**
Pump depth setting: 38.97
Pump type/model: mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 0850 | 14.73 | 1304 | 24.3 | 2.40 | 7.19 | -84.4 | 28.52 | 500 | | | HACH: 3.0 mg/L |
| 0855 | 13.66 | 1314 | 8.8 | 0.88 | 7.16 | -102.9 | 28.53 | 450 | | | |
| 0900 | 16.54 | 1313 | 4.5 | 0.45 | 7.17 | -113.1 | 28.52 | 300 | | | |
| 0905 | 16.02 | 1315 | 3.1 | 0.30 | 7.17 | -118.6 | 28.53 | 375 | | | |
| 0910 | 15.54 | 1322 | 2.8 | 0.28 | 7.18 | -121.9 | 28.52 | 350 | | | |
| 0915 | 15.44 | 1327 | 3.2 | 0.31 | 7.20 | -122.9 | 28.52 | 350 | | | |
| 0920 | 16.66 | 1338 | 3.2 | 0.30 | 7.16 | -123.3 | 28.53 | 500 | | | |

Recorded By: DWerth

6/18/2014

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 1-22-15

## Ground Water Sampling Data Sheet

Well ID: MW-14S Sample ID: MW-14S Sample Time: 0800

Casing diameter/type: 2" Well location: Laun-Dry Supply Co. Weather: -30°F, windy

Screened interval(s): Sampling personnel: DWorth

Total depth: ~~48.7~~ 48.70 Sampling method: Low-flow

Initial depth to water (w/o pump): 27.59 Water level indicator: Solinst

Final depth to water (w/o pump): Water quality meter: Oakton & YSI

Measuring point: North side of casing Pump depth setting: 40.00 Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 0743 | 16.2 | 905 | ~~2.66~~ 26.8 | 2.66 | 7.59 | — | 29.21 | 500 | | | HACH I₂ : 0.0 mg/L |
| 0748 | 16.8 | 908 | 18.3 | 1.76 | 7.60 | — | 29.24 | 500 | | | |
| 0753 | 17.4 | 907 | 21.9 | 2.11 | 7.68 | — | 29.35 | 500 | | | |
| 0758 | 17.8 | 904 | 21.9 | 2.06 | 7.71 | — | 29.39 | 500 | | | |

Recorded By: [signature]

6/18/2014

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 1-28-15

## Ground Water Sampling Data Sheet

Well ID: OB-3 Sample ID: OB-3 Sample Time: 1245

Casing diameter/type: 2" PVC
Screened interval(s): ~~[illegible]~~ 28'-48'
Total depth: 48.20
Initial depth to water (w/o pump): 27.99
Final depth to water (w/o pump):
Measuring point: **North side of casing**

Well location: Laun-Dry Supply Co.
Sampling personnel: DWerth
Sampling method: **Low-flow**
Water level indicator: **Solinst**
Water quality meter: Oakton & YSI
Pump depth setting: 38'
Pump type/model: Mega Monsoon

Weather: clear ~55°F breezy

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% pH | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1223 | 18.6 | 1301 | 13.7 | 1.26 | 7.20 | | 28.00 | 500 | | | HACH Iron: 3.0 mg/L |
| 1228 | 18.8 | 1309 | 4.8 | 0.45 | 7.26 | | 28.01 | 500 | | | |
| 1233 | 18.6 | 1314 | 3.0 | 0.29 | 7.28 | | 28.01 | 400 | | | |
| 1238 | 18.9 | 1310 | 2.5 | 0.24 | 7.28 | | 28.01 | 425 | | | |
| 1243 | 19.0 | 1302 | 2.0 | 0.19 | 7.31 | | 28.01 | 450 | | | |

Recorded By: [illegible]

6/18/2014

Laun-Dry Supply Co.

Sheet 1 of ____
Date: 2/25/15

# Ground Water Sampling Data Sheet

**Well ID:** MW-6A **Sample ID:** MW-6A **Sample Time:** 10:53

Casing diameter/type: 4" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, Calm
Screened interval(s): 16'-30' and 43'-48'
Sampling personnel: D Werth / R. Mullen
Total depth: 44'
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.73'
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI 556
Measuring point: **North side of casing**
Pump depth setting: ~~35'~~ 43'
Pump type/model: Mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1031 | 18.28 | 1381 | 27.6 | 2.55 | 7.10 | -100.9 | 28.73 | 250 | — | | very faint unidentifiable odor |
| 1036 | 17.58 | 1381 | 22.1 | 2.10 | 7.05 | -70.8 | 28.74 | 450 | — | 1.25 | |
| 1041 | 17.97 | 1386 | 17.6 | 1.64 | 7.04 | -61.6 | 28.74 | 400 | — | 3.50 | |
| 1046 | 18.23 | 1383 | 15.9 | 1.49 | 7.04 | -60.3 | 28.74 | 400 | — | 4.50 | |
| 1051 | 18.45 | 1384 | 13.4 | 1.25 | 7.04 | -57.7 | 28.74 | 350 | — | 5.50 | Hach iron 2.5 mg/L |

Recorded By: R. Mullen

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 2/25/15

# Ground Water Sampling Data Sheet

Well ID: SVE-1 Sample ID: SVE-1 Sample Time: 1146

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: sunny, light breeze
Screened interval(s): 10'-40'
Sampling personnel: D Wenth R Mullen
Total depth: 40'
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.99'
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI 556
Measuring point: **North side of casing**
Pump depth setting: ~~25'~~ 34.5'
Pump type/model: Megamonsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1125 | 18.61 | 1907 | 32.2 | 2.95 | 6.98 | -33.5 | 29.01 | 400 | – | | faint unidentifiable |
| ~~1200~~ 1130 | 18.13 | 1927 | 18.8 | 1.75 | 6.95 | -28.4 | 29.00 | 350 | – | | odor |
| ~~1205~~ 1135 | 18.89 | 1924 | 13.8 | 1.28 | 6.92 | -31.8 | 29.00 | 450 | | | |
| ~~1210~~ 1140 | 19.02 | 1919 | 12.4 | 1.14 | 6.88 | -50.0 | 29.00 | 400 | – | | Hach iron 2.5 mg/L |
| 1145 | 18.80 | 1922 | 11.3 | 1.05 | 6.87 | -51.2 | 29.00 | 500 | – | | |

Recorded By: R. Mullen

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 2/25/15

# Ground Water Sampling Data Sheet

Well ID: MW-6C Sample ID: MW-6C Sample Time: 0843

Casing diameter/type: 4" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, calm
Screened interval(s): ~~8'~~ 8'-28' and 40'-45'
Sampling personnel: D Wenth / R Mullen
Total depth: ~~45'~~ 42'
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.27
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI 556
Measuring point: **North side of casing**
Pump depth setting: 41'
Pump type/model: Mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0821 | 16.86 | 1993 | 48.3 | 4.00 | 5.93 | -72.7 | 27.36 | 550 | — | 0 | Water has potent fish-like odor |
| 0826 | 18.40 | 2341 | 13.7 | 1.27 | 5.93 | -109.1 | 27.32 | 500 | — | 2.75 | |
| 0831 | 18.42 | 2333 | 10.1 | 0.94 | 5.95 | -117.1 | 27.31 | 400 | | 5.25 | |
| 0836 | 18.41 | 2262 | 6.9 | 0.64 | 5.96 | -116.3 | 27.31 | 450 | — | 7.25 | |
| 0841 | 18.49 | 2228 | 6.2 | 0.54 | 5.97 | -118.7 | 27.31 | 500 | | 9.5 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | HACH Iron 3.0 mg/L |
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Recorded By: R Mullen

Laun-Dry Supply Co.

Sheet 1 of 1
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# Ground Water Sampling Data Sheet

Well ID: OB-2 Sample ID: OB-2 Sample Time: 0947

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, calm
Screened interval(s): 29-49'
Sampling personnel: D Wenth/R Mullen
Total depth: 49'
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.37
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: VS1 556
Measuring point: **North side of casing**
Pump depth setting: 39'
Pump type/model: Megamonsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0924 | 16.50 | 1576 | 16.2 | 1.51 | 6.67 | -181.5 | 28.37 | 250 | — | | strong fishy odor |
| 0929 | 16.68 | 1642 | 4.2 | 0.40 | 6.64 | -184.9 | 28.38 | 400 | — | 1.25 | |
| 0934 | 17.95 | 1651 | 3.2 | 0.30 | 6.66 | -204.3 | 28.37 | 500 | — | 3.25 | |
| 0939 | 17.98 | 1651 | 2.0 | 0.18 | 6.66 | -207.1 | 28.37 | 350 | — | 5.75 | |
| 0944 | 18.49 | 1656 | 1.5 | 0.14 | 6.67 | -203.0 | 28.36 | 450 | — | 7.5 | |
| | | | | | | | | | | | Hach iron 0.5 mg/L |

Recorded By: R Mullen

2/24/2015

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 2/25/15

# Ground Water Sampling Data Sheet

**Well ID:** MW-145 **Sample ID:** MW-145 **Sample Time:** 1242

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, light breeze
Screened interval(s): 33'-45'
Sampling personnel: D Werth R Mullen
Total depth:
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.48'
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI 556
Measuring point: **North side of casing**
Pump depth setting: 39'
Pump type/model: Megamonsoons

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (~~mS/cm~~) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1225 | 18.46 | 1302 | 39.4 | 3.74 | 7.29 | -24.9 | 28.71 | 375 | — | ~~187~~ | faint odor |
| 1230 | 18.53 | 1308 | 39.6 | 3.68 | 7.26 | -23.5 | 28.57 | 400 | — | 1875 | |
| 1235 | 19.24 | 1308 | 35.1 | 3.23 | 7.24 | -22.6 | 28.70 | 450 | — | 3875 | |
| 1240 | 19.30 | 1306 | 32.8 | 3.02 | 7.24 | -22.3 | 28.90 | 450 | — | 6125 | Hach iron Ø mg/L |

**Recorded By:** R Mullen

2/24/2015

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 2-25-15

# Ground Water Sampling Data Sheet

**Well ID:** OB-3 **Sample ID:** OB-3 **Sample Time:** 1323

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Clear ~50°F
Screened interval(s): 29'-49'
Sampling personnel: DWeth, G. Mullen
Total depth: 49'
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.91
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI 556
Measuring point: **North side of casing**
Pump depth setting: 39'
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1306 | 18.79 | 1283 | 13.0 | 1.11 | 7.11 | -37.2 | 27.93 | 450 | — | 0 | faint odor |
| 1311 | 19.01 | 1284 | 3.3 | 0.31 | 7.10 | -38.0 | 27.93 | 400 | — | 2250 | |
| 1316 | 18.90 | 1291 | 2.7 | 0.24 | 7.10 | -39.4 | 27.93 | 400 | — | 4250 | |
| 1321 | 19.28 | 1301 | 1.7 | 0.16 | 7.09 | -42.7 | 27.93 | 400 | — | 6250 | Hach iron 2.5 mg/L |
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**Recorded By:** RMullen

2/24/2015

Laun-Dry Supply Co.

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Date: 04-23-2015

## Ground Water Sampling Data Sheet

Flock Iron = 1.5 mg/L

Well ID: MW-6A  Sample ID: MW-6A  Sample Time: 0928

Casing diameter/type: 4"
Screened interval(s):
Total depth: 42.70
28.58 Initial depth to water (w/o pump): 28.56
Final depth to water (w/o pump):
Measuring point: **North side of casing**

Well location: Laun-Dry Supply Co.
Sampling personnel: A Spilk, Colton Lake
Sampling method: **Low-flow**
Water level indicator: **Solinst**
Water quality meter: YSI 556 MPS
Pump depth setting: 35.8

Weather: warm, hazey, breezey
Pump type/model: Mega Manifold

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0853 | | | | | 6.78 | | | | | | |
| 0857 | 19.18 | 1.351 | 2.4 | 0.21 | 6.80 | ~~-13.3~~ NM | 28.61 | 750 | | | |
| 0902 | 19.22 | 1.351 | 1.6 | 0.15 | 6.86 | ~~-16.2~~ NM | 28.60 | 600 | | | |
| 0907 | 19.26 | 1.351 | 1.4 | 0.13 | 6.89 | ~~-17.4~~ NM | 28.60 | 500 | | | |
| 0912 | 19.32 | 1.351 | 1.2 | 0.11 | 6.90 | ~~-18.8~~ NM | 28.60 | 500 | | | |
| 0917 | 19.33 | 1.351 | 1.1 | 0.10 | 6.93 | 86.9 | 28.60 | 600 | | | |
| 0922 | 19.39 | 1.351 | 1.1 | 0.10 | 6.94 | 74.0 | 28.60 | 500 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: [signature]

4/17/2015

Laun-Dry Supply Co.

C

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## Ground Water Sampling Data Sheet

Hach Iron = 0.0 mg/L

Well ID: SVE-1 Sample ID: SVE-1 Sample Time: 1055

Casing diameter/type: 2"
Screened interval(s):
Total depth: 38.80
28.80 Initial depth to water (w/o pump): 28.79
Final depth to water (w/o pump):
Measuring point: **North side of casing**

Well location: Laun-Dry Supply Co.
Sampling personnel: C. Lake A. Spiller
Sampling method: **Low-flow**
Water level indicator: **Solinst**
Water quality meter: YSI 556 MPS
Pump depth setting: 33.96

Weather: warm, windy, cloudy
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1020 | | | | | | | | | | | |
| 1025 | 20.16 | 1.783 | 9.8 | 0.88 | 7.00 | 86.8 | 28.80 | 100 | | | Cloudy |
| 1030 | 20.69 | 1.785 | 8.3 | 0.73 | 6.95 | 87.6 | 28.81 | 100 | | | |
| 1035 | 21.92 | 1.776 | 8.3 | 0.75 | 6.70 | 89.1 | 28.81 | 900 | | | |
| 1040 | 20.80 | 1.743 | 2.7 | 0.24 | 6.90 | 88.1 | 28.81 | 100 | | | |
| 1045 | 20.38 | 1.750 | 3.1 | 0.28 | 6.90 | 88.2 | 28.81 | 100 | | | |
| 1050 | 20.31 | 1.733 | 2.7 | 0.24 | 6.90 | 86.7 | 28.82 | 100 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: CZ

Laun-Dry Supply Co.

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## Ground Water Sampling Data Sheet

Hach Iron 1.5 mg/L

Well ID: MW-6C  Sample ID: MW-6C  Sample Time: 1630

Casing diameter/type: 4"  Well location: Laun-Dry Supply Co.  Weather: Overcast

Screened interval(s):  Sampling personnel: C. Lake  A. Spiller

Total depth: 41.50  Sampling method: **Low-flow**

27.00 Initial depth to water (w/o pump): NM  Water level indicator: **Solinst**

Final depth to water (w/o pump):  Water quality meter: YSI 556 MPS

Measuring point: **North side of casing**  Pump depth setting: 34.45  Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1600 | 19.74 | 1.428 | 12.3 | 1.11 | 6.75 | -91.4 | 27.40 | 500 | | | Heavy odor, dark water |
| 1605 | 19.79 | 1.427 | 10.9 | 0.99 | 6.75 | -109.2 | 27.39 | 400 | | | almost black, carbon in |
| 1610 | 19.93 | 1.425 | 10.5 | 0.95 | 6.76 | -117.9 | 27.27 | 400 | | | flow through cell |
| 1615 | 19.89 | 1.421 | 7.3 | 0.66 | 6.76 | -124.0 | 27.30 | 400 | | | |
| 1620 | 20.07 | 1.412 | 1.6 | 0.14 | 6.74 | -129.5 | 27.30 | 200 | | | |
| 1625 | 20.12 | 1.408 | 1.5 | 0.13 | 6.75 | -132.5 | 27.22 | 200 | | | |

1555
~~1552~~

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33%  ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13%  In ex. stabilization has not occurred.

Recorded By: [signature]

Laun-Dry Supply Co.

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Date: 4/23/15

## Ground Water Sampling Data Sheet

Well ID: OB-2 Sample ID: OB-2 Sample Time: 1532

Hach Iron 1 mg/L

Casing diameter/type: 2" Well location: Laun-Dry Supply Co. Weather: Warm Hazy

Screened interval(s): Sampling personnel: C. Lake A. Spiller

Total depth: 49.45 Sampling method: **Low-flow**

28.17 Initial depth to water (w/o pump): 28.14 Water level indicator: **Solinst**

Final depth to water (w/o pump): Water quality meter: YSI 556 MPS

Measuring point: **North side of casing** Pump depth setting: 38.97 Pump type/model: Mega Mansion

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1502 | | | | | | | | | | | |
| 1507 | 20.13 | 1.279 | 0.2 | 0.02 | 6.99 | -31.9 | 28.20 | 600 | | | Strong Odor, very dark water almost black, carbon in flow through cell |
| 1512 | 20.89 | 1.362 | 0.8 | 0.07 | 6.97 | -58.0 | 28.20 | 500 | | | |
| 1517 | 20.79 | 1.416 | 0.9 | 0.08 | 6.97 | -77.0 | 28.19 | 350 | | | |
| 1522 | 20.38 | 1.460 | 0.6 | 0.06 | 6.97 | -88.5 | 28.21 | 400 | | | |
| 1527 | 20.31 | 1.470 | 0.6 | 0.05 | 6.98 | -99.8 | 28.20 | 500 | | | |
| 1532 | 20.61 | 1.481 | 0.6 | 0.05 | 6.96 | -102.6 | 28.20 | 400 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: CL

4/17/2015

Laun-Dry Supply Co.

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# Ground Water Sampling Data Sheet

Well ID: MW-14S  Sample ID: MW-14S  Sample Time: 1320

Hach IRon = 0.5 mg/L

Casing diameter/type: 2"
Screened interval(s):
Total depth: 48.70
29.00 Initial depth to water (w/o pump): 29.00
Final depth to water (w/o pump):
Measuring point: **North side of casing**

Well location: Laun-Dry Supply Co.
Sampling personnel: C. Lake A. Spiller
Sampling method: **Low-flow**
Water level indicator: **Solinst**
Water quality meter: YSI 556 MPS
Pump depth setting: 40.00

Weather: Warm, Hazy
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1245 | | | | | | | | | | | |
| 1250 | 20.22 | 1.420 | 21.1 | 1.87 | 6.98 | 108.8 | 29.01 | 500 | | | |
| 1255 | 20.37 | 1.412 | 6.0 | 0.53 | 7.03 | 99.3 | 29.03 | 500 | | | |
| 1300 | 20.49 | 1.408 | 5.9 | 0.53 | 7.04 | 96.5 | 29.03 | 500 | | | |
| 1305 | 20.44 | 1.387 | 6.4 | 0.58 | 7.05 | 92.7 | 28.99 | 500 | | | |
| 1310 | 20.42 | 1.365 | 7.0 | 0.63 | 7.08 | 88.9 | 29.04 | ~~500~~ 550 | | | |
| 1315 | 20.21 | 1.353 | 6.4 | 0.58 | 7.11 | 84.9 | 29.33 | 500 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: CZ

4/17/2015

Laun-Dry Supply Co.

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Date: 4/23/15

## Ground Water Sampling Data Sheet

Well ID: OB-3 Sample ID: OB-3 Sample Time: 1425

High Iron 2.5 mg/L

Casing diameter/type: 2" Well location: Laun-Dry Supply Co. Weather: Warm Hazy

Screened interval(s): Sampling personnel: C. Lalie A. Spiller

Total depth: 48.20 Sampling method: **Low-flow**

27.75 Initial depth to water (w/o pump): 27.74 Water level indicator: **Solinst** ~~YSI 556 MPS~~ OL

Final depth to water (w/o pump): Water quality meter: YSI 556 MPS

Measuring point: **North side of casing** Pump depth setting: 38 Pump type/model: Mega Mansoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1350 | | | | | | | | | | | |
| 1355 | 20.16 | 1.268 | 2.9 | 0.26 | 7.19 | 59.2 | 27.76 | 450 | | | Slight Odor |
| 1400 | 20.26 | 1.287 | 1.5 | 0.14 | 7.02 | 52.5 | 27.78 | 350 | | | |
| 1405 | 20.41 | 1.291 | 1.4 | 0.13 | 7.03 | 46.8 | 27.78 | 400 | | | |
| 1410 | 20.02 | 1.299 | 1.2 | 0.10 | 7.04 | 37.4 | 27.80 | 400 | | | |
| 1415 | 20.05 | 1.305 | 1.3 | 0.11 | 7.06 | 29.3 | 27.79 | 400 | | | |
| 1420 | 20.03 | 1.307 | 1.4 | 0.13 | 7.07 | 21.4 | 27.80 | 350 | | | |
| ~~1425~~ | ✓ | | | | | | | | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: [signature]

4/17/2015

Laun-Dry Supply Co.

