

1R - 484

# REPORTS

DATE:

Aug. 26, 2009

August 26, 2009

Mr. Edward Hansen  
State of New Mexico – Oil Conservation Division  
1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

RECEIVED  
AUG 28 2009  
Environmental Bureau  
Oil Conservation Division

RE: OCD Remediation Project Nos. 1R-483, Elliott B-9 #1,4,&5 Tank Battery, Unit C (NE/4, NW/4), Section 9, T22S, R37E, and 1R-484, Elliott B-9 #2 & 3 Tank Battery Unit D (NW/4, NW/4), Section 9, T22S, R37E, Release Delineation Report, John H. Hendrix Corporation, Lea County, New Mexico

Dear Mr. Hansen:

This report is submitted to the State of New Mexico Oil Conservation Division on behalf of John H. Hendrix Corporation (JHHC) by Larson and Associates, Inc., its agent, and presents the results of remedial actions performed at the referenced sites. LAI and JHHC respectfully request a 180 day remediation design extension to negotiate groundwater extraction for remediation with the Office of the State Engineer (OSE), and to design remediation system consistent with OSE requirements.

This report combines the evaluation of two nearby sites since the data from each site separately does not plot well for graphics, and the physical characteristics of the site areas are very similar. However, remediation efforts will be treated separately.

If you have any questions or concerns, please call me at 432.687.0901 to discuss.

Sincerely,

**LARSON & ASSOCIATES, INC.**



William D. Green, PG No. 136  
Texas Licensed Professional Geologist  
[wgreen@laenvironmental.com](mailto:wgreen@laenvironmental.com)

Attachments

CC

Ms. Carolyn Haynes – JHHC Midland  
Mr. Larry Johnson – OCD District 1

RECEIVED

AUG 28 2009

Environmental Bureau  
Oil Conservation Division

## **Release Delineation Report**

1R-483 & 1R-484

Elliott B-9 #1, 4, & 5 Tank Battery &

Elliott B-9 #2 & 3 Tank Battery

Unit C & D, Section 9, T22S, R37E

Lea County, New Mexico

OCD Project Nos. 1R-483 & 1R-484

LAI Project Nos. 6-0104-02, -03

August 26, 2009

Prepared for:

John H Hendrix Corporation

110 N Marienfeld, Suite 400

Midland, TX 79701-4461

Prepared by:

William D. Green, PG No. 136

Texas Registered Professional Geologist

Larson & Associates, Inc.

507 North Marienfeld, Suite 200

Midland, Texas 79701

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## Executive Summary

This report is submitted to the State of New Mexico Oil Conservation Division (OCD) on behalf of John H. Hendrix Corporation (JHHC) by Larson and Associates, Inc. (LAI), its agent, and presents the results of delineation at referenced leak sites. The report has been prepared based upon the *Guidelines for Remediation of Leaks, Spills and Releases* (OCD, August 13, 1993), with a slight deviation.

Two site investigations are presented in this report since both locations are nearby (both sites are in the N/2 of the NW/4 of Section 9), are similar in contaminants of concern, and the three monitor wells associated with each site are near linear in placement, limiting the ability to determine groundwater gradient and chemical distribution for individual sites.

## Responsible Party Contact Information

JHHC's contact for environmental concerns is:

Ms. Carolyn Haynes  
John H. Hendrix Corporation  
110 N. Marienfeld, Suite 400  
Midland, Texas 79701  
Office – 432.684.6631, Cell – 575.390.9689  
Email – [cdoranhaynes@jhhc.org](mailto:cdoranhaynes@jhhc.org)

## Historic Information

Site releases were identified through the investigation of closed production pits. Both sites are located approximately 1.5 miles south of Eunice, New Mexico. Figure 1 presents the site locations plotted on a topographic map.

## General Site Characteristics

The release locations are at latitude N 32° 24' 44.63", longitude W 103° 10' 31.30" for the #2&3 site, and N 32° 24' 37.28", W 103° 10' 11.77" for the #1,4,5 site (Figure 1). The surface estate is owned by Mr. Charlie Bettis and is used for oil and gas production and occasional livestock grazing.

The surface elevation is approximately 3,420 feet above mean sea level and slope gently east-southeast. The nearest surface water is more than two miles from either location. Surface soil is comprised of windblown sand with a vegetation cover of shin oak, sand burr grass, and yucca. No water wells were identified within 1,000 feet of either site using the Office of the State Engineer (OSE) Water Right Lookup database.

Several pipelines are either within the release investigation areas, or are adjacent to the points of release (Figures 2 and 3).

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## Geology

The *Geologic Map of New Mexico* (2003) and the *Geologic Atlas of Texas, Hobbs Sheet* indicate the vicinity's surface geology is comprised of Holocene to mid-Pleistocene age interlaid eolian and piedmont-slope deposits. This material covers the eastern flank of the Pecos River valley. These surficial deposits are primarily derived from reworking the underlying Tertiary-aged Ogallala Formation of the Southern High Plains, which are also comprised of alluvial and eolian deposits with petrocalcic soils. The Ogallala Formation is comprised of fluvial sand, silt, clay and localized gravel, with indistinct to massive crossbeds. The Ogallala sand is generally fine- to medium-grained quartz, and is known to contain arsenic, barium and other heavy metals in an easily mobilized Van der Waals bonded surficial coating.

Monitor well boring logs indicate a general lithology of an unconsolidated veneer of eolian sand over an eight- to 20-foot thickness of carbonate-indurated sand (caliche). The caliche layer is most like the zone of illuviation where carbonate dust accumulates from surface transportation by meteoric water movement. Beneath the caliche layer is a thickness of fine-grained reddish-yellow quartz sand. Redbeds were not encountered at 90' bgs. Depth to groundwater is between 75 and 80 feet below ground surface (bgs), based on monitor wells data (Table 1).

### Regional Structure

The site is located over the north-central portion of the Central Basin Platform, a large elevated block between the Delaware and Midland Basins of southeastern New Mexico and West Texas. Prior to late Mississippian time this region had only mild structural deformation, producing broad shallow depressions and regional arches. Tectonic events associated with the Marathon-Ouachita orogeny in the late Mississippian uplifted the platform and subsequent Pennsylvanian and early Permian deformation compressed and faulted the area. Deformation ceased in the early Permian, as evidenced by high angle faulting that ended during Wolfcampian-aged sedimentation, and the presence of younger strata draped over the preexisting structures. A period of tectonic quiescence followed, during which erosion and gradual subsidence took place. An expanding sea eventually covered the area, depositing several thousand feet of evaporites, carbonates, and shales.

During Triassic time the region underwent slow uplift and erosion followed by down-warping that created a large landlocked basin that was filled with sediments that accumulated in flood plain, deltaic and lacustrine environments. This was followed by another period of erosion during Jurassic time, and a final marine inundation by Cretaceous seas, resulting in the deposition of a basal clastic unit with overlying marine shales and carbonates.

The Laramide Orogeny (when Rocky Mountains were formed) uplifted the area west of the Permian Basin and the Cretaceous sea retreated to the south and east. There has been no significant faulting since Permian time; only gentle regional tilting with some local folding and small scale faulting. Hills (1