Sheet 1 of 1
Date: 7/22/15

## Ground Water Sampling Data Sheet

**Well ID:** MW-6A **Sample ID:** MW-6A **Sample Time:** 0848

Casing diameter/type: 4" Well location: Laun-Dry Supply Co. Weather: warm, clear, calm

Screened interval(s): Sampling personnel: CL TC

Total depth: 42.65 Sampling method: **Low-flow**

Initial depth to water (w/o pump): 28.22 Water level indicator: **Solinst**

Final depth to water (w/o pump): 28.22 Water quality meter: YSI

Measuring point: **North side of casing** Pump depth setting: ~~21.00~~ cL 35.44 Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| Startup 0814 | 20.89 | 1461 | 18.4 | 1.61 | 5.90 | 110.0 | ~~28.22~~ 28.22 | 200 | | | Hach = 1.5 mg/L |
| 0819 | 20.77 | 1421 | 9.0 | 0.81 | 6.39 | 27.0 | 28.24 | 250 | | | |
| 0824 | 20.92 | 1410 | 7.8 | 0.69 | 6.47 | 10.0 | 28.24 | 200 | | | |
| 0829 | 21.15 | 1412 | 6.1 | 0.57 | 6.52 | ~~-2.2~~ -7.4 cL | 28.24 | 250 | | | ORP = -7.4 |
| 0835 | 21.64 | 1408 | 7.0 | 0.60 | 6.57 | -19.2 | 28.23 | 200 | | | |
| 0839 | 21.59 | 1410 | 6.0 | 0.53 | 6.58 | -23.0 | 28.24 | 200 | | | |
| 0844 | 21.75 | 1408 | 6.2 | 0.55 | 6.59 | -24.9 | 28.24 | 200 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

**Recorded By:** _____

7/21/2015

Laun-Dry Supply Co.

Sheet ____ of ____
Date: 7/22/15

# Ground Water Sampling Data Sheet

Well ID: SVE-1 Sample ID: SVE-1 Sample Time: 1445

Casing diameter/type: 2"
Well location: Laun-Dry Supply Co.
Weather: Hot, sunny, 90°
Screened interval(s):
Sampling personnel: TC CL
Total depth: 38.70
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 28.45
Water level indicator: **Solinst**
Final depth to water (w/o pump): 28.45
Water quality meter: YSI
Measuring point: **North side of casing**
Pump depth setting: ~~33.6~~ CL 33.57
Pump type/model: Aqua Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1403 | 22.47 | 1816 | 16.1 | 1.36 | 6.76 | 69.2 | 28.46 | 350 | | | Hach = 0.5 mg/L |
| 1408 | 21.58 | 1793 | 6.0 | 0.50 | 6.69 | 70.3 | 28.48 | 350 | | | |
| 1413 | 20.85 | 1770 | 4.2 | 0.37 | 6.69 | 68.9 | 28.47 | 350 | | | |
| 1418 | 21.93 | 1754 | 4.2 | 0.37 | 6.72 | 59.6 | 28.46 | 325 | | | |
| 1423 | 22.12 | 1756 | 4.3 | 0.38 | 6.71 | 48.2 | 28.45 | 300 | | | |
| 1428 | 21.60 | 1745 | 4.3 | 0.38 | 6.71 | 37.9 | 28.46 | 400 | | | |
| 1433 | 21.64 | 1736 | 4.6 | 0.40 | 6.71 | 29.9 | 28.46 | 350 | | | |
| 1438 | 21.70 | 1720 | 4.2 | 0.35 | 6.71 | 19.3 | 28.46 | 400 | | | |
| 1443 | 21.90 | 1714 | 4.0 | 0.35 | 6.71 | 13.3 | 28.46 | 400 | | | |
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Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: _____

Laun-Dry Supply Co.

Sheet ____ of ____
Date: 7/22/15

## Ground Water Sampling Data Sheet

Well ID: MW-6C Sample ID: MW-6C Sample Time: 0953

Casing diameter/type: 4" Well location: Laun-Dry Supply Co. Weather: warm, sunny, clear

Screened interval(s): Sampling personnel: CL TC

Total depth: 41.50 Sampling method: **Low-flow**

Initial depth to water (w/o pump): 26.72 Water level indicator: **Solinst**

Final depth to water (w/o pump): 26.72 Water quality meter: YSI

Measuring point: **North side of casing** Pump depth setting: 34.11 Pump type/model: Grundfos Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (~~mS/cm~~) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 0925 | 22.62 | 1578 | 41.3 | 3.51 | 6.33 | 84.1 | 26.72 | 250 | | | Strong odor, dark black color |
| 0930 | 21.60 | 1577 | 20.4 | 1.78 | 6.29 | -97.7 | 26.75 | 300 | | | |
| 0935 | 21.97 | 1571 | 11.9 | 1.02 | 6.30 | -97.2 | 26.75 | 250 | | | |
| 0940 | 21.65 | 1569 | 9.3 | 0.81 | 6.28 | -96.8 | 26.75 | 300 | | | Hach = 5.5 mg/L |
| 0945 | 21.24 | 1573 | 8.6 | 0.76 | 6.28 | -94.4 | 26.75 | 325 | | | |
| 0950 | 20.85 | 1571 | 8.3 | 0.74 | 6.28 | -94.1 | 26.76 | 325 | | | |

Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: _____

7/21/2015

Laun-Dry Supply Co.

Sheet ____ of ____
Date: 7/22/15

# Ground Water Sampling Data Sheet

Well ID: OB-2 Sample ID: OA-2 Sample Time: 1055

Casing diameter/type: 2
Well location: Laun-Dry Supply Co.
Weather: Sunny, warm
Screened interval(s):
Sampling personnel: CL TC
Total depth: 49.46
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.81
Water level indicator: **Solinst**
Final depth to water (w/o pump): 27.81
Water quality meter: YSI
Measuring point: **North side of casing** 27.81
Pump depth setting: 38.64
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1025 | 22.80 | 1387 | 17.5 | 1.43 | 6.75 | -102.9 | 27.82 | 375 | | | Hach = 3.0 mg/L |
| 1030 | 21.82 | 1384 | 4.4 | 0.38 | 6.68 | -102.2 | 27.82 | 300 | | | |
| 1035 | 21.90 | 1399 | 3.0 | 0.26 | 6.67 | -106.2 | 27.82 | 300 | | | |
| 1040 | 22.00 | 1449 | 2.9 | 0.25 | 6.68 | -88.7 | 27.82 | 350 | | | |
| 1045 | 22.18 | 1461 | 2.4 | 0.21 | 6.67 | -84.7 | 27.82 | 300 | | | |
| 1050 | 21.98 | 1486 | 2.0 | 0.17 | 6.67 | -81.8 | 27.82 | 300 | | | |
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Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: _____

7/21/2015

Laun-Dry Supply Co.

Sheet ____ of ____
Date: 7/22/15

# Ground Water Sampling Data Sheet

Well ID: MW-145 Sample ID: MW-145 Sample Time: 1322

Casing diameter/type: 2"
Well location: Laun-Dry Supply Co.
Weather: Sunny, warm, ~95°
Screened interval(s):
Sampling personnel: CL TL
Total depth: 48.65
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 26.93
Water level indicator: **Solinst**
Final depth to water (w/o pump): 27.36
Water quality meter: YSI
Measuring point: **North side of casing**
Pump depth setting: 37.79
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1255 | 24.37 | 835 | 82.8 | 7.03 | 7.15 | -87.6 | ~~43x~~ | 425 | | | Water level = 28.30 |
| 1300 | 22.57 | 806 | 79.9 | 6.89 | 7.17 | -85.4 | 28.45 | 425 | | | |
| 1305 | 23.36 | 777 | 73.7 | 6.24 | 7.13 | -60.4 | 28.18 | 300 | | | Hach = 0.5 mg/L |
| 1310 | 23.13 | 765 | 71.7 | 6.12 | 7.12 | -54.8 | 28.25 | 300 | | | |
| 1315 | 22.55 | 768 | 70.4 | 6.08 | 7.12 | -45.10 | 28.40 | 375 | | | |
| 1320 | 22.90 | 746 | 64.7 | 5.54 | 7.10 | -45.3 | 28.36 | 350 | | | |
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Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

Recorded By: _____

Laun-Dry Supply Co.

Sheet ____ of ____
Date: 7/22/15

# Ground Water Sampling Data Sheet

**Well ID:** OB-3 **Sample ID:** OB-3 **Sample Time:** 1234

Casing diameter/type: 2"
Well location: Laun-Dry Supply Co.
Weather: Sunny, Hot, 98°
Screened interval(s):
Sampling personnel: CL TC
Total depth: 48.10
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.38
Water level indicator: **Solinst**
Final depth to water (w/o pump): 27.38
Water quality meter: YSI
Measuring point: **North side of casing**
Pump depth setting: 37.74
Pump type/model: Mega Mahjoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp (°C)** | **Conductivity (mS/cm) or (µS/cm)** | **DO (%)** | **DO (mg/L)** | **pH** | **ORP (mV)** | **Water Level (feet btoc)** | **Flow Rate (L/min) or (mL/min)** | **Turbidity (NTU)** | **Purge Volume (L) or (mL)** | **Additional Comments** |
| 1208 | 22.76 | 1300 | 6.8 | 0.58 | 6.91 | -65.2 | 27.40 | 225 | | | Hach = 2.0 mg/L |
| 1213 | 22.84 | 1313 | 5.4 | 0.47 | 6.88 | -66.7 | 27.40 | 300 | | | |
| 1218 | 22.15 | 1321 | 3.4 | 0.32 | 6.88 | -67.4 | 27.40 | 375 | | | |
| 1223 | 21.81 | 1317 | 2.8 | 0.25 | 6.87 | -69.0 | 27.41 | 400 | | | |
| 1228 | 21.84 | 1325 | 2.8 | 0.24 | 6.87 | -66.5 | 27.41 | 400 | | | |
| 1233 | 22.11 | 1330 | 3.0 | 0.26 | 6.86 | -65.4 | 27.41 | 400 | | | |
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Parameter Stabilization Limits (3 consecutive readings) for percent difference type parameters.
Percent difference formula =
ABS[((first reading - second reading)/first reading) x 100]
Ex: Readings 12, 16, 15, 13
((12-16)/12)*100 = 33% ((16-15)/16)*100 = 6%
((15-13)/15)*100 = 13% In ex. stabilization has not occurred.

**Recorded By:** CJ

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

## Ground Water Sampling Data Sheet

Well ID: MW-6A  Sample ID: MW-6A  Sample Time: 1410

Casing diameter/type: 4" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, 60°
Screened interval(s):
Sampling personnel: David Werth / Laura Van Alst
Total depth: 42.80
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.65
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YDI & Flow Cell
Measuring point: **North side of casing**
Pump depth setting: 35'
Pump type/model: Mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1354 | 17.5 | 1404 | 11.5 | 1.09 | 7.65 | -28.3 | 27.69 | 450 | | | |
| 1359 | 18.3 | 1423 | 5.3 | 0.52 | 7.68 | -59.9 | 27.68 | 400 | | | |
| 1404 | 18.3 | 1424 | 3.8 | 0.34 | 7.68 | ~~-56.9~~ | 27.68 | 400 | | | |
| ~~1409~~ | ~~+~~ | | | | | -40.4 | ~~27.68~~ | | | | |
| 1409 | 18.4 | 1425 | 2.0 | 0.17 | 7.71 | -14.5 | 27.68 | 400 | | | |
| | | | | | | | | | | | 2.5 mg/L $Fe^{2+}$ |

Recorded By: Laura Van Alst

2/24/2015

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

# Ground Water Sampling Data Sheet

Well ID: MW-6C Sample ID: MW-6C Sample Time: 1220

Casing diameter/type: 4" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny ~50°
Screened interval(s):
Sampling personnel: David Westh / Laura Van Alst
Total depth: 41.6
Sampling method: Low-flow
Initial depth to water (w/o pump): 26.11
Water level indicator: Solinst
Final depth to water (w/o pump):
Water quality meter: YSI & Flow Cell
Measuring point: North side of casing
Pump depth setting: 34'
Pump type/model:

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1203 | 18.0 | 1404 | 27.2 | 2.55 | 7.75 | -109.3 | 26.14 | 450 | | | ~~0 mg/L $Fe^{2+}$~~ |
| 1208 | 18.4 | 1400 | 18.8 | 1.76 | 7.74 | -112.5 | 26.13 | 300 | | | |
| 1213 | 18.4 | 1401 | 12.7 | 1.15 | 7.68 | -103.6 | 26.13 | 325 | | | |
| 1218 | 18.1 | 1401 | 9.6 | 0.90 | 7.65 | -102.4 | 26.13 | 250 | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | $Fe^{2+}$ could not be measured. |

Recorded By: Laura Van Alst

2/24/2015

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

# Ground Water Sampling Data Sheet

Well ID: SVE-1 Sample ID: SVE-1 Sample Time: 1450

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny, 60°
Screened interval(s):
Sampling personnel: David Werth / Laura Van Alst
Total depth: 38.80
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.89
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI & load cell
Measuring point: **North side of casing**
Pump depth setting: 33
Pump type/model: mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity ~~(mS/cm)~~ or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate ~~(L/min) or~~ (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1429 | 17.4 | 1850 | 29.8 | 2.87 | 7.64 | 75.8 | 27.91 | 375 | | ~~375~~ | |
| 1434 | 18.2 | 1845 | 66.3 | 6.44 | 7.64 | 90.0 | 27.91 | 425 | | | bubble on $O_2$ sensor |
| 1439 | 17.7 | 1843 | 8.6 | 0.82 | 7.65 | 83.9 | 27.91 | 350 | | | |
| 1444 | 18.4 | 1852 | 8.0 | 0.77 | 7.70 | 107.4 | 27.91 | 300 | | | |
| | | | | | | | | | | | 0 mg/L $Fe^{2+}$ |

Recorded By: Laura Van Alst

2/24/2015

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

## Ground Water Sampling Data Sheet

Well ID: OB-2 Sample ID: OB-2 Sample Time: 1300

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny ~50°
Screened interval(s):
Sampling personnel: David Werth / Laura Van Alst
Total depth: 49.55
Sampling method: **Low-flow**
Initial depth to water (w/o pump): 27.21
Water level indicator: **Solinst**
Final depth to water (w/o pump):
Water quality meter: YSI & Flow Cell
Measuring point: **North side of casing**
Pump depth setting: 38'
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate ~~(L/min) or~~ (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1243 | 17.8 | 1302 | 6.0 | 0.47 | 7.66 | -89.9 | 27.21 | 325 | | | |
| 1248 | 17.6 | 1305 | 5.6 | 0.54 | 7.69 | -101.0 | 27.20 | 300 | | | |
| 1253 | 18.6 | 1321 | 3.9 | 0.37 | 7.71 | -98.7 | 27.21 | 350 | | | |
| 1258 | 19.0 | 1339 | 4.8 | 0.45 | 7.70 | -88.5 | 27.21 | 275 | | | |
| 1300 | sampled | | | | | | | | | | 3.5 mg/L $Fe^{2+}$ |

Recorded By: Laura Van Alst

2/24/2015

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

# Ground Water Sampling Data Sheet

Well ID: MW-14S  Sample ID: MW-14S  Sample Time: 1050

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny 47°
Screened interval(s):
Sampling personnel: David Weth / Laura Van Alst
Total depth: 48.9
Sampling method: Low-flow
Initial depth to water (w/o pump): 26.60
Water level indicator: Solinst
Final depth to water (w/o pump):
Water quality meter: YSI & Load Cell
Measuring point: North side of casing
Pump depth setting: 38'
Pump type/model: Mega Monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity ~~(mS/cm) or~~ (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate ~~(L/min) or~~ (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| 1031 | 16.5 | 866 | ~~54.1~~ 54.1 | 5.22 | 7.84 | 297.3 | 27.43 | 225 | | | |
| 1036 | 16.4 | 848 | 53.1 | 5.18 | 7.85 | 294.7 | 27.23 | 250 | | | 0 mg/L $Fe^{2+}$ |
| 1041 | 16.3 | 846 | 51.8 | 5.08 | 7.87 | 293.6 | 27.10 | 225 | | | |
| 1046 | 16.6 | 846 | 49.8 | 4.84 | 7.88 | 291.9 | 27.09 | 200 | | | |

Recorded By: Laura Van Alst

2/24/2015

Laun-Dry Supply Co.

Sheet _____ of _____
Date: 1-20-16

# Ground Water Sampling Data Sheet

Well ID: OB-3 Sample ID: OB-3 Sample Time: 1135

Casing diameter/type: 2" PVC
Well location: Laun-Dry Supply Co.
Weather: Sunny 48°
Screened interval(s):
Sampling personnel: David Werth / Laura Van Alst
Total depth: 48.30
Sampling method: Low-flow
Initial depth to water (w/o pump): 26.80
Water level indicator: Solinst
Final depth to water (w/o pump):
Water quality meter: YSI & Flow cell
Measuring point: North side of casing
Pump depth setting: 37.5
Pump type/model: mega monsoon

| 3-5 min | Δ < 10% | Δ < 10% | | | Δ < 10% | | Δ < 0.3 ft | < 1L/min | < 10 NTU | < 0.5 L/min | Parameter Stabilization Limits (3 consecutive readings) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Temp (°C) | Conductivity (mS/cm) or (µS/cm) | DO (%) | DO (mg/L) | pH | ORP (mV) | Water Level (feet btoc) | Flow Rate (L/min) or (mL/min) | Turbidity (NTU) | Purge Volume (L) or (mL) | Additional Comments |
| | | | | | | | 26.80 | | | | |
| 1116 | 16.7 | 1232 | 33.4 | 3.21 | 7.76 | 91.3 | 26.81 | 400 | | | |
| 1121 | 17.2 | 1326 | 8.6 | 0.72 | 7.79 | -11.6 | 26.81 | 325 | | | |
| 1126 | 17.0 | 1324 | 3.5 | 0.34 | 7.87 | -32.4 | 26.81 | 250 | | | |
| 1131 | 16.5 | 1324 | 3.7 | 0.36 | 7.93 | -40.5 | 26.81 | 200 | | | |
| | | | | | | | | | | | 3.0 mg/L $Fe^{2+}$ |

Recorded By: Laura Van Alst

2/24/2015

# ATTACHMENT 2
# ANALYTICAL LABORATORY REPORTS
# (on Compact Disc)

# ATTACHMENT 3
# CENSUS RESULTS AND INFORMATION

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Fax: (865) 573-8133

**Client:** Teri McMillan
EA Engineering, Science, and Technology, Inc.
320 Gold Ave SW
Ste 1210
Albuquerque, NM 87102

**Phone:** 505-224-9013

**Fax:**

**Identifier:** 098MI **Date Rec:** 09/25/2015 **Report Date:** 09/29/2015

**Client Project #:** 14394 **Client Project Name:** Laun-Dry

**Purchase Order #:** 14394

**Analysis Requested:** CENSUS

**Reviewed By:**

NOTICE: This report is intended only for the addressee shown above and may contain confidential or privileged information. If the recipient of this material is not the intended recipient or if you have received this in error, please notify Microbial Insights, Inc. immediately. The data and other information in this report represent only the sample(s) analyzed and are rendered upon condition that it is not to be reproduced without approval from Microbial Insights, Inc. Thank you for your cooperation.

**MICROBIAL INSIGHTS, INC.**

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Tel. (865) 573-8188 Fax. (865) 573-8133

**CENSUS**

**Client:** **EA Engineering, Science, and Technology, In**
Project: Laun-Dry

**MI Project Number:** **098MI**
Date Received: 09/25/2015

## Sample Information

| **Client Sample ID:** | **MW-6A** | **MW-6C** | **MW-14S** |
|---|---|---|---|
| Sample Date: | 09/24/2015 | 09/24/2015 | 09/25/2015 |
| Units: | cells/mL | cells/mL | cells/mL |
| Analyst: | JS | JS | JS |

## Dechlorinating Bacteria

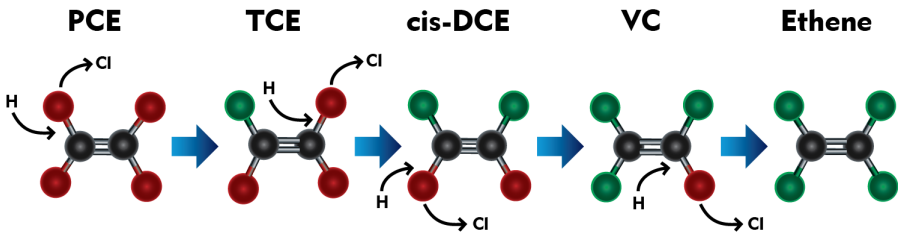
| | | | | |
|---|---|---|---|---|
| *Dehalococcoides* | *DHC* | **8.20E+00** | **1.35E+01** | **8.42E+02** |
| tceA Reductase | TCE | **3.00E-01 (J)** | <1.00E+00 | <6.00E-01 |
| BAV1 Vinyl Chloride Reductase | BVC | <5.00E-01 | <1.00E+00 | <6.00E-01 |
| Vinyl Chloride Reductase | VCR | <5.00E-01 | <1.00E+00 | <6.00E-01 |

**Legend:**
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

# DHC Interpretation

### *Dehalococcoides* 16S rRNA gene (qDHC)

Under anaerobic conditions, tetrachloroethene (PCE) and trichloroethene (TCE) can undergo sequential reductive dechlorination through the daughter products *cis*-dichloroethene (*cis*-DCE) and vinyl chloride to nontoxic ethene (1,2).




While a number of bacterial cultures capable of utilizing PCE and TCE as growth supporting electron acceptors have been isolated (3-7), *Dehalococcoides* spp. may be the most important because they are the only bacterial group that has been isolated to date which is capable of complete reductive dechlorination of PCE to ethene (8). In fact, the presence of *Dehalococcoides* spp. has been associated with complete dechlorination to ethene at sites across North America and Europe (9).

| Status | *Dehalococcoides spp.* | Observation |
|---|---|---|
| | **≥ $10^4$** (cells/mL) | Lu et al. proposed that a concentration of 1 x $10^4$ DHC cells/mL could be used as a screening criterion to identify sites where reductive dechlorination will yield a generally useful biodegradation rate (10).<br><br>Similarly, in an internal study conducted with nearly 1000 groundwater samples obtained from sites across the US, ethene production was observed in approximately 80% of samples in which CENSUS® qDHC results were greater than or equal to $10^4$ DHC cells/mL. |
| | **$10^1$ to < $10^4$** (cells/mL) | When vinyl chloride reductase genes (See DHC functional genes discussion below) are also detected, complete reductive dechlorination of PCE and TCE to ethene may still occur even with moderate DHC concentrations.<br><br>When the DHC population is below the $10^4$ cells/mL criterion proposed by Lu et al. (10), project managers should carefully consider other site-specific data to determine whether subsurface conditions may be limiting reductive dechlorination. For example, the addition of an electron donor may be able to stimulate DHC growth and enhance anaerobic bioremediation. |
| | **< $10^1$** (cells/mL) | DHC concentrations are low suggesting that complete reductive dechlorination of PCE and TCE to ethene is unlikely to occur under existing conditions. Enhanced anaerobic bioremediation options (biostimulation or bioaugmentation) may need to be considered. |



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### DHC Functional Genes (*tce*A, *bvc*A, *vcr*A)

A "stall" where daughter products *cis*-DCE and vinyl chloride accumulate can occur at PCE- and TCE-impacted sites especially under MNA conditions. The accumulation of vinyl chloride, generally considered more carcinogenic than the parent compounds, is particularly problematic. Although elevated *Dehalococcoides* concentrations correspond to ethene production in numerous studies, the range of chlorinated ethenes metabolized and cometabolized varies among species and strains within the *Dehalococcoides* genus. For example, *Dehalococcoides ethenogenes* str. 195 metabolizes PCE, TCE, and *cis*-DCE and cometabolizes vinyl chloride (8) to produce ethene. Conversely, *Dehalococcoides* sp. CBDB1 utilizes PCE and TCE but does not cometabolize additional chloroethenes (11). Other *Dehalococcoides* strains, such as BAV1, GT and VS, are known to fully dechlorinate cis-DCE and VC to ethene (14,16,19). Quantification of reductive dehalogenase genes is used to more definitively confirm the potential for reductive dechlorination of TCE, cis-DCE, and vinyl chloride (12-15).

| Functional Gene | Observation |
|---|---|
| **TCE Reductase** | |
| ***tce*A gene** | The *tce*A gene encodes the enzyme responsible for reductive dechlorination of TCE to *cis*-DCE in some strains of *Dehalococcoides*.<br>Absence of *tce*A does not preclude the potential for reductive dechlorination of TCE in the field since the *tce*A gene is not universally distributed among all DHC and is not present in other microorganisms capable of reductive dechlorination of TCE (e.g. *Dehalobacter*).<br>Detection of the *tce*A gene provides an additional line of evidence indicating the potential for dechlorination of TCE. |
| **Vinyl Chloride Reductase** | |
| ***bvc*A gene** | The *bvc*A gene encodes the vinyl chloride reductase enzyme responsible for reductive dechlorination of vinyl chloride to ethene by *Dehalococcoides* sp. str. BAV1 (16).<br>Presence of *bvc*A gene indicates the potential for reductive dechlorination of VC to ethene.<br>Absence of both *bvc*A and *vcr*A genes suggests VC may accumulate.<br>An internal study with ~1,000 samples showed ethene production was observed in 80% of the samples that the DHC population was greater than or equal to $10^4$ cells/mL. The *bvc*A gene was detected in over 50% of these samples.<br>Van Der Zaan et al (17) noted that the bvcA gene was the only VC reductase gene detected at three of their sites.<br>Alfred Spormann's laboratory at Stanford University (18) reported that the *bvc*A gene was the most abundant and active at the outflow of a PCE fed column study. This section of the column was in the DCE to VC stages of reductive dechlorination thus confirming the importance of the *bvc*A gene for complete reductive dechlorination. |
| ***vcr*A gene** | The *vcr*A gene encodes the vinyl chloride reductase enzyme responsible for reductive dechlorination of *cis*-DCE and vinyl chloride by *Dehalococcoides* sp. strain VS (14).<br>Presence of *vcr*A gene indicates the potential for reductive dechlorination of DCE and/or VC to ethene.<br>Absence of both *bvc*A and *vcr*A genes suggest VC may accumulate.<br>As with the *bvc*A gene, detection of the *vcr*A gene is associated with ethene production in internal studies (67%) and vinyl chloride reduction in independent studies (14, 17). |



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## Reporting

Microbial Insights can provide a variety of data packages and reporting levels to suit the needs of any project. Data packages range from simple analytical reports with results only to more complex data packages that include a report narrative, analytical results, QC data, and supporting materials including all raw data and chain-of-custody documentation. The figure below shows our standard report and explains the way values are reported.

**Microbial Insights, Inc.**

2340 Stock Creek Blvd. Rockford, TN 37853-3044
Tel. (865) 573-8188 Fax. (865) 573-8133

**CENSUS**

**Client:** Company Name
Project: Your Project Name

**MI Project Number:** Unique Laboratory Identifier
Date Received: Date Samples Arrived

**Sample Information**

| **Client Sample ID:** | | Sample A | Sample B | Sample C |
|---|---|---|---|---|
| Sample Date: | | 00/00/0000 | 00/00/0000 | 00/00/0000 |
| Units: | | cells/mL | cells/mL | cells/mL |
| Analyst: | | Intials | Intials | Intials |
| Dechlorinating Bacteria | | | | |
| *Dehalococcoides spp.* | DHC | **1.84E+05** | **2.76E+02** | **2.28E+01 (J)** |
| Functional Genes | | | | |
| tceA Reductase | TCE | **6.00E+01** | **3.23E+01** | <4.00E-01 |
| bvcA Reductase | BVC | **1.17E+04** | **1.81E+01** | <4.00E-01 |
| vcrA Reducatase | VCR | **8.42E+04** | **1.74E+02** | <4.00E-01 |

**"J" value**
Result is an estimated value. This data qualifier (flag) is used when the target gene is detected but at a concentration or abundance below the practical quantification limit (PQL).

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

**< value**
The target gene was not detected at the limit of quantitation (LOQ) reported for that sample.

**"I" value**
QA Procedure indicated that the sample may have exhibited PCR inhibition. Although relatively rare, PCR inhibition can occur due to the presence of metals or humic acids at high concentrations in the sample.



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## Quality Assurance

Microbial Insights' comprehensive Quality Assurance (QA) Program is the foundation of all laboratory analyses, ensuring that our clients receive high-quality analytical services that are timely, reliable, and meet their intended purpose in a cost effective manner. MI is committed to providing quality data that surpasses regulatory and industry standards, thus enabling the client to make well-informed decisions. MI maintains strict standard operating procedures and QA/QC measures throughout all of the analyses offered. The following Table details specific QA/QC procedures that are used for CENSUS.

| QA/QC | Description |
|---|---|
| **Date of Extraction** | DNA and RNA extractions are performed the day the samples are received by MI to minimize the possibility of any changes to the microbial community prior to analysis. |
| **Laboratory Method Blanks** | An extraction blank (no sample added) is processed alongside each set of field samples from DNA extraction through CENSUS® analysis to ensure that cross contamination has not occurred. Although MI has never experienced this issue, the detection of the CENSUS® target (e.g. *Dehalococcoides*) in an extraction blank is direct evidence of cross contamination with a sample or contamination of a reagent and would invalidate the results. If this were to occur, MI would re-extract the sample. If not possible to re-extract, MI would contact the client immediately and notate it on the laboratory report. |
| **Laboratory Control Samples (LCS)** | A laboratory control sample (LCS) or positive control (target DNA) is included with each CENSUS® plate to confirm amplification and as a continuing calibration check. |
| **Negative Controls** | A negative control (no DNA) is included with each CENSUS plate to ensure that cross contamination has not occurred during amplification. As with the extraction blank, detection of CENSUS target (e.g. DHC) in a negative control is direct evidence of contamination and would invalidate the results. If this were to occur, MI would rerun the analysis. |

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# APPENDIX E
# PRODUCT INFORMATION SHEETS

# SAFETY DATA SHEET
# EHC® ISCR Reagent

**SDS # :** EHC-C
**Revision date:** 2016-02-18
**Format:** NA
**Version** 2

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Identifier**

**Product Name** EHC® ISCR Reagent

**Other means of identification**

**Alternate Commercial Name** EHC Fine, EHC Granular, EHC 50%

**Recommended use of the chemical and restrictions on use**

**Recommended Use:** Bioremediation product for the remediation of contaminated soil and groundwater

**Restrictions on Use:** Not for drinking water purification treatment.

**Manufacturer/Supplier**

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

**Emergency telephone number**

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

## 2. HAZARDS IDENTIFICATION

**Classification**

**OSHA Regulatory Status**
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Combustible dust

**GHS Label elements, including precautionary statements**

**EMERGENCY OVERVIEW**

**Warning**

**Hazard Statements**
May form combustible dust concentrations in air

**Precautionary Statements - Prevention**
Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ignitable or explosive. Minimize airborne dust generation and eliminate sources of ignition.

**Hazards not otherwise classified (HNOC)**
No hazards not otherwise classified were identified.

**Other Information**
CONTAINMENT HAZARD: Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

| Chemical name | CAS-No | Weight % |
|---|---|---|
| Iron | 7439-89-6 | 18-48 |
| Organic amendment | Proprietary | 52-82 |
| Soybean oil | 8001-22-7 | 2 |
| Viscosity modifier | Proprietary | 0-5 |

Synonyms are provided in Section 1.

## 4. FIRST AID MEASURES

**Eye Contact** — In case of contact, immediately flush skin with plenty of water. Get medical attention if irritation develops and persists.

**Skin Contact** — Wash off with soap and water.

**Inhalation** — Remove person to fresh air. If signs/symptoms continue, get medical attention.

**Ingestion** — Rinse mouth with water and afterwards drink plenty of water or milk. Call a poison control center or doctor immediately for treatment advice. Never give anything by mouth to an unconscious person.

**Most important symptoms and effects, both acute and delayed** — Inhalation of dust in high concentration may cause irritation of respiratory system.

**Indication of immediate medical attention and special treatment needed, if necessary** — Treat symptomatically

## 5. FIRE-FIGHTING MEASURES

**Suitable Extinguishing Media** — Dry chemical, $CO_2$, sand, earth, water spray or regular foam.

**Unsuitable extinguishing media** — Do not use a solid water stream as it may scatter and spread fire.

**Specific Hazards Arising from the Chemical** — Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Combustible material

**Explosion data**
**Sensitivity to Mechanical Impact** — Not sensitive.
**Sensitivity to Static Discharge** — Not sensitive.

**Protective equipment and precautions for firefighters** — As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautions** Avoid dust formation. Avoid dispersal of dust in the air (i.e., cleaning dust surfaces with compressed air.). For personal protection see Section 8.

**Other** Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Use only non-sparking tools.

**Environmental Precautions** Recover the product in solid form, if possible. Do not flush into surface water or sanitary sewer system.

**Methods for Containment** Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.

**Methods for cleaning up** Sweep or vacuum up spillage and return to container. The waste may be recovered and recycled.

## 7. HANDLING AND STORAGE

**Handling** Minimize dust generation and accumulation. Keep away from open flames, hot surfaces and sources of ignition. Refer to Section 8.

**Storage** Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition. Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases.

**Incompatible products** Oxidizing agents. Strong acids.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Control parameters**

**Exposure Guidelines** This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies. Local nuisance dust standards apply.

**Appropriate engineering controls**

**Engineering measures** It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in the handling of this product contain explosion relief vents or an explosion suppression or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

**Individual protection measures, such as personal protective equipment**

**Eye/Face Protection** Safety glasses with side-shields.

**Skin and Body Protection** Wear suitable protective clothing. Protective shoes or boots.

**Hand Protection** Use gloves if extended exposure is anticipated

**Respiratory Protection** Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.

**Hygiene measures** Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Information on basic physical and chemical properties**

| | |
|---|---|
| **Appearance** | Tan, Brown, flakes, |
| **Physical State** | Solid |
| **Color** | Brown, Tan |
| **Odor** | odorless |
| **Odor threshold** | Not applicable |
| **pH** | 5.6 (as aqueous solution) |
| **Melting point/freezing point** | Decomposes |
| **Boiling Point/Range** | Not applicable |
| **Flash point** | Not applicable No information available |
| **Evaporation Rate** | No information available |
| **Flammability (solid, gas)** | Combustible material |
| **Flammability Limit in Air** | |
| **Upper flammability limit:** | No information available |
| **Lower flammability limit:** | No information available |
| **Vapor pressure** | No information available |
| **Vapor density** | No information available |
| **Density** | 0.80 g/mL |
| **Specific gravity** | No information available |
| **Water solubility** | practically insoluble |
| **Solubility in other solvents** | No information available |
| **Partition coefficient** | No information available |
| **Autoignition temperature** | No information available |
| **Decomposition temperature** | No information available |
| **Viscosity, kinematic** | No information available (Solid) |
| **Viscosity, dynamic** | No information available |
| **Explosive properties** | Low level dust explosion hazard |
| **$K_{st}$** | 19 bar-m/sec: St1 Class dust |
| **Oxidizing properties** | No information available |
| **Molecular weight** | No information available |
| **Bulk density** | No information available |

## 10. STABILITY AND REACTIVITY

None under normal use conditions

| | |
|---|---|
| **Chemical Stability** | Stable. |
| **Possibility of Hazardous Reactions** | May react with water to release flammable hydrogen gas. |
| **Hazardous polymerization** | Hazardous polymerization does not occur. |
| **Conditions to avoid** | Heat, flames and sparks. |
| **Incompatible materials** | Strong acids. Oxidizing agents. |
| **Hazardous Decomposition Products** | Burning produces obnoxious and toxic fumes. |

## 11. TOXICOLOGICAL INFORMATION

**Product Information**

| | |
|---|---|
| **LD50 Oral** | Iron: 98.6 g/kg (rat) |
| **LD50 Dermal** | No information available |
| **LC50 Inhalation** | Iron: > 100 mg/m$^3$ 6 hr (rat) |
| **Serious eye damage/eye irritation** | Not expected to be irritating based on the components. |
| **Skin corrosion/irritation** | Not expected to be irritating based on the components. |
| **Sensitization** | As a precaution the product should be treated as a sensitizer. |

**Information on toxicological effects**

**Symptoms** Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

**Irritation** Not expected to be irritating based on the components.
**corrosivity** Not applicable.
**Chronic toxicity** No known chronic effects of components present at greater than 1%.

**Carcinogenicity** Contains no ingredient listed as a carcinogen.

**Mutagenicity** No known mutagenic or teratogenic effects.

**Neurological effects** Contains no ingredient listed as a mutagen

**Reproductive toxicity** This product does not contain any known or suspected reproductive hazards.

**STOT - single exposure** No information available.
**STOT - repeated exposure** No information available.

**Aspiration hazard** No information available.

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

**Ecotoxicity effects** Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

| Chemical name | Toxicity to algae | Toxicity to fish | Toxicity to Microorganisms | Toxicity to daphnia and other aquatic invertebrates |
|---|---|---|---|---|
| Iron | | 96 h LC50: = 13.6 mg/L (Morone saxatilis) static | | |

**Persistence and degradability** No data is available on the product itself. The organic components are biodegradable and can be expected to contribute to BOD.

**Bioaccumulation** Does not bioaccumulate.

**Mobility** Is not likely mobile in the environment due its low water solubility.

**Other Adverse Effects** None known.

## 13. DISPOSAL CONSIDERATIONS

**Waste disposal methods** Recovery/recycling recommended. Dispose of in accordance with local regulations.

**Contaminated Packaging** Empty remaining contents. Dispose of in accordance with local regulations.

## 14. TRANSPORT INFORMATION

**DOT** NOT REGULATED

## 15. REGULATORY INFORMATION

## U.S. Federal Regulations

**SARA 313**
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

**SARA 311/312 Hazard Categories**

| | |
|---|---|
| **Acute health hazard** | Yes |
| **Chronic health hazard** | No |
| **Fire hazard** | No |
| **Sudden release of pressure hazard** | No |
| **Reactive Hazard** | No |

**Clean Water Act**
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

**CERCLA/EPCRA**
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

### International Inventories

| Component | TSCA (United States) | DSL (Canada) | EINECS/ELINCS (Europe) | ENCS (Japan) | China (IECSC) | KECL (Korea) | PICCS (Philippines) | AICS (Australia) | NZIoC (New Zealand) |
|---|---|---|---|---|---|---|---|---|---|
| Iron 7439-89-6 ( 18-48 ) | X | X | X | | X | X | X | X | X |
| Organic amendment ( 52-82 ) | | X | X | | X | | X | X | X |
| Soybean oil 8001-22-7 ( 2 ) | X | X | X | | X | X | X | X | X |
| Viscosity modifier ( 0-5 ) | X | X | X | X | X | X | X | X | X |

**CANADA**

**WHMIS Statement**
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the CPR.

**WHMIS Hazard Class** Non-controlled

## 16. OTHER INFORMATION

| | | | | |
|---|---|---|---|---|
| **NFPA** | **Health Hazards** 1 | **Flammability** 1 | **Stability** 0 | **Special Hazards** - |
| **HMIS** | **Health Hazards** 1 | **Flammability** 1 | **Physical hazard** 0 | **Personal Protection** - |

**NFPA/HMIS Ratings Legend** Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

**References** Refer to NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids* , for safe handling.

**Revision date:** 2016-02-18
**Revision note** *** Indicates updated section
**Issuing Date:** 2015-07-14

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**Prepared By:**

PeroxyChem

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**End of Safety Data Sheet**

# SAFETY DATA SHEET
## Zero Valent Iron (ZVI)

## Section 1. PRODUCT AND COMPANY IDENTIFICATION

**PRODUCT NAME:** **ZVI**
**GENERAL USE:** Chemical reduction of halogenated organics and-or metals

**MANUFACTURER:**

**Redox Tech, LLC**
200 Quade Drive
Cary, NC 27513
919-678-0140

**EMERGENCY TELEPHONE:**

Within USA and Canada: 1-800-424-9300
+1 703-527-3887 (collect calls accepted)

## Section 2. HAZARDS IDENTIFICATION

Physical state : Solid (Powder)
Emergency Overview : Potential dust explosion. Avoid contact with oxidizing agents. USE WITH CARE. Follow good industrial hygiene practice

Routes of entry : Demal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects
- Eyes : May cause eye irritation.
- Skin : No known significant effects or critical hazards
- Inhalation : May cause respiratory tract irritation.
- Ingestion : No known significant effects or critical hazards.

Potential Chronic Effects: : Carcinogenic effects: Not classified or listed by IARC, NTP, OSHA, EU AND ACGIH.
Mutagenic effects: Not available
: Teratogenic effects: Not Available
Medical conditions : Repeated exposure of the eyes to a low level of dust can produce eye irritation

## Section 3. COMPOSITION INFORMATION ON INGREDIENTS

Greater than 98% Iron CAS# 7439-89-6
Contains carbon, sulfur and other metal impurities.

## Section 4. FIRST AID MEASURES

Eye contact : Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention if irritation occurs
Skin contact : Wash with soap and water. Get medical attention if irritation occurs.
Inhalation : Move person to fresh air. Get medical attention if breathing difficulty persists

| | | |
|---|---|---|
| Ingestion | : | Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention if symptoms appear. |
| Notes to physician: | | No specific antidote. Material is used as an iron supplement in food and vitamins. Treatment would be the same as for iron overdose. |

# Section 5. FIRE FIGHTING MEASURES

| | |
|---|---|
| Flammability of the product | Generally non-flammable but susceptible to dust explosion. |
| Fire-fighting media | Use a fog nozzle to spray water. |
| Special protective Equipment for fire-fighters | Fire-fighters should wear appropriate protective equipment. |
| Special remarks on fire | As with any finely granulated product, a risk of dust explosion is present should the material be dispersed in air and exposed to a source of ignition. Fine powder can form flammable and explosive mixtures in air. |

# Section 6. ACCIDENTAL RELEASE MEASURES

In case of a significant release, take immediate efforts to minimize discharge to surface water (storm drains, streams, lakes, rivers, etc). If the release occurs in a closed area, take steps to improve ventilation. If improvement of ventilation is not possible, call the fire department. The material can be swept up and placed into approved storage containers. Do not use a vacuum to gather the material because this may result in dispersion of dust particles and increase the risk for a dust explosion.

# Section 7. HANDLING AND STORAGE

The material should be stored in a cool, dry, environment. It is not recommended to store the material in the proximity of oxidants. When handling the product, wear a dusk mask, eye protection and gloves. The product should always be handled in a well ventilated environment.

# Section 8. EXPOSURE CONTROLS – PERSONAL PROTECTION

| | | |
|---|---|---|
| Engineering controls | : | Use process enclosures, local exhaust ventilation or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fumes or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit. |
| Personal protection | | |
| Eyes | : | Safety eyewear complying with an approved standard should be used and selected based on the t ask being performed and the risks involved (avoid exposure to liquid splashed, mists, gases or dusts).<br>Where there is a risk of exposure to high velocity particles safety glasses or face shield complying with an approved standard should be used to protect against impact. Where there is a risk of exposure to dusts, goggles should be used.<br>Recommended: Safety glasses. |
| Respiratory | : | Dusk mask or respirator is recommended. |
| Hands | : | Gloves are recommended |

| | | |
|---|---|---|
| Skin/Body | : | Personal protective equipment for the body should be selected based on the task being performed and the risks involved. Risk from dermal contact is minimal. |

## Section 9. PHYSICAL AND CHEMICAL PROPERTIES

| | | |
|---|---|---|
| Physical State | : | Solid (Powder) |
| Color | : | Gray |
| Melting/freezing point | : | 1535ºC (2795ºF) |
| Specific gravity | : | 7.88 |
| Bulk density | : | 2.4 to 3.2 g/cm³ |
| Solubility | : | Insoluble in water |

## Section 10. STABILITY AND REACTIVITY

The product is reactive with oxidizers. Precautions should be taken not to store or contact the product with oxidizers.

Fine particles of this product (not widely found in this grade) have a potential for a dust explosion. The product should be handled in a well ventilated area where dust generation is minimized.

## Section 11. TOXICOLOGICAL INFORMATION

Acute Effects

| | |
|---|---|
| Eyes | May cause eye irritation. |
| Skin | No known significant effects or critical hazards. |
| Inhalation | May cause respiratory tract irritation. |
| Ingestion | No known significant effects or critical hazards. |

| | |
|---|---|
| Chronic Health Effects: | Carcinogenic effects: Not classified or listed by IARC, NTP, OSHA, EU and ACGIH |

## Section 12. ECOLOGICAL INFORMATION

Will reduce dissolved oxygen levels in aquatic ecosystems. Direct discharge to surface water should be avoided.

## Section 13. DISPOSAL CONSIDERATIONS

The generation of waste should be avoided or minimized to the extent practical. Disposal of this product, solutions and any by-products should be completed in an environmentally responsible manner that complies with all local, state and federal laws.

## Section 14. TRANSPORT INFORMATION

Classification:

AND/ADR/TDG/DOT/IMDG/IATA: Not regulated.

# Section 15. REGULATORY INFORMATION

This product is not regulated in the United States and Canada. The user should ensure this product is not regulated where used.

# Section 16. OTHER INFORMATION

| | |
|---|---|
| Health | 0 |
| Fire Hazard | 2 |
| Reactivity | 1 |
| Personal Protection | C |

PLUME STOP®
Liquid Activated Carbon

White Paper

# Securing Rapid Contaminant Reduction and Accelerated Bioremediation Using a Dispersive Injectable Reagent

Jeremy Birnstingl, PhD; Craig Sandefur, MS; Kristen Thoreson, PhD; Stephanie Rittenhouse, BS; Ben Mork, PhD

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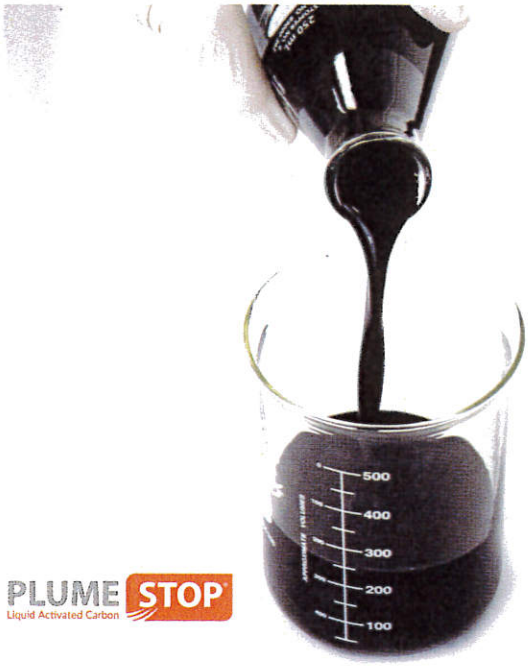
PlumeStop® Liquid Activated Carbon™ represents a new technology innovation designed to address the challenges of excessive time and end-point uncertainty in groundwater bioremediation. The technology secures rapid groundwater contaminant concentration reduction (days), coupled with accelerated bio-destruction.

It is effective on most organic groundwater contaminants including hydrocarbons, halogenated compounds, and a wide variety of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The technical innovation allows for wide dispersion of a sorptive medium in the aqueous subsurface. The product has a dual function; it sorbs contaminants, quickly removing them from the mobile phase ('PlumeStop'), and provides a high surface area matrix favorable for microbial colonization and growth. Contaminant availability within a risk pathway is therefore reduced while at the same time contaminant destruction is accelerated.

The product can be applied in combination with compatible controlled release electron donors/acceptors. Upon reagent injection, target contaminants partition out of the aqueous phase and into the reagent matrix, thereby removing mobile contaminants from the immediate risk pathway. Concentration of the contaminants in this manner, in a matrix conducive to degrader colonization and activity, results in a direct increase in the overall instantaneous rate of contaminant destruction, given the quasi first-order biodegradation kinetics characteristic of environmental systems.

This phenomenon can be especially important at low contaminant concentrations, which may otherwise prove insufficient to support appreciable growth and activity of a degrading microflora.

The technology can be applied to inhibit spreading of contaminant plumes, to protect sensitive receptors, or to prevent contaminant migration across property boundaries. PlumeStop is also a very effective tool for treating sites with very low contaminant concentrations, and for control and treatment of groundwater contamination associated with low-permeability porous formations and matrix back-diffusion, promoting diffusion out of the immobile porosity while preventing groundwater impact.




Field studies confirm wide-area dispersion, with an order of magnitude (>90%) reduction in dissolved-phase concentrations at the test sites post-application sampling, and a further increase to two orders of magnitude (>99%) within two months for both chlorinated solvent and hydrocarbon species alike. Laboratory data provide confirmation of post-sorption degradation enhancement, describing a significant increase in the rate of contaminant destruction in biotic matrix systems compared to abiotic matrix and biotic non-matrix controls.

## 1 Introduction

This paper provides an introduction and technical overview of PlumeStop® Liquid Activated Carbon™, designed to combine a rapid step-change reduction in groundwater contaminant concentrations with accelerated bio-destruction of the same. At the basis of the technology are the core features of:

- Dispersibility of a highly sorptive medium; and,
- Enhanced biodegradation of the sorbed contamination.

These features will be addressed respectively in individual sections of this paper. Laboratory demonstration of the principles of dispersion, retained sorptive capacity, and biodegradation enhancement of the product are provided. Field performance examples of the technology are shown and finally, typical product usage scenarios are discussed.

## 2 Securing Sorbent Dispersibility

### 2.1 Material Composition

PlumeStop is an aqueous liquid wherein a colloidal solid sorbent (carbon-based) is suspended. Incorporated into this, is an anti-clumping, distribution-supporting surface treatment and low-solubility/controlled availability matrix nutrients. Distribution limitation is overcome by altering the surface charge of the colloidal particles, thereby reducing interaction between particles, the soil matrix, and the particles themselves. As a consequence, the resulting material can be dispersed widely, and gradually coats the aquifer matrix rather than accumulating in localized clumps in or close to the point of application, as is common with activated carbon products.

### 2.2 Dispersibility – Benefits to Application

The sorptive characteristics of granular activated carbon (GAC) are well understood in the remediation industry (1). Sorption may be coupled with biodegradation (2, 3), with 'bio-GAC' a familiar term in common industry parlance. However, the solid nature of activated carbon has restricted its use in remediation principally to the *ex situ* treatment of extracted media, such as in pump-and treat (P&T) installations. The attraction of its use as a passive means of *in situ* groundwater treatment has been restricted to date by the challenge of distributing solid activated carbon through the charged, granular medium of soil. Solutions to this problem have included auger-based soil-mixing, trench-application, injection on tight centers, and fracture-based emplacement. These come at a cost; not only are the engineering requirements significant compared to those of fluid-injection, but good access to the contaminated area is required both above ground (e.g. absence of buildings, structures) and below ground (e.g. absence of services, structures). Limitations of depth may also be encountered, whether imposed by expense alone (e.g. mounting costs of tight injection spacing in large, deep applications) or in combination with physical constraints (e.g. trench or soil-mixing applications).

In addition to the physical challenge of application, another limiting factor for *in situ* application of GAC is the uncertainty of the subsurface distribution. The distribution of injected powdered GAC, irrespective of particle size, carrier volume, and dilution, will typically be restricted to the injection point; for example, the well-pack or near surround, or to the fractures themselves. This presents a risk of incomplete or variable clean-up. There may also be a potential for mistaking 'monitoring-well clean-up' for aquifer clean-up. This would not only be restricted to the obvious circumstance of using the same well for application and monitoring, but may also arise from a fracture-emplaced injection 'fingering' into a monitoring well and giving the appearance of remediation, yet leaving the bulk of the aquifer untreated.

The development of an injectable, dispersive form of activated carbon overcomes the majority of the limitations outlined above. In addition to improving confidence of reagent delivery and addressing certain access challenges, the cost-reduction in application may also be significant. With dispersible activated carbon, fracture-emplacement or augered soil mixing become unnecessary, and simpler injection-well or direct-push application approaches suffice.

Increasing the spacing of an injection grid will itself produce benefits, not only through minimization of obstacles, but also through savings of cost, disturbance, and time on site. For example, increasing the spacing of an injection grid from 2 m to 3 m will reduce the required number injection points by more than 50%, while increasing the spacing to 5 m presents a reduction in required points of over 80% (Figure 1).

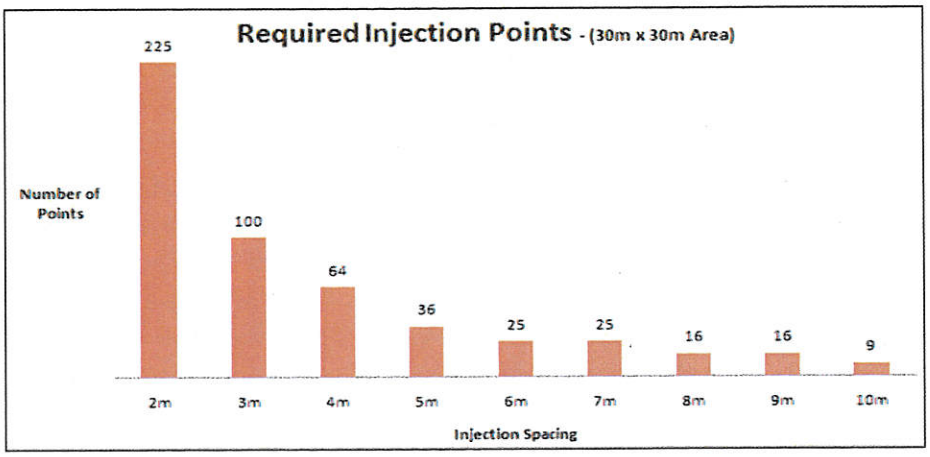



Figure 1. Impact of injection spacing on injection point requirement for a fixed area

## 3 Securing Bio-Enhancement

### 3.1 Introduction

The sorptive capacity of PlumeStop in itself is beneficial to remediation projects, as it is able to secure reductions in groundwater contamination and risk very rapidly, with the potential to achieve low clean-up targets in weeks or even days. The additional effect of PlumeStop to promote bio-destruction of the sorbed contaminants results in the permanent removal of the contaminant from the aquifer setting. To explore this feature, it may first be helpful to review some of the wider principles of bioremediation that are relevant to the process.

### 3.2 The Central Importance of Biological Processes

For groundwater remediation and aquifer restoration, biodegradation represents the principal destruction mechanism of organic species within the subsurface; this process may occur naturally without additional remediation efforts, or may be initiated by outside means. Biological processes are indeed recognized as the principal destruction mechanism among natural attenuation processes (4, 5), and as a means of completing contaminant destruction/ mineralization following mass reduction technologies such as *in situ* chemical oxidation (ISCO) (6).

The potential of bioremediation is perhaps not surprising given that the biodegradation of organic compounds is of central importance to carbon cycling and thus to life on earth (7). The sheer potency of the degradative capacity of microorganisms given appropriate conditions has long been recognized (8). Moreover, an understanding of the range, diversity, resilience, and apparent ubiquity of their distribution continues to grow, (9).

### 3.3 Bioremediation – Potential and Challenges

*In situ* groundwater bioremediation is now itself an established remediation approach widely used around the world. However, since its early adoption as a contemporary remediation technology in the 1970s and 80s, there have been relatively few significant innovations within the sector beyond the increasing sophistication of electron donors and acceptors, and beyond ancillary developments such as improved measurement technologies. The technology of *in situ* groundwater remediation remains challenged by a number of factors, including two perennial, core issues:

- **Bioremediation takes time** – despite advances in bioremediation techniques over the years, it remains a relatively slow remediation approach;
- **End-points remain uncertain** – while bioremediation may be employed with confidence to efficiently and inexpensively reduce contamination by one or two orders of magnitude, the (linear) rate of destruction characteristically decreases with time, leading to unpredictable performance against very low clean-up targets.

*In situ* bioremediation nevertheless offers important benefits as a relatively low-cost, low-energy (green), minimally intrusive, destructive technology (i.e. contaminants destroyed, not simply relocated or bound), with applicability to most organic contaminants in a broad range of geological settings. These benefits would be enjoyed by a wider range of projects should the above limitations be overcome.

### 3.4 Analysis of the Problem

#### 3.4.1 Biodegradation Takes Time

The basis of the time requirement of bioremediation cannot be reduced to a single factor. Some compounds simply degrade faster than others, microbial populations can take time to establish and/or acclimate, and conditions for microbial growth and activity are seldom uniformly optimal despite the skillful and earnest endeavors of environmental engineers.

Beyond this, complex biological processes themselves are not instant. With respect to end-point uncertainty, the above factors are joined by others related to varied mass-transfer limitations and to the fact that microbial populations may simply require a minimum amount of substrate to maintain appreciable activity (10). Within the varied factors that can limit biodegradation, however, certain principles are seen to recur.

#### 3.4.2 Biodegradation Kinetics

The biodegradation rates of given compounds are commonly cited in terms of first-order kinetics – typically as half-lives (11, 12). The rates may vary from compound to compound and from setting to setting, but the principle of a quasi first-order kinetic approximation remains consistent across nearly all conditions. As illustrated in Figure 2, the result of this first-order approximation is that the rate of instantaneous mass destruction (mass removed per unit time) consistently decreases over time. Similar decays of instantaneous destruction rates (mass removed per unit time) are observed for other technologies, for example, *in situ* chemical oxidation ISCO.

At the basis of the first-order approximation is the principle of decreasing bioavailability. As the concentration of a contaminant in groundwater is reduced, the frequency of contact between contaminants and microorganisms is also reduced. The microorganisms that perform bioremediation are predominantly attached to particle surfaces rather than suspended or free-swimming in the aqueous phase, or as large immobile bundles of organisms living

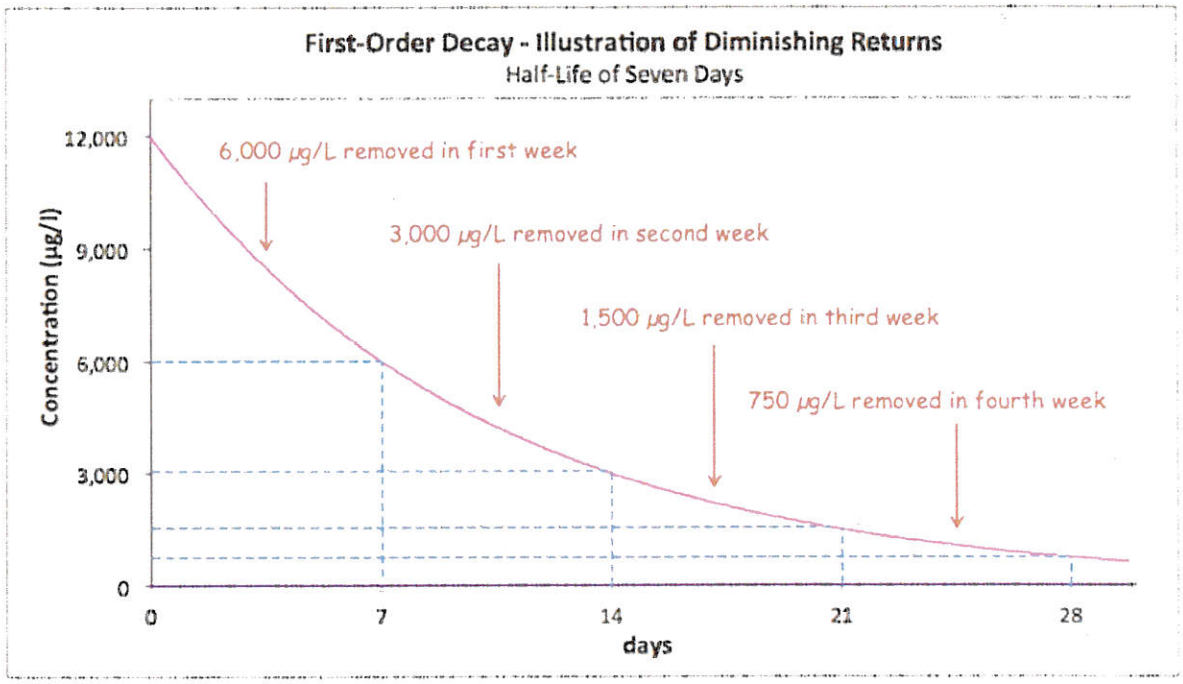



Figure 2. First-order decay – illustration of decreasing instantaneous mass destruction rates

in the interstitial spaces between aquifer mineral particles (biofilms) (7, 13). The contaminant must therefore approach and make contact with the microorganism if it is to be degraded – a separation of even a few microns between the microorganism and the substrate can be enough to prevent degradation (14). The degradation rate will therefore decrease naturally over time, albeit counteracted to an extent by increasing microbial numbers and proficiency, especially in the early treatment stages.

As the groundwater clean-up proceeds beyond the early stages of treatment, mass-transfer constraints begin to dominate the rate of contaminant destruction. At this advanced stage, the microorganisms have depleted their immediate environment of substrate (i.e. on the micro-scale), and the concentrations of contaminant within the bulk groundwater have also been reduced. As a result, the rate of contaminant bio-destruction becomes increasingly influenced by the rate of contaminant desorption into the groundwater and hence its availability to the microorganism (15, 16, 17).

### 3.4.3 Bioremediation End-Point Uncertainty

The uncertainty of end-point relates to the practical challenge of predicting the point at which the preceding factors will reach equilibrium and establish a performance asymptote. Beyond this asymptote, declining microbial activity may be expected due to depletion of the substrate, which is known as 'starvation' in familiar terms. The environmental conditions of bioremediation are generally favorable for copiotrophic microbial species, which are those that thrive on a high-concentration of substrate and are sometimes considered 'opportunists' (18, 19). For these microbes, sufficient contamination / substrate is required to initiate and maintain remediation. As degradation proceeds, oligotrophic conditions become prevalent, meaning substrate availability may be insufficient to support a viable, high-activity microbial population. This decrease in microbial activity contributes to the rate-limitation principles that were discussed earlier. Substrate concentration thresholds for microbial activity have been reported elsewhere (20, 21, 10, 22).

### 3.5 Addressing the Problem

The challenges outlined in the two preceding sections ultimately have bioavailability at their core. Given the fact that the mass of contamination in the system to be treated is fixed, the above rate limitations may be overcome through either of two approaches:

- Increasing the solution concentration – for example, using surfactants to desorb contaminants from the soil and other matrices (23, 24, 25). While this may be effective in overcoming the bioavailability constraint, uncontrolled contaminant concentration spikes in the dissolved-phase are not welcome. Furthermore, surfactants may present additional problems such as clogging of the formation or the introduction of a competing biological oxygen demand (BOD) (26, 27).
- Concentrating the contaminants and the bacteria together – for example, using a common sorptive surface.

This approach of concentrating the contaminant and bacteria on a surface reduces dissolved phase contaminant concentrations, benefits bioavailability, and ultimately enhances degradation.

### 3.6 Benefits of Liquid Activated Carbon

The principles of increasing contaminant-microbe contact and overcoming oligotrophic limitations are addressed directly by PlumeStop. The novelty of PlumeStop as a technology lies in the ability to widely distribute a sorptive medium using simple injection equipment and without compromise to sorptive capacity. PlumeStop injected into the aqueous subsurface quickly sorbs organic contaminants. Partitioning of contaminants out of the dissolved-phase and onto PlumeStop results in a fast and striking reduction in groundwater contaminant concentration. Thereafter, the sorptive PlumeStop medium provides a high surface-area, virgin matrix for fresh microbial colonization, thereby achieving the objective of concentrating the bacteria and the contaminants together.

### 3.7 Core Hypothesis

The core hypothesis of the PlumeStop technology may thus be summarized as follows: PlumeStop is injected into the subsurface as a colloidal suspension using simple liquid-injection equipment, securing wide-area dispersion on the order of meters. Dissolved-phase contamination then partitions out of the groundwater and onto the PlumeStop matrix, resulting in a rapid drop in groundwater contamination on the timescale of days. The net rate of sorptive partitioning is considerable owing to the extremely high relative surface area of the colloidal (1-2 μm) particles. The PlumeStop biomatrix itself becomes impregnated with the contaminants, concentrating them within its structure. Under favorable growth conditions of optimal electron donor acceptor nutrient concentrations, which can be artificially engineered as necessary through combined application of compatible reagents, microbial colonization of the PlumeStop quickly follows. The colonizing microflora will predominantly comprise degrader species given that the contaminants impregnating the matrix act as the principle available substrate. Contaminants and microbes are thereby concentrated together, enhancing bioavailability and maintaining adequate substrate-availability (copiotrophic status) locally, irrespective of possible substrate-limited (oligotrophic) conditions in the wider aquifer. In this manner, the PlumeStop provides both a growth-medium and a substrate reservoir to support suitable microbial growth, while keeping the contaminants out of the groundwater. This results in:

- A rapid drop in groundwater contamination
- An increased rate of contaminant destruction
- An ability to pursue bioremediation effectively even at very low contaminant levels

Degradation of substrate within the matrix regenerates the sorption sites (28), extending and replenishing the reagent's sorptive capacity. The PlumeStop itself is not consumed; thus providing long-term management solutions for back-diffusion and ongoing low-level sources.

## 4 Reagent Development

### 4.1 Background

A variety of sorptive media could establish the desired dispersive biomatrix concept, and a spectrum of media was therefore evaluated through the course of the product development research. Once a medium was selected, its dispersibility was optimized through a series of over one hundred soil-packed column tests intended to identify and refine a proprietary treatment that would provide the desired step-change in dispersibility. The resulting PlumeStop composition exhibits striking performance improvements over conventional slurries and dispersed forms of carbon particles previously reported in the scientific literature (29).

The medium selected for initial commercialization as PlumeStop is liquid activated (micron-scale) carbon, which therefore represents the focus of the present paper. Mixed with this carbon medium is an anti-clumping distribution supporting surface treatment of non-toxic polymeric and molecular additives plus low-solubility controlled availability matrix nutrients. The inherent limitation in the dispersibility of colloidal carbon is overcome by cloaking the surface charge of the colloidal particles, thereby reducing interaction between the particles and the soil matrix and between the particles themselves. As a consequence, the resulting material can be dispersed widely, and gradually coats the aquifer matrix rather than clumping in, or close to, the point of application. The stabilized colloidal composition is therefore able to achieve unprecedented subsurface distribution and site remediation performance. A visual illustration of the dispersed PlumeStop distributed among and coating sand particles is given in the scanning electron microscope (SEM) photomicrograph images in Figure 3-Figure 5.

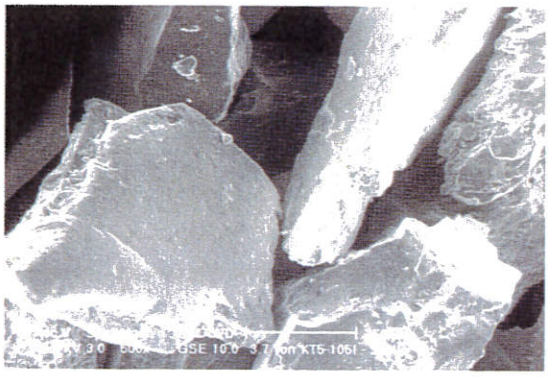


Figure 3. SEM image of sand particles without PlumeStop

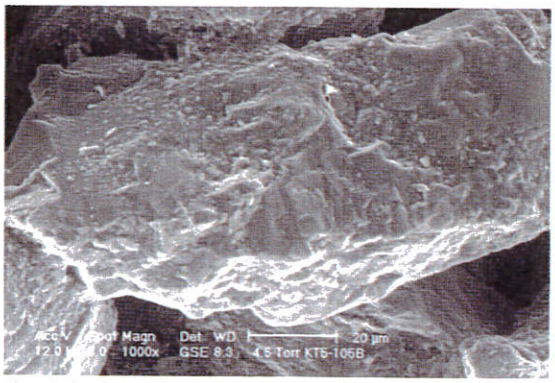


Figure 5. SEM image of sand particle coated with PlumeStop

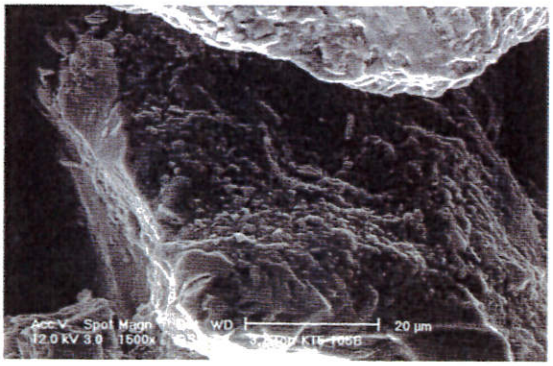


Figure 4. SEM image of sand particle coated with PlumeStop

### 4.2 Hypothesis Testing – Laboratory

The following sections of this paper describe laboratory-scale testing of the principles underpinning the core hypothesis of the PlumeStop technology. The following questions are addressed in sequence:

1. Can the liquid activated carbon be effectively distributed through a saturated soil medium?
2. Does the treatment to enhance distribution negatively affect sorption capacity?
3. Does biodegradation proceed within the biomatrix?
4. Is net contaminant degradation rate enhanced, inhibited, or unaffected by sorption into the biomatrix?

### 4.3 Test 1. Reagent Distribution

#### 4.3.1 Introduction

Powdered solid materials are, by nature, difficult to apply and distribute through a soil matrix by injection. Poor distribution and clumping in or close to the point of application or fracture are typically observed.

**Q: Can the matrix be effectively distributed through a saturated soil medium?**

#### 4.3.2 Test Description

The test set-up comprised two 25 mm (1") internal diameter columns 600 mm (2') in length, packed with a loamy coarse sand[2] and tap water. 25 g of 0.6% PlumeStop colloid was placed at the head of the test column, with an equivalent mass and concentration of powdered activated carbon in aqueous suspension placed at the head of the control column. The columns were allowed to drain by gravity upon opening a tap at their base. A head of water was maintained by manual addition of water to each column, pausing the flow as necessary in either column to maintain net volume / flux consistency. A total of three pore volumes of water were applied to each column.

#### 4.3.3 Test Results

The comparative distribution of PlumeStop and powdered activated carbon is visually illustrated in the following figures.

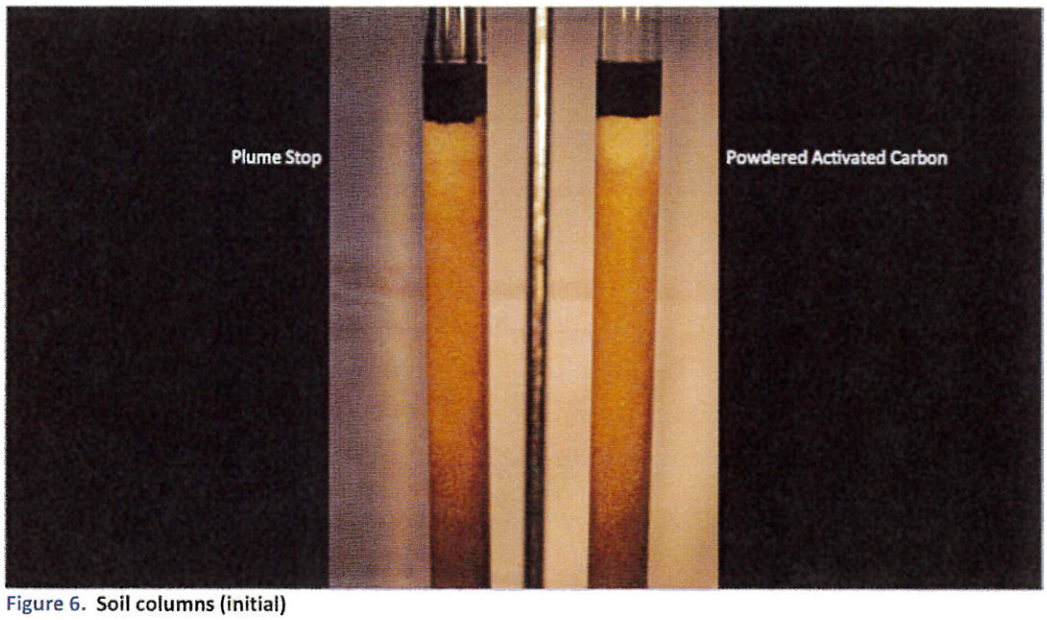



**Figure 6. Soil columns (initial)**

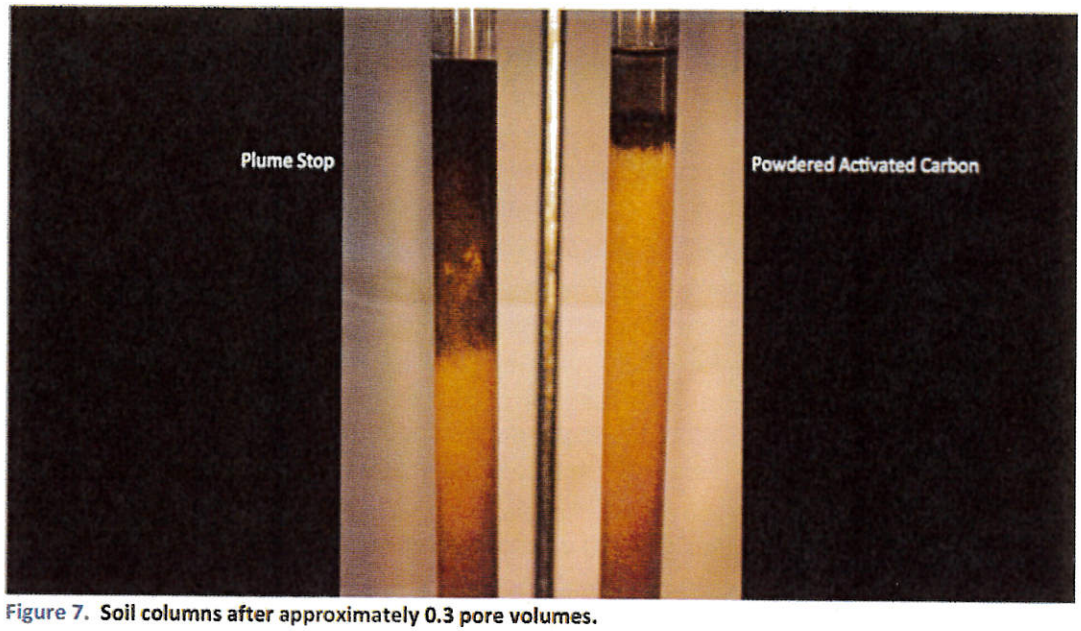



**Figure 7. Soil columns after approximately 0.3 pore volumes.**

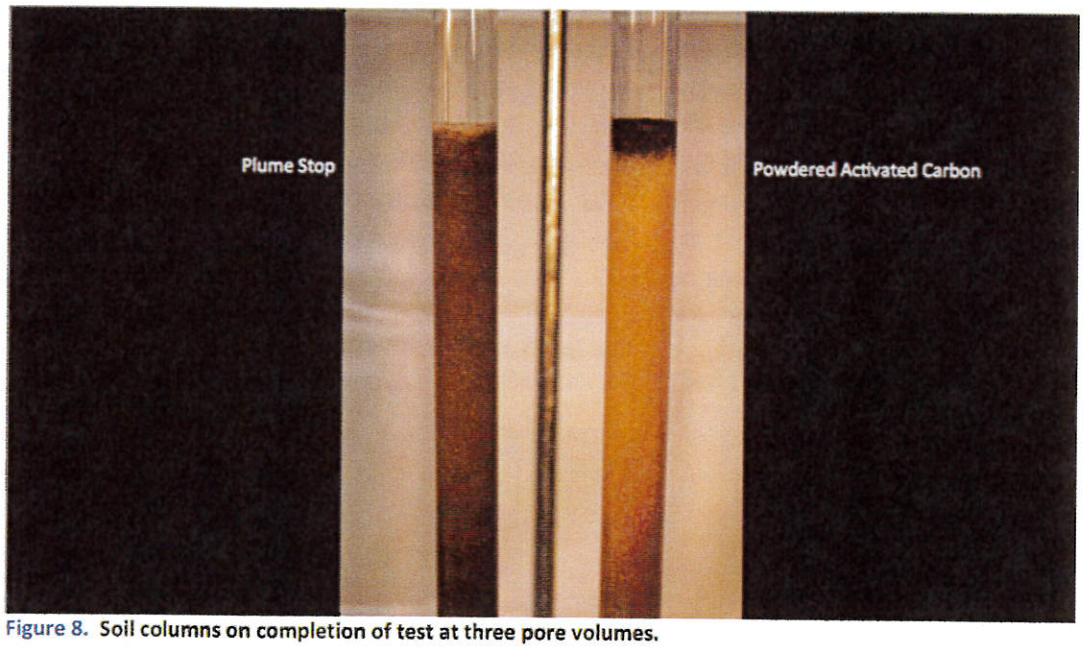



**Figure 8. Soil columns on completion of test at three pore volumes.**

### 4.3.4 Test Conclusion

The test confirmed that PlumeStop transports through 600 mm (2') of loamy coarse sand columns easily, whereas the distribution of the powdered activated carbon control was limited to approximately the top 25 mm (1") of the column. This represents a distribution difference in excess of a factor of 20 (the test being limited by the maximum length of the column).

PlumeStop material remained visually apparent throughout the column during the course of the study and showed no apparent decline/wash-out upon flushing of three pore volumes. The dispersibility assertion of the PlumeStop technology hypothesis was therefore supported by this study.

### 4.4 Test 2. Sorption Capacity

#### 4.4.1 Introduction

Securing an effective distribution of PlumeStop through a saturated soil system is a core component of its function as a practical technology. However, a second functional question is if the treatment to effect dispersibility negatively impacts the sorptive capability of the PlumeStop material.

Q: Does the treatment to enhance distribution negatively affect sorption capacity?

#### 4.4.2 Test Description

The test set-up for evaluation of the sorptive capacity of PlumeStop comprised:

1. A column study with o-xylene; and,
2. The determination of the sorption isotherm of PlumeStop with respect to benzene

The column study comprised two columns, through which an aqueous solution of approximately 10,000 µg/L of o-xylene in tap water was passed (Figure 9). The columns were set up identically and packed with loamy coarse sand, as per Test 1 (Section 4.3). An equal flux of aqueous xylene solution was passed in parallel through each column in order to establish the natural equilibrium between aqueous phase and soil-sorbed xylene. The systems were run in this manner until the baseline conditions stabilized (approximately four weeks). 327 g of 0.2% Colloidal carbon suspension were then added to the head of the test column followed by continued elution with the o-xylene solution. For the control column, the o-Xylene solution was eluted without interruption. o-Xylene concentrations in the effluent of each column were recorded at intervals of 1–3 days over the course of six weeks.

The sorption isotherm of benzene on PlumeStop was determined through measurement of sorbed and dissolved benzene concentrations at equilibrium in multiple test systems. Benzene was applied to each system at a concentration of 50,000 µg/L. PlumeStop concentrations in each system were varied over a range of 63 – 4,000 mg/L (Figure 10)

Figure 9. o-Xylene column study set-up.

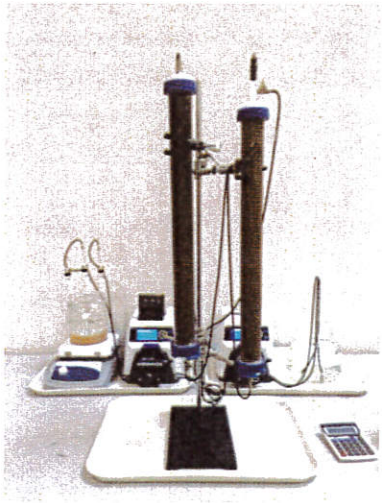
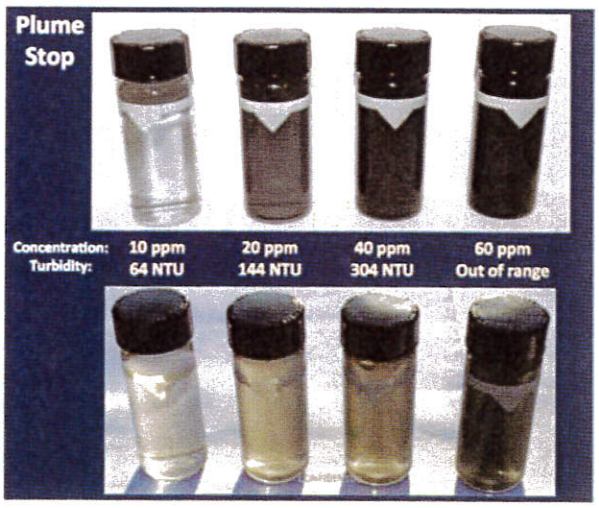


Figure 10. Serial dilution of PlumeStop for the isotherm study.



### 4.4.3 Test Results

The comparative o-Xylene concentrations in the effluent of the column study treatment and control systems are presented graphically in Figure 11.

o-Xylene concentrations in the effluent from the PlumeStop-treated column were reduced from a baseline of approximately 10,000 µg/L to below the quantitation limit of 1,000 µg/L within ten days of application, with the response delay corresponding closely with the time required to elute one pore volume of PlumeStop solution through the column. Concentrations in the treated system remained below quantitation limits through the course of the study (six weeks), over which time approximately fifteen pore volumes of ca. 11,000 µg/L o-Xylene solution were fed through each system. The sorption isotherm of benzene on PlumeStop is shown in Figure 12. The data is fit to a Freundlich model.

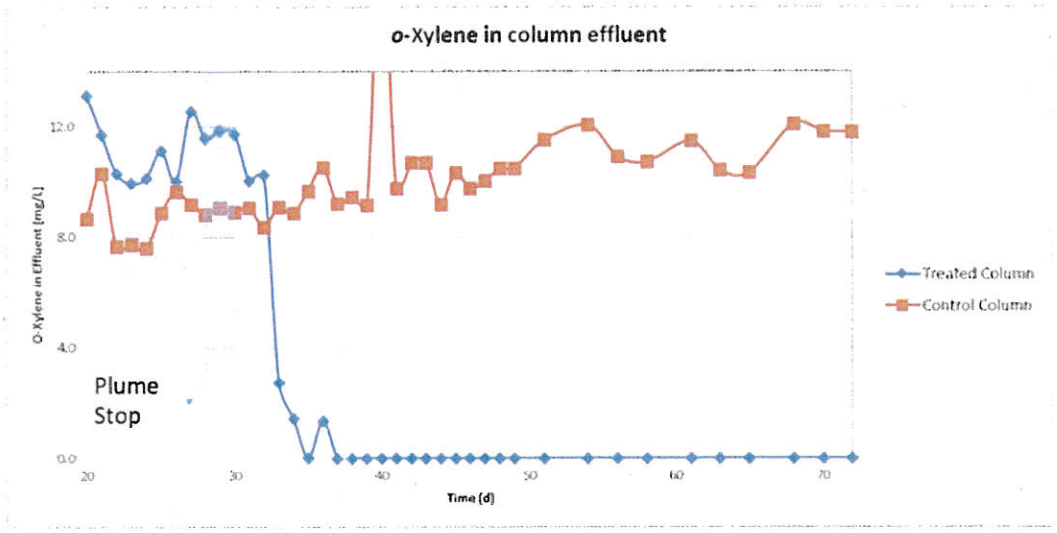



Figure 11. Comparative o-xylene concentrations in column effluent. The application of PlumeStop to the test column at 28- 30 days is shown by the blue box.

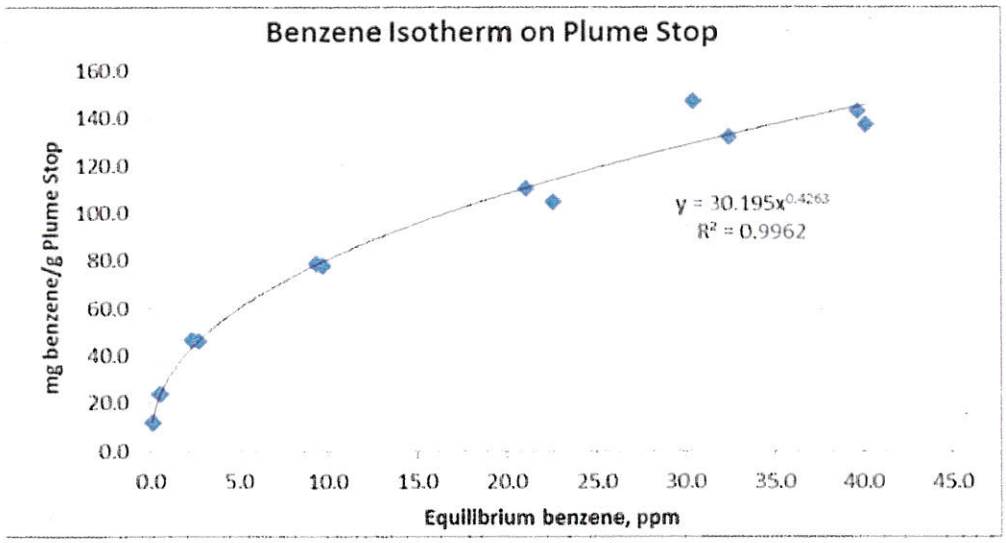



Figure 12. Sorption isotherm of benzene with PlumeStop.

### 4.4.4 Test conclusion

The column study provides confirmation that the distribution treatment of PlumeStop does not inhibit contaminant sorption – the PlumeStop in the test system was able to sorb 10,000 µg/L o-Xylene for well over ten pore volumes. The study additionally confirms that the PlumeStop was sufficiently retained within the soil to effect this result – the treatment not only did not inhibit sorption, but also did not result in excessive mobility leading to wash-out. The Freundlich sorption isotherms of PlumeStop with respect to benzene provide further illustration of the retained sorptive capacity and its relationship to concentration, which remains similar to unmodified powdered activated carbon. The retained sorptive capacity assertion of the PlumeStop technology hypothesis is therefore supported by this study.

## 4.5 Test 3. Post-Sorption Biodegradation

### 4.5.1 Introduction

The ability of PlumeStop to be readily dispersed into and then retained by a formation while maintaining its sorptive capacity provides a means of rapidly reducing or eliminating risk posed by organic groundwater contamination. The reduction of mobile contaminants from groundwater is sufficient in itself for securing common remedial objectives. The fate of the sorbed contaminant, however, continues to be a topic of interest, given that while sorption may indeed address risk, it does not in itself destroy the contaminant. Other questions that arise from a scenario in which contaminants are trapped but not destroyed include:

- How reliable is the sorption?
- Will the sorption be temporary?
- What long-term performance can be expected?

Such questions are commonly asked in relation to the remediation of inorganic contaminants, which cannot be destroyed. However, for organic species, the requirement for permanent binding is negated by the fact that they may be destro-yed through biological processes post-sorption. The present test therefore evaluates the propensity for contaminants sorbed into the PlumeStop biomatrix to biodegrade.

**Q: Does biodegradation proceed within the biomatrix?**

### 4.5.2 Test Outline

The test comprises a batch-equilibrium study consisting of 227 mL (8 oz.) soil-water systems that are spiked with benzene, both with and without PlumeStop (Figure 13). Each system contained 70 mL of water and 10 g of soil, thereby filling approximately one third of the container volume. This allowed sufficient remaining capacity for headspace analysis and the provision of adequate oxygen to maintain aerobic status throughout the study. Three treatment profiles were completed (Table 1).

**Table 1. Batch-Equilibrium Study – Test and Control Treatments**

| Treatment | Description |
|---|---|
| Sterile control | Autoclaved soil and sodium azide (abiotic control) |
| PlumeStop Treated | Soil and PlumeStop (test) |
| Sterile PlumeStop Treated (abiotic control) | Autoclaved soil, PlumeStop and sodium azide |

The tests were conducted in parallel and run over a period of 21 days. Microcosms were sampled destructively in triplicate on days 1, 7, 14, and 21. Benzene was quantified in the aqueous phase and also as a mass-balance extract of the total soil-water system (i.e. the aqueous and solid-phase microcosm contents together).

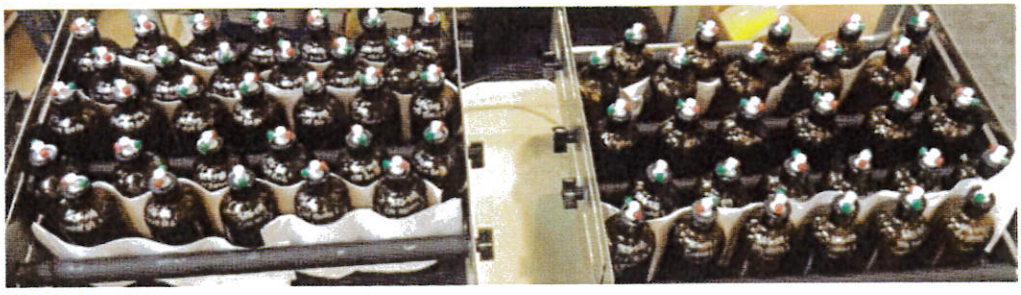


Figure 13. Batch-Equilibrium Study – Experimental Set-up

### 4.5.3 Test Results

Aqueous-phase concentrations of benzene are presented graphically in Figure 14. Data from the total system mass extractions are presented in Figure 15.

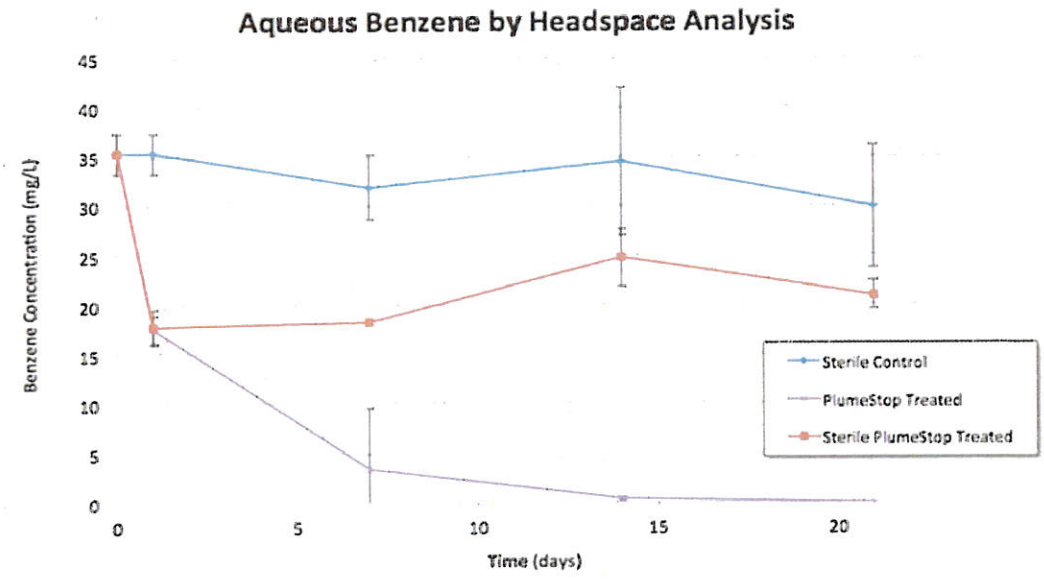



Figure 14. Batch-Equilibrium Study– Aqueous-Phase Results

Figure 14 illustrates a rapid and equal reduction in dissolved-phase benzene concentration in both the biotic and abiotic PlumeStop systems within the first sampling period. Thereafter, the aqueous benzene concentration in the biotic PlumeStop system continues to fall, whereas that in the abiotic PlumeStop control remains broadly static. Benzene concentrations in the soil-only sterile control did not change significantly throughout the study.

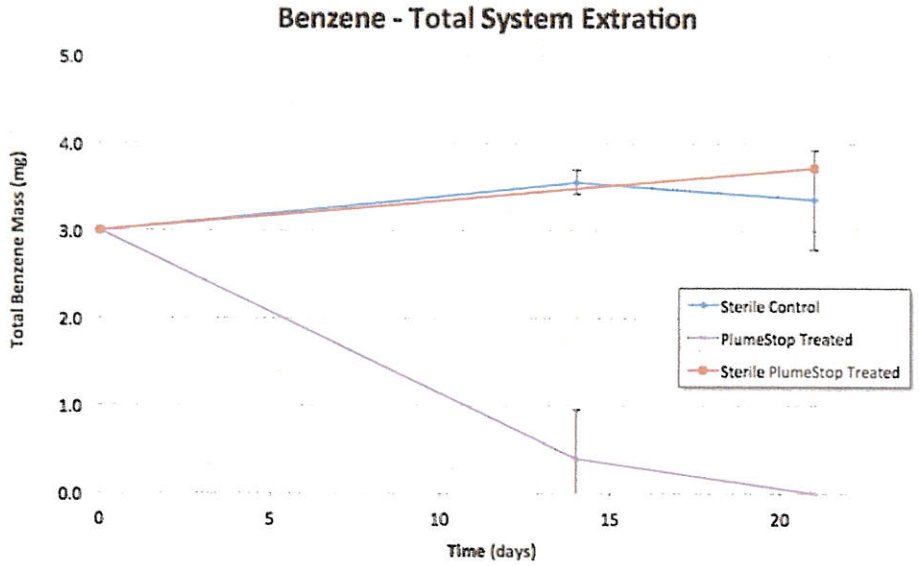



Figure 15. Batch-Equilibrium Study – Total System Extracts

In Figure 15, the total mass of benzene in the system (both aqueous-phase and solid-phase microchosm) are compared over a 21-day period, with the objective of determining whether the on-going reduction in the PlumeStop system could be attributed to a further sorption process, or whether it was indeed a reflection of a separate destructive process. This figure shows that the total mass of benzene in the two sterile treatments remained essentially unchanged throughout the course of the study, while in the biotic PlumeStop-treated sample, the total mass of benzene decreased to non-detect.

### 4.5.4 Conclusion

The rapid and equal reduction in aqueous-phase concentration over the first sampling period in both the biotic and abiotic PlumeStop systems may reasonably be attributed to abiotic sorption processes. The continued reduction in concentration in the biotic PlumeStop system with a kinetically distinct (Figure 14) and broadly first-order rate approximation is consistent with a biodegradative process. This conclusion also aligns with the biotic nature of this system containing PlumeStop compared to the analogous abiotic system, which showed no further reduction in benzene concentration following the initial change. The destruction of benzene in the biotic PlumeStop system is further confirmed in the total mass extractions shown in Figure 15, in which the full initial mass of benzene was recovered from the abiotic PlumeStop control, confirming non-destructive abiotic sorption (and a method validation of the extractive recovery efficiency). In contrast, the mass-balance of benzene in the biotic PlumeStop system describes a destructive reduction that is consistent with biodegradation. Together, this experiment provides confirmation that sorption of the contaminant by PlumeStop does not inhibit its subsequent biodegradation.

## 4.6 Test 4. Impact on Biodegradation Rate

### 4.6.1 Introduction

The final question related to proof-of-concept testing of the core PlumeStop technology hypothesis relates to the rate of post-sorption degradation, and whether the concentration of contaminants and microorganisms within the PlumeStop biomatrix increases net biodegradation rate.

Q: Is net contaminant degradation rate enhanced, inhibited, or unaffected by sorption into the biomatrix?

### 4.6.2 Test Outline

This test broadly follows the protocol of the preceding test, differing principally in that it includes a biotic soil-only control in addition to the biotic PlumeStop system. All systems were again reproduced in triplicate.

### 4.6.3 Test Results

Test results are presented in Figure 16, which illustrates the total system extracts of benzene (soil + water) over the course of a 28-day study. Abiotic test systems with and without PlumeStop show similar mass recoveries of benzene. In contrast, reductions in the total mass of benzene recovered are evident for the two biotic systems with and without PlumeStop. However, in the case of the PlumeStop system, the mass is reduced to below detection limit within the first sampling period (seven days) whereas the biotic soil-only control took until day 28 to reach non-detect.

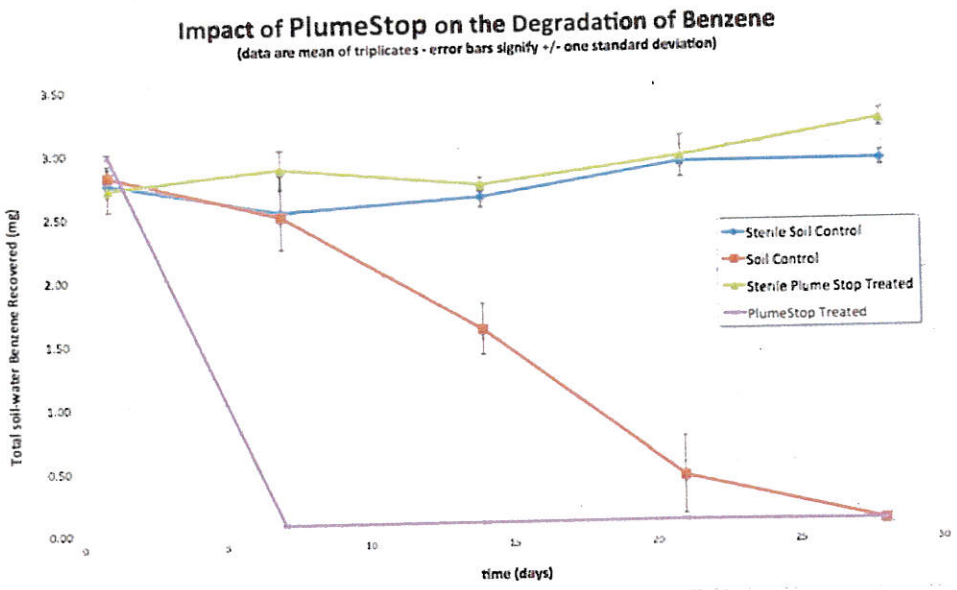



Figure 16. Second Batch-Equilibrium Study – Total System Extracts (all treatments)

### 4.6.4 Test Conclusions

The total mass of benzene was fully degraded in the biotic PlumeStop system within the first seven days of the test, in contrast with only 12.5% degradation over the same period in the biotic soil-only control. This approximates to a half-life of less than one day in the biotic PlumeStop system as compared to 10 days in the biotic control and represents a >10x rate increase based on the first-order approximation. Note that the half-life estimated for the biotic soil-only control is consistent with aqueous biotic rates that are published in the literature (11).

Although the absolute rates determined from these laboratory tests cannot be extrapolated to the field, the tests do serve to demonstrate a qualitative di-fference in the performance between the system containing PlumeStop and the one without. In so doing, they support the hypothesis that the contaminant degradation rate is enhanced by interaction with the PlumeStop.

### 4.7 Satisfaction of Laboratory Test Objectives

The preceding sections of this paper described laboratory-scale testing of the principles underpinning the core hypothesis of the PlumeStop technology. The following questions were sequentially addressed:

1. Can the PlumeStop biomatrix be effectively distributed through a saturated soil medium?
2. Does the treatment to enhance distribution negatively affect sorption capacity?
3. Does biodegradation proceed within the biomatrix?
4. Is net contaminant degradation rate enhanced, inhibited, or unaffected by sorption into the biomatrix?

The data presented are consistent with the core hypothesis, confirming that PlumeStop represents a dispersible, sorptive biomatrix that distributes easily through soil to coat the particles without washing out, and is capable of capturing a significant flux of test hydrocarbon (o-xylene). Post-sorption biodegradation is shown to proceed, and occurs at an accelerated rate compared to biotic untreated systems.

## 5 Performance Testing – Field

### 5.1 Introduction

Laboratory testing can provide a valuable means of testing specific principles relating to environmental technologies, but cannot be considered a substitute for appropriate field performance testing. Although quantitative data can be obtained in the laboratory to support key principles, extrapolation of the numeric results to the field cannot be technically supported. The following sections of this paper therefore extend the testing program of PlumeStop into field evaluation.

### 5.2 Field Test Objectives

The specific objectives of the field tests are to answer the following questions:

1. Can the performance shown in the lab be replicated in the field?
2. Can distribution be secured over field-practical distances?
3. Can significant field reductions in groundwater concentration be secured?
4. Can tentative indications of bio-destruction be identified?
5. Can the performance shown with hydrocarbons be replicated with chlorinated solvents?

Data addressing these questions are presented from two sites, one contaminated with hydrocarbons and one with chlorinated solvents. Both studies represent proof-of-concept evaluations rather than formal remediation endeavors.

### 5.3 Site Test 1 – Hydrocarbons

#### 5.3.1 Introduction

The field impact of PlumeStop on hydrocarbon contamination was evaluated on a historic gasoline plume at a confidential site of a former private high school in the Midwest United States (Figure 17). A leaking gasoline underground storage tank was identified as the source of the dissolved gasoline plume and subsequently removed. The site had a building foundation dewatering/control system that exerted a strong influence on the direction and extent of groundwater flow.

#### 5.3.2 Test Arrangement

The PlumeStop biomatrix was trialed in two areas of the plume: the original source (tank field) area (MW1) and in the plume body (MW2) approximately 14 m (46 feet) down-gradient from the source. Pre-application

groundwater contamination levels were similar in each of the test areas (Table 2). The target application interval in each case was comprised of saturated sandy silt with gravelly interbeds, underlain by a continuous hard silt layer. Depth to groundwater was approximately 2.5 m (7.5–8.0 ft). The building dewatering system imposed an artificial seepage velocity of approximately 200–280 m/yr (650-900 ft/yr) to the southwest (Figure 19).

Table 2. Hydrocarbon Site – Pre-Treatment Contamination Levels

| | MW1 – Source Area | MW2 – Plume Area |
|---|---|---|
| Gasoline-Range Petroleum Hydrocarbons (TPH-g) | 16,000 µg/L | 14,000 µg/L |
| Benzene, Toluene, Ethyl-Benzene and Xylenes (BTEX) | 7,000 µg/L | 9,000 µg/L |

PlumeStop was applied via direct-push injection (Figure 18) in a grid array. Eleven injection points were advanced in the area of MW1, and eight injection points were advanced around MW2, each at an approximate spacing of 1.5 m (5 feet) (Figure 20). The controlled release electron acceptor, ORC-Advanced® (REGENESIS, San Clemente, CA USA), was applied up-gradient and between points to support aerobic conditions appropriate for microbial colonization and activity.

Soil cores were taken before and after the PlumeStop application to provide local detail of the aquifer formation and visual evaluation of the reagent's distribution.

Figure 17. Hydrocarbon Site – Fieldwork

Figure 18. Hydrocarbon Site – Injection

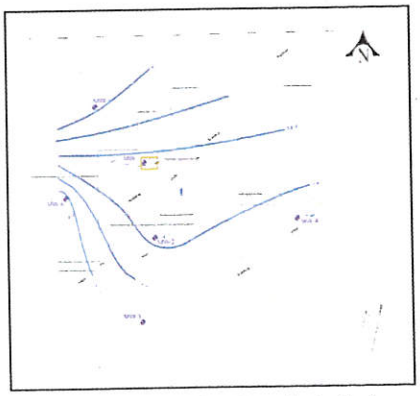


Figure 19. Hydrocarbon Site – Groundwater Contours

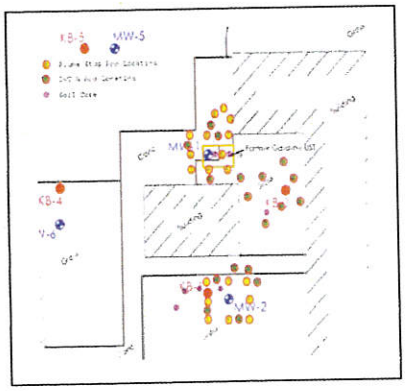



Figure 20. Hydrocarbon Site – Injection Arrangement

### 5.3.3 Test Results – First Three Months

Pre-application soil core data revealed significant contamination at the vadose/saturated zone interface, centered within a gravelly stratum (Figure 21). PlumeStop distribution extended throughout the entire lateral range that was evaluated by the soil cores (1-2 meters from the closest application point). Close inspection of these soil cores revealed good visual evidence of an even dispersion of the PlumeStop through the permeable strata (Figures 22 and 23).

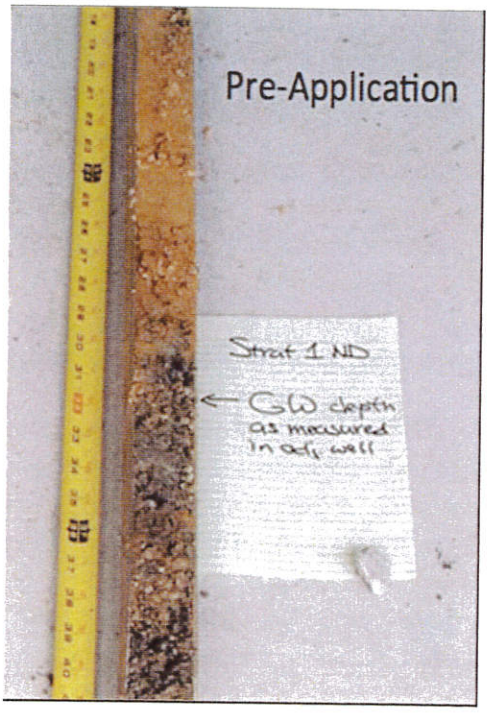



Figure 21. Pre-Application Soil Core

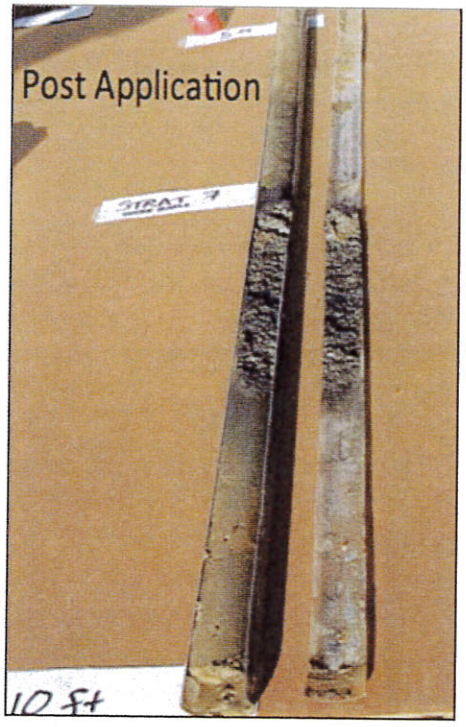



Figure 22. Post-Application Soil Core

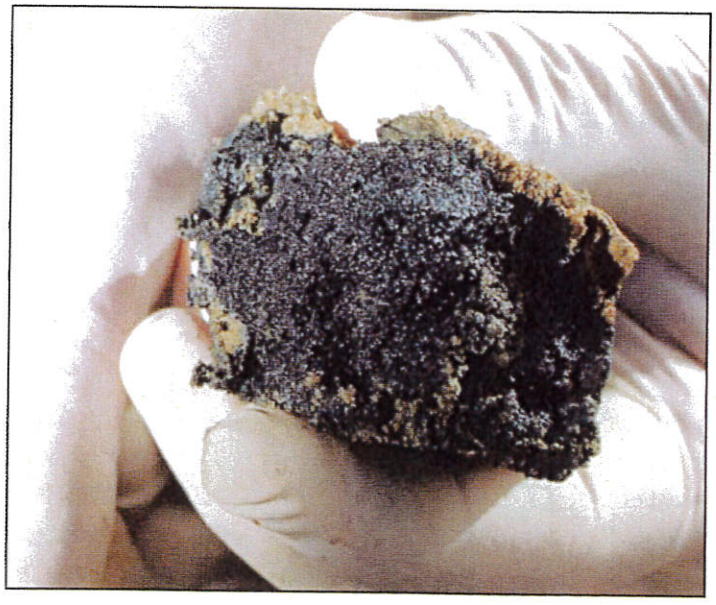


Figure 23. PlumeStop Dispersed Through Permeable Stratum

Hydrocarbon analysis of the groundwater revealed removal of contamination to below detection limits within the first sampling period (16 days). This represented a reduction of over three orders of magnitude (>99.9%) from original concentrations of 14,000–16,000 µg/L to < 100 µg/L. Data are presented in Figure 24. Groundwater concentrations remained below detection limits through the next sampling event, but then at 58 days rebounded to approximately 10% of their pre-treatment levels. Thereafter, the concentration in the plume well (MW2) reduced once more to below detection limits but remained largely unchanged in the source area well (MW1) at 10% of the baseline condition.

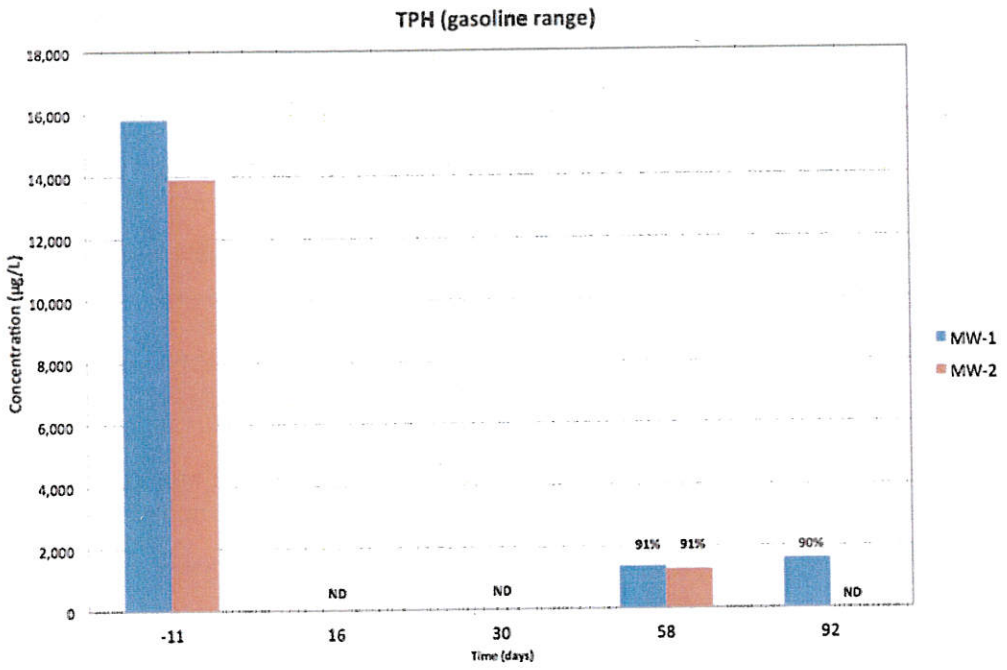



Figure 24. Hydrocarbon Site – Field Results

### 5.3.4 Test Conclusions

The field study confirms the ability of PlumeStop to be applied and dispersed through an aquifer formation using simple direct-push injection. Distribution through the maximum tested radius of 2.0 m (6.5 feet) was observed, suggesting the actual distribution may have been greater. A relatively even distribution of the reagent was observed within the permeable strata, consistent with the anticipated good dispersion throughout the mobile porosity that was suggested by the preceding laboratory studies. The striking reduction in groundwater hydrocarbon concentrations immediately following application is consistent with the hypothesized sorption of contamination by the PlumeStop. Note that simple displacement of the contaminated groundwater upon injection of PlumeStop could not account for this reduction in concentration, as the total fluid injection was significantly less than one pore volume and would be unlikely to result in an absolute a decline. The modest rebound in groundwater concentration at 58 days that was observed at both locations is believed to be due to the saturation ('over-topping') of the sorptive capacity of the PlumeStop owing to the entry of additional contaminant mass into the groundwater. This may either be from soil-sorbed, NAPL, or immobile porosity mass within the test area partitioning or back-diffusing into the groundwater as a result of the initial groundwater concentration reduction.

The introduction of such additional mass should be captured directly by the PlumeStop in a manner similar to the initial sorption of the bulk-porosity contaminants and result in little or no observable impact on groundwater concentration. However, saturation of the PlumeStop would cause groundwater concentrations to rise upon introduction of additional mass. The rate at which concentrations increased would be the balance of the rate of soil-contaminant desorption back-diffusion and the rate of biodegradation within the PlumeStop biomatrix, which would free-up sorption sites in an analogous manner to bio-GAC (28, 30). As a result, any rebound in groundwater concentrations would similarly decline as the rate of biodegradation increases and the rate of desorption back-diffusion slows with the depletion of the secondary source-mass. This is possibly what occurred at the 92-day point in the plume area well (MW2), where there was presumably less secondary source mass than that in the original source area (MW1).

### 5.4 Site Test 2 – Chlorinated Solvents

#### 5.4.1 Introduction

The field impact of PlumeStop on chlorinated solvent contamination (chlorinated volatile organic compounds – CVOCs) was evaluated on a mixed trichloroethene (TCE) and trichlorethane (TCA) plume at a former electronics facility in the Midwest United States. These solvents had been used at the site until the late 1980s, and multiple source areas were evident.

#### 5.4.2 Test Arrangement

The PlumeStop was trialed in a single test area located down gradient from the known sources, in an area of the plume believed to comprise dissolved and sorbed-phase contamination only, i.e. without residual non-aqueous-phase liquid (NAPL) present (Figure 25). Pre-test concentrations of TCA and TCE were 3,500 µg/L and 1,400 µg/L, respectively. The aquifer soil type was sand to silty-sand, with groundwater located between 3 and 4 m from the surface (10 – 13 feet). Groundwater seepage velocity was approximately 3.7 m/yr (12 ft/yr) to the southwest (Figure 26).

**Figure 25. Solvent Site – Test Location**

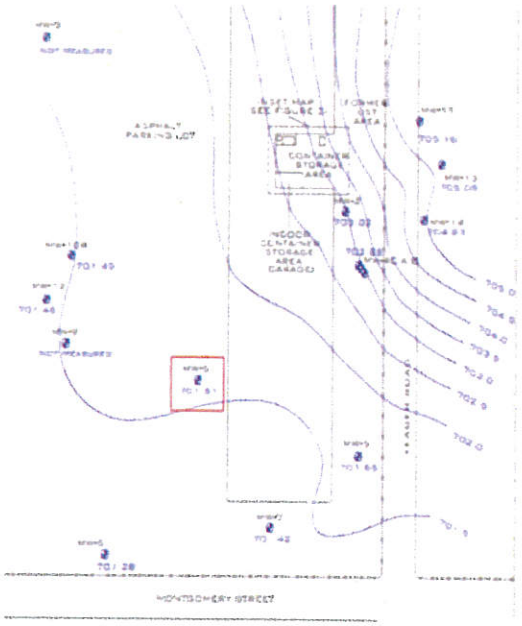


**Figure 26. Solvent Site – Groundwater Contours**

PlumeStop was applied by direct-push injection in a grid array of 10 injection points around the test well, spaced at a distance of 1.5–2.0 m (5–6.5 feet) (Figure 27 and Figure 28). The target application interval was across a depth of 2.75–6.5 m (9–21 feet) below ground surface.

The controlled release electron donor HRC® (REGENESIS, San Clemente, CA USA) was applied in a linear array of four points immediately up-gradient of the test zone to establish and maintain anaerobic conditions appropriate for microbial colonization and activity (Figure 28).

Soil cores were taken before and after the PlumeStop application to provide local detail of the aquifer formation and visual evaluation of the reagent's distribution.

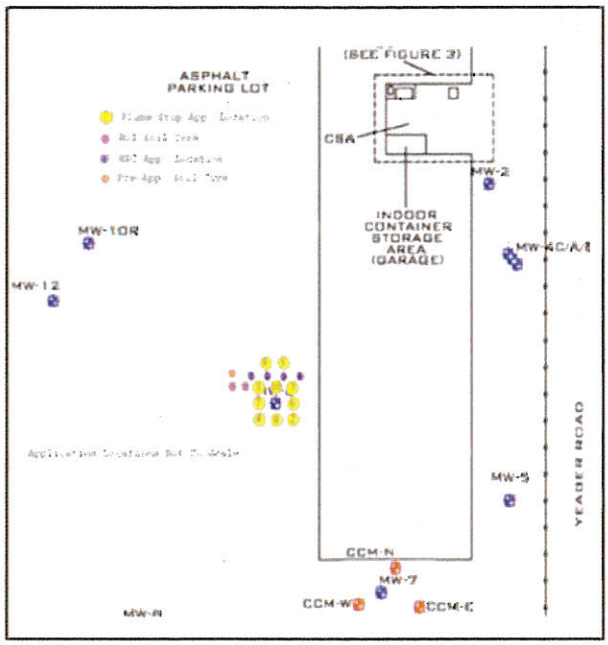



Figure 27. Solvent Site – Injection Arrangement

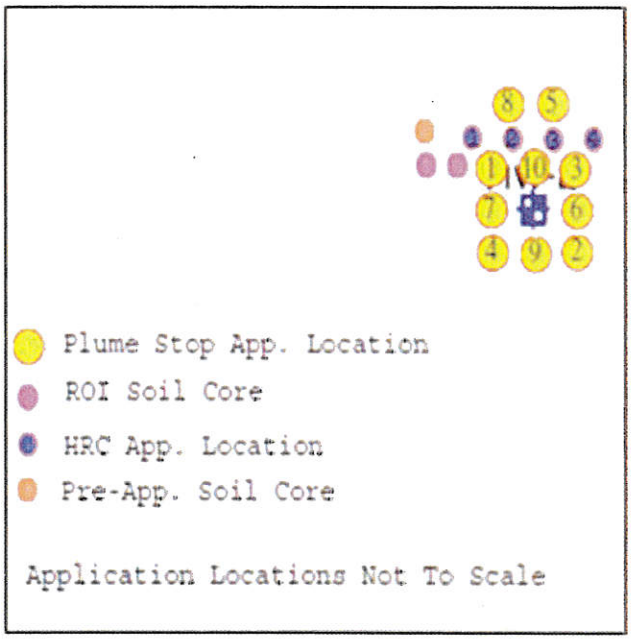



Figure 28. Solvent Site – Injection Arrangement (detail)

### 5.4.3 Test Results – First Two Months

Post-application soil core data revealed good dispersion of the PlumeStop throughout the radius tested (2 m; 6.5 feet). Groundwater analysis revealed total CVOC concentration had dropped from 5,718 µg/L to 467 µg/L (92% decrease) by the time of the first monitoring event, two weeks after application (Table 3).

Subsequent monitoring rounds showed a consistent decline in concentration to 113 µg/L at one month and 12.9 µg/L at two months, representing concentration reductions from pre-treatment baseline of 98% and >99%, respectively.

The data are presented graphically in Figure 29.

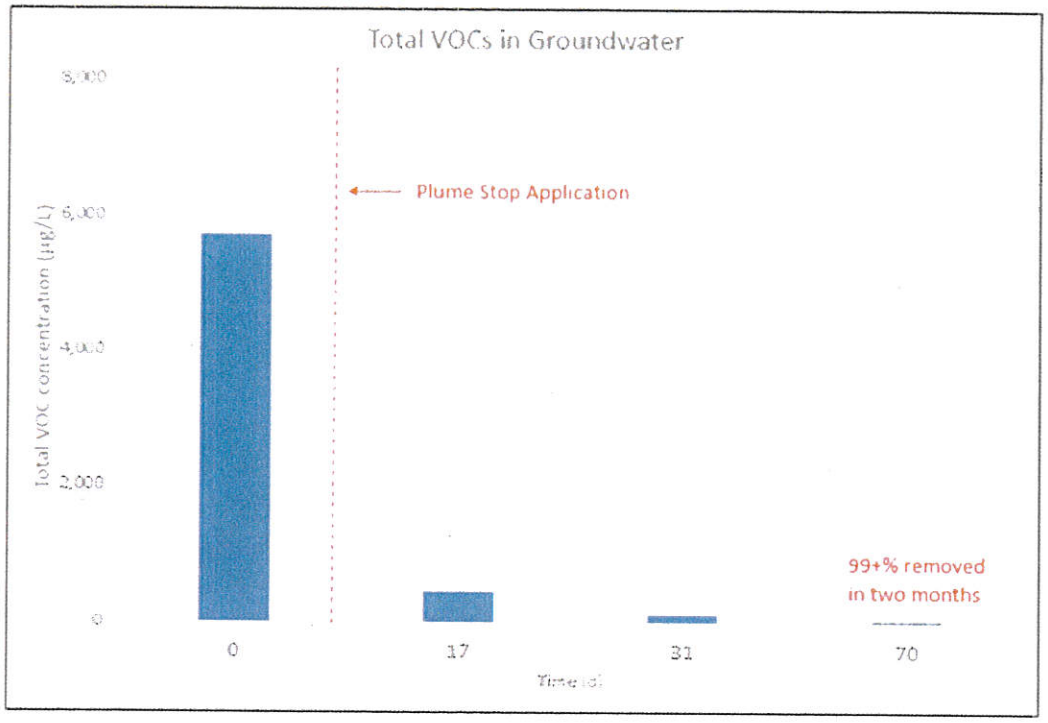



Figure 29. Solvent Site – Field Results

Geochemical changes observed in the groundwater included the establishment of reducing conditions between 17 and 31 days and a rise in dissolved iron from zero to 2,000 µg/L over the first 70 days. pH remained unchanged at 6.6 throughout the test period.

### 5.4.4 Test Conclusions

Examination of soil cores collected outside of the PlumeStop application area indicated that PlumeStop was transported at least 2 m (6.5 feet) – the maximum interval measured – by the injection process used in this pilot testing program. The actual radius of dispersion was not determined beyond this, but may reasonably be presumed to have been greater.

The sharp reduction in groundwater CVOC concentrations immediately following application is consistent with the hypothesized sorption of contamination by PlumeStop. The on-going reduction following the initial step-change may be due to plume-equilibration and on-going partitioning of contaminant mass into the PlumeStop, biodegradation, or a combination of these processes. The timing, however, would suggest sorption to be the dominant phenomenon in the present case given that conducive conditions for anaerobic biodegradation were only recently becoming established and degradation daughter products were not observed.

## 5.5 Satisfaction of Field Test Objectives

The preceding sections of this paper describe the testing of PlumeStop performance in the field, for the treatment of hydrocarbons and chlorinated solvents respectively. The following questions were addressed:

1. Can the performance shown in the lab be replicated in the field?
2. Can distribution be secured over field-practical distances?

3. Can significant field reductions in groundwater concentration be secured?
4. Can tentative indications of bio-destruction be identified?
5. Can the performance shown with hydrocarbons be replicated with chlorinated solvents?

The field test data suggest an affirmative answer to each of these questions. Specifically, PlumeStop has been shown to distribute easily through soil over field-practical distances of at least 2.0 m (6.5 ft) (the maximum tested interval) and to rapidly secure reductions of groundwater contaminant concentration of at least one to two orders of magnitude for both hydrocarbon and chlorinated solvent contamination. Field data suggest that biodegradation post-sorption is occurring, and as such, are consistent with the laboratory study data presented in the earlier part of this paper.

## 6 Discussion

### 6.1 Technology Implications – Key Features

The development of an injectable, dispersible, sorptive biomatrix has the potential to directly address a number of widespread challenges in the groundwater clean-up sector. Specifically, the principal features of technology are its ability to:

- Widely distribute throughout the subsurface to impact a significant area;
- Adsorb contaminants and rapidly reduce associated groundwater concentrations;
- Inhibit transport of contaminants in the aquifer;
- Provide a "biomatrix" for microorganisms and contaminants;
- Enhance contaminant biodegradation, resulting in remediation of the site; and,
- Address matrix back-diffusion, where applicable.

### 6.2 Technology Implications – Selected Usage Scenarios

Among the selected usage indicators postulated for PlumeStop are the following:

1. **When time is critical** PlumeStop arguably represents the fastest groundwater risk-reduction/remediation technology presently available[3]. Immediate risk-reduction is secured through sorption, quickly removing contaminants from groundwater; long-term destruction is then secured through in-matrix biodegradation.
2. **As a long-term control of migrating diffuse pollution** (or migrating pollution per se). PlumeStop can be used in a barrier formation to capture diffuse contaminants, concentrating them within its biomatrix for locally intensive treatment. This would provide a tighter capture-zone than bio-barriers alone, which is valuable where space is limited and/or groundwater is fast-flowing. It would also provide faster destruction rates and greater timing tolerance between bio- amendment applications.
3. **As a means of treating low-concentration plumes** Bioremediation of low concentrations (e.g. low µg/L range) is often challenging owing to concentrations being insufficient to support microbial activity. PlumeStop overcomes this limitation by accumulating low-level contaminants into the biomatrix until concentrations become sufficient within the matrix to support an active microflora, all while keeping the contaminants out of the groundwater.
4. **To address matrix back-diffusion** Injection of PlumeStop into groundwater results in a rapid drop of contam nant groundwater concentration, typically of one to two orders of magnitude. This drop reverses the concentration gradient between the immobile porosity and the bulk solution (or increases the gradient out of the matrix if the bulk solution concentration has previously been reduced by other means). On entering the bulk solution, back-diffused contaminants are in turn captured by the PlumeStop where they are

[3] It is recognized that solid sorptive media may be introduced through other means such as fracture-emplacement, soil-mixing, or tight- application grids. Howe beyond the obvious cost and practicality benefits of dispersive liquid activated carbon injection, the application fieldwork itself would be significantly faster.

biodegraded. The reverse gradient is therefore maintained, and diffusion out of the immobile porosity continues until the back-diffusing mass is depleted. PlumeStop is not consumed in this process and will theoretically continue to function in this manner over decades, easily matching the timescales necessary to address back-diffusion and thus providing robust remedy-in-place protection from a one time application.

## 7 PlumeStop Liquid Activated Carbon – Product Summary

### 7.1.1 Overview

PlumeStop Liquid Activated Carbon is a new technology for groundwater treatment that allows for wide dispersion of a sorptive medium in the aqueous subsurface. The product has a dual function: it sorbs contaminants, quickly removing them from the mobile phase ('PlumeStop'), and provides a high surface area matrix favorable for microbial colonization and growth ('Biomatrix'). Contaminant availability within a risk pathway is therefore reduced while at the same time contaminant destruction is accelerated. This product offers attributes unlike any reagent on the market today.

### 7.1.2 Description

PlumeStop is an environmentally compatible, proprietary formulation of liquid activated carbon combined with polymeric and molecular dispersion agents that allow the material to distribute widely throughout soil and groundwater without compromise to sorptive capacity. Once contaminants are embedded within PlumeStop's structure, rapid biodegradation occurs. Intrinsic biodegradation processes can then be further enhanced with the proximal co-application of controlled-release electron acceptors or electron donors if desired.

### 7.1.3 Applicability

The PlumeStop technology is effective on most organic groundwater contaminants, including hydrocarbons, halogenated compounds, and a wide variety of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). It can be applied to inhibit spreading of contaminant plumes, to protect sensitive receptors, or to prevent contaminant migration across property boundaries. PlumeStop is also a very effective tool for control and treatment of groundwater contamination associated with matrix back-diffusion, and for treating sites with very low contaminant concentrations (oligotrophic bio-limitation).

### 7.1.4 Performance

Laboratory and field studies with PlumeStop indicate that it has minimal impacts on groundwater quality, oxidation- reduction potential (redox), and geochemistry. Once injected into the subsurface, PlumeStop is expected to last on the order of decades, continually immobilizing and stimulating the biodegradation of contaminants.

Field studies confirm wide-area dispersion, with order of magnitude (>90%) reductions in dissolved-phase concentration at the test sites post-application sampling, which further increased to two orders of magnitude (>99%) within two months for both chlorinated solvent and hydrocarbon species. Laboratory data provided confirmation of post-sorption degradation enhancement, describing a significant increase in the rate of contaminant destruction in biotic matrix systems compared to abiotic matrix and biotic non-matrix controls.

## 8 Further Information

PlumeStop Liquid Activated Carbon has been developed by and is commercially available from REGENESIS, San Clemente, California, USA. U.S. and international patents pending. Further product information and a full listing of technical contact personnel are available at www.REGENESIS.com.

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Environmental Solutions

**EHC® Reagent**

Product Sheet

# EHC® The Original ISCR Reagent

EHC® *in situ* chemical reduction (ISCR) reagent is the original patented combination of controlled-release organic carbon and zero valent iron (ZVI) used for the treatment of groundwater and saturated soil impacted by persistent halogenated compounds, including chlorinated solvents, pesticides and organic explosives. The EHC formula is the culmination of years of research and successful field use. EHC is comprised of a synergistic mixture of micro-scale ZVI and a solid organic carbon source, stimulating both abiotic and biotic dechlorination mechanisms.

## Contaminants treated

- Chlorinated solvents including chlorinated ethenes, ethanes and methanes
- Energetic compounds such as TNT, DNT, HMX, RDX and perchlorate
- Most pesticides including DDT, DDE, dieldrin, 2,4-D and 2,4,5-T
- Chlorobenzenes including di- and tri-chlorobenzene
- Chloroflurocarbons
- Nitrate compounds

## Applications

EHC can address a wide range of contaminant concentrations and has successfully been applied to treat large dilute plume areas, groundwater hots-spots, and high concentration source areas:

- Permeable Reactive Barriers (PRBs) for Plume Control: EHC has an estimated lifetime > 5 years in the subsurface, which makes it ideal for placement into PRBs. The first full-scale EHC PRB has been operating since 2005, and has continuously supported >90% CVOC removal under flow-through conditions.
- Grid-Applications: EHC is also commonly used for source area/hot-spot treatment, and the product's longevity allows for continued treatment of contaminants as they slowly back diffuse from the solid matrix to groundwater at sites with high concentrations of sorbed mass / NAPL. EHC successfully treated a site with starting TCE concentrations >600 mg/L.
- Plume Treatment: Designs with multiple PRBs have been employed for cost effective treatment of large dilute plume areas.

## Installation methods

- Injection of EHC Slurry via Direct Push Technology (DPT)
- Hydraulic or Pneumatic Fracturing (applied to fine-grain formations including weathered and fractured bedrock)
- Direct placement into open excavations or trench PRBs
- Deep soil mixing

## SPECIFICATIONS

**Composition:**

- Micro-scale ZVI (~40%*)
- Controlled-release, food grade, complex organic carbon (~60%*)
- Major, minor, and micronutrients
- Food grade organic binding agent

**Packaging:**

Delivered as a dry powder, available in 50-lb / 25 kg bags and 1 ton super sacs.

**Health and Safety:**

Non-hazardous and safe to handle.

**Longevity:**

3 to 5+ years, depending on application

*Custom formulations available upon request

Environmental Solutions

# EHC® Reagent

Product Sheet

## The sound science of EHC

EHC will rapidly create strong reducing conditions via biotic and abiotic mechanisms as detailed below:

- The addition of organic carbon to the subsurface will support the growth of indigenous heterotrophic bacteria in the groundwater environment. As the bacteria feed on the organic carbon particles, the bacteria consume dissolved oxygen and other electron acceptors, thereby reducing the redox potential in groundwater.
- The ZVI particles will scavenge oxygen as it undergoes oxidation promoting an additional drop in the redox potential of groundwater.

EHC promotes both biotic and abiotic dechlorination reactions:

- As the bacteria ferment the organic portion of EHC, they release a variety of volatile fatty acids (VFAs) such as lactic, propionic and butyric acids, which diffuse from the site of fermentation into the groundwater plume and serve as electron donors for other bacteria, including dehalogenators.
- The small ZVI particles (i.e., <100 μm) provide substantial reactive surface area that stimulates direct chemical dechlorination. Furthermore, as the ZVI is corroding ferrous iron is released into the groundwater. As the dissolved iron travels into areas with higher redox potential, it will precipitate out as a number of ferrous and ferric precipitates, including, but not limited to iron oxide and sulfide. These ferrous iron precipitates have also been proven to be reactive with CVOCs and will stimulate abiotic dechlorination mechanisms in an extended area downgradient of the points of application.

### EHC KEY ATTRIBUTES

- Abiotic and Biotic Degradation
- pH Balanced
- Long-Lasting
- Field-Proven
- Quickly Generates Reducing Conditions
- Minimal Generation of Daughter Products
- Manufactured from Sustainable Recycled Materials

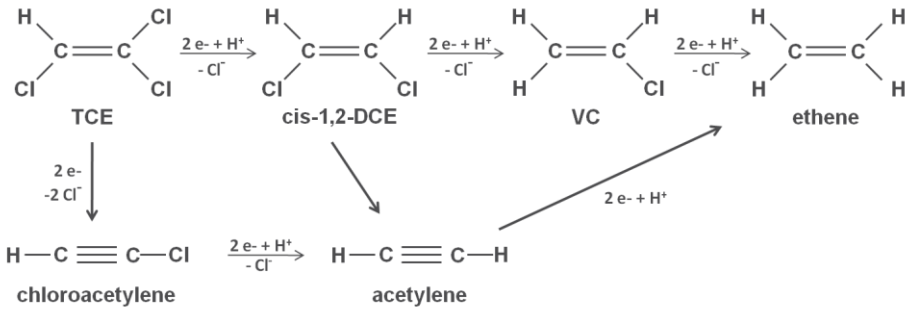
Synergistic benefits of combining organic carbon and ZVI:

- Redox potentials as low as –500 mV have been observed in groundwater after EHC addition. These Eh values are significantly lower than those achieved when using either organic materials (e.g. lactate and molasses) or reduced metal alone. These low Eh potentials not only improve the kinetics of the dechlorination reactions but also support more complete decomposition of chlorinated solvents.
- Self-buffered – the alkalinity generated from ZVI corrosion (release of hydroxide) is off-set by the acidity from organic carbon fermentation (VFAs). Maintaining a near neutral pH is beneficial for microbial growth and also serves to prevent ZVI passivation from mineral coatings, hence extending the reactive life of the ZVI.

Multiple degradation pathways:

The addition of organic carbon will promote conventional step-wise reductive dechlorination reactions, whereas the dominant abiotic pathway observed in contact with zero-valent iron and ferrous iron precipitates is beta-elimination; minimizing the generation of daughter products (specifically vinyl chloride).

**Biotic Pathway (Step-Wise Reductive Dechlorination)**




**Main Abiotic Pathway (β-Elimination)**

PeroxyChem

remediation@peroxychem.com | 1.866.860.4760 | peroxychem.com/remediation

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Document 04-02-ESD-14

# APPENDIX F
# COMMENTS ON THE SUPPLEMENTAL FINAL SITE INVESTIGATION REPORT

# NEW MEXICO ENVIRONMENT DEPARTMENT

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**JOHN A. SANCHEZ**
Lieutenant Governor

**RYAN FLYNN**
Cabinet Secretary

**BUTCH TONGATE**
Deputy Secretary


**CERTIFIED MAIL – RETURN RECEIPT REQUESTED**

April 29, 2016

Dan March, Manager
Laun-Dry Supply Company, Inc.
1503 12th St. NW
Albuquerque, NM 87104

**RE: Comments on the Supplemental Final Site Investigation Report, Stage 1 Abatement Plan, Laun-Dry Supply Company, Albuquerque, New Mexico**

Dear Mr. March:

The Ground Water Quality Bureau of the New Mexico Environment Department (NMED) has reviewed the document prepared by EA Engineering, Science, and Technology, Inc, PBC (EA) on behalf of Laun-Dry Supply Company (Laun-Dry) titled, *Supplemental Final Site Investigation Report and Semi-Annual Groundwater Monitoring Report* (FSIR) dated March 21, 2016. In the Report, Laun-Dry summarizes field investigations conducted under the Stage 1 Abatement Plan pursuant to Section 20.6.2.4106.C NMAC and interim remedial actions. NMED has the following comments on the FSIR:

**General Comments**

Many years of investigations into widespread groundwater impacts at Laun-Dry have resulted in an informed picture of the nature and extent of the contamination. NMED and Laun-Dry also recognize the need for additional investigations in the near future. However, for the purposes of moving forward with a Stage 2 Abatement Plan and the requisite public notification, the work completed to date will suffice at this time. As future investigations further define human health and groundwater impacts, additional characterization activities may be required.

**Specific Comments**

1. Section 2.1, Page 5 references Table 1 Well Construction Details. This table notes that the total depth and well screen intervals are unknown for several monitoring wells. Laun-Dry should determine the screen intervals so that groundwater data is collected appropriately from these wells.

2. Section 2.1, Page 5 lists the wells sampled during the investigation. In order to better understand groundwater impacts in the distal end of the plumes, supply and irrigation wells at the Menaul School, Sunset Memorial Cemetery and Mt. Calvary Cemetery should be incorporated into the sampling network and sampled on a semi-annual basis.

3. Section 2.2, Page 7 references results of a Passive Soil Gas Survey that have been interpreted in Section 5.0, Page 18, as indicating potential sources of chlorinated solvents in the vicinity of 5th Street and Haines Avenue. Additional characterization of soil, soil gas, and groundwater must occur to determine if this area represents additional sources or is the centerline of the plume originating from Laun-Dry.

4. Section 4.2, Page 16 references the installation of monitoring wells MW-17 through MW-19 to delineate the downgradient extent of the plume. The increasing trend and magnitude of TCE concentration detected in MW-17 indicate that the northern distal portion of the plume has not been characterized.

5. Section 4.4, Page 17 states that the Vapor Intrusion pathway is considered an incomplete human health exposure pathway. NMED does not agree that the pathway is incomplete for the site. The residential area investigated was chosen due to the potentially exposed population, not as a surrogate for the entire potentially affected area. The portion of the plume that poses a risk for vapor intrusion, as identified by groundwater concentrations that exceed the Industrial/Occupational Vapor Intrusion Screening Level for the Groundwater to Indoor Air pathway of 24.3 ug/L TCE, incorporates a large area with tens of buildings.

6. Section 5.0 states that the medial portion of the groundwater plume has been determined. NMED is concerned that the centerline of the plume has not been adequately defined between MW-5 and the RayMar wells. The southern edge of the plume by MW-5 has not been delineated.

Given the complexity at the Laun-Dry site, additional investigations will be necessary to quantify potential impacts to human health via vapor intrusion and to further define existing impacts to groundwater quality. Issues specifically identified to date include:

- evaluation of the vapor intrusion pathway for buildings along the centerline of the plume;
- further characterization of groundwater and soil vapor in medial portion of the plumes between MW-5 and the RayMar wells;
- further characterization of groundwater in the distal portion of the plume, downgradient of the RayMar wells and downgradient of MW-17; and
- the influence of pumping of irrigation wells on the distal portion of the plume; and
- a three-dimensional representation of the plumes to effectively communicate the extent of the plume to the public.

This list is not inclusive, as additional areas may be identified and included during Stage 2 activities.

Please submit a Stage 2 Abatement Plan proposal within 60 days of receipt of this letter. Response to these comments may be submitted as an addendum to the FSIR.

If you have any questions, please contact Justin Ball, Project Manager, at (505) 222-9522 or Kristie Kilgore, Team Leader, at (505) 827-2778. Thank you for your cooperation in this matter.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

xc: Pete Domenici, Jr., 320 Gold Ave. SW, Suite 1000, Albuquerque., NM 87102
PDomenici@domenicilaw.com
Teri McMillan, EA, 320 Gold Ave. SW, Suite 1210, Albuquerque, NM 87102 McMillan,
tmcmillan@eaest.com
Mary Lou Leonard, City of Albuquerque Environmental Health
Kathryn S. Becker, OGC
Kristie Kilgore, GWQB-SCP
Justin Ball, GWQB-SCP
ROS Read File

# APPENDIX G
# PUBLIC NOTICE

# PUBLIC NOTICE PSA FOR RADIO

EA ENGINEERING, SCIENCE, AND TECHNOLOGY INC., ON BEHALF OF LAUN-DRY SUPPLY COMPANY, HAS PREPARED A PROPOSED STAGE 2 ABATEMENT PLAN FOR TREATMENT OF GROUNDWATER CONTAINING TETRACHLOROETHENE (PCE) AND TRICHLOROETHENE (TCE) IN EXCESS OF THE NEW MEXICO WATER QUALITY CONTROL COMMISSION (NMWQCC) STANDARDS. LAUN-DRY SUPPLY COMPANY IS LOCATED AT 1503 12$^{TH}$ STREET NW IN ALBUQUERQUE, NEW MEXICO.

QUESTIONS, COMMENTS OR REQUEST FOR PUBLIC HEARING ABOUT THE ABATEMENT PLAN MUST BE SUBMITTED IN WRITING WITHIN 60 DAYS AFTER THE DEPARTMENT MAKES A DETERMINATION THAT THE PROPOSAL IS ADMINISTRATIVELY COMPLETE. WRITTEN STATEMENTS, COMMENTS AND/OR REQUEST FOR NOTIFICATION OF ADMINISTRATIVE COMPLETENESS MUST BE SUBMITTED TO:

NEW MEXICO ENVIRONMENT DEPARTMENT
GROUND WATER QUALITY BUREAU
NEW MEXICO ENVIRONMENT DEPARTMENT
121 TIJERAS AVENUE, NE
ALBUQUERQUE, NM 87102-3400

COMMENTS CAN ALSO BE MADE BY CALLING JUSTIN BALL AT 505-222-9522.

**LETTER FOR DISTRIBUTION TO PROPERTY OWNERS**

Dear Property Owner:

This is to inform you that Laun-dry Supply Company (Laun-dry), located at 1503 12th Street, Albuquerque, New Mexico, has submitted a Stage 2 Abatement Plan, pursuant to the New Mexico Water Quality Control Commission (NMWQCC) requirements for the treatment of ground water containing tetrachloroethene (PCE) (dry cleaning product) and trichloroethene (TCE) (by product of PCE), in excess of the NMWQCC standards.

This contamination is found in the groundwater beneath and beyond the Laun-dry boundaries as a result of past release of PCE. On April 29, 2016, NMED notified Laun-dry that it required a remediation proposal or Stage 2 Abatement Plan.

The submitted Stage 2 Abatement Plan proposal consists of: 1) institutional control in the form of an Office of the State Engineer order to prohibit new wells from being installed in the Abatement Plan Area, 2) permeable reactive barriers (PRB), emplaced via injection of microbes, fluids and or slurries to treat and/or sequester the contamination, 3) long term monitoring and 4) monitored natural attenuation of the groundwater plumes.

The Secretary of the NMED will consider the proposed plan and comments received by the public in his decision to approve or notify Laun-Dry of the proposal's deficiency.

Persons interested in reviewing the Stage 2 Abatement Plan proposal and/or obtaining additional information, may do so by contacting the Department's Ground Water Quality Bureau office in Albuquerque (505 222-9522). A copy of the plan is available on the NMED web page at https://www.env.nm.gov/gwb/NMED-GWQB-PublicNotice.htm.

The Secretary of the NMED will accept written statements or comments regarding the proposed Stage 2 Abatement Plan, and requests for a public meeting or hearing that include the reasons why a meeting or hearing should be held must be submitted within 60 days after the department makes a determination that the proposal is administratively complete. Written statements, comments and/or request for notification of administrative completeness must be submitted to:

Justin Ball, Project Manager
Ground Water Quality Bureau
New Mexico Environment Department
121 Tijeras Avenue, NE
Albuquerque, NM 87102-3400
Justin.Ball@state.nm.us

**NOTICE FOR NEWSPAPER AD**

This is to inform you that Laun-Dry Supply Company (Laun-Dry), located at 1503 12th Street, Albuquerque, New Mexico, has submitted a Stage 2 Abatement Plan, pursuant to the New Mexico Water Quality Control Commission (NMWQCC) requirements for the treatment of groundwater containing tetrachloroethene (PCE) (dry cleaning product) and trichloroethene (TCE) (by product of PCE), in excess of the NMWQCC standards.

This contamination is found in the groundwater beneath and beyond the Laun-Dry boundaries as a result of past release of PCE. On April 29, 2016, NMED notified Laun-dry that it required a remediation proposal or Stage 2 Abatement Plan.

The submitted Stage 2 Abatement Plan proposal consists of: 1) institutional control in the form of an Office of the State Engineer order to prohibit new wells from being installed in the Abatement Plan Area, 2) permeable reactive barriers (PRB) emplaced via injection of microbes, fluids and or slurries to treat and/or sequester the contamination, 3) long term monitoring and 4) monitored natural attenuation of the groundwater plumes.

The Secretary of the NMED will consider the proposed plan and comments received by the public in his decision to approve or notify Laun-Dry of the proposal's deficiency.

Persons interested in reviewing the Stage 2 Abatement Plan proposal and/or obtaining additional information, may do so by contacting the Department's Ground Water Quality Bureau office in Albuquerque (505 222-9522). A copy of the plan is available on the NMED web page at https://www.env.nm.gov/gwb/NMED-GWQB-PublicNotice.htm.

The Secretary of the NMED will accept written statements or comments regarding the proposed Stage 2 Abatement Plan, and requests for a public meeting or hearing that include the reasons why a meeting or hearing should be held must be submitted within 60 days after the department makes a determination that the proposal is administratively complete. Written statements, comments and/or request for notification of administrative completeness must be submitted to:

Justin Ball, Project Manager
Ground Water Quality Bureau
New Mexico Environment Department
121 Tijeras Avenue, NE
Albuquerque, NM 87102-3400
Justin.Ball@state.nm.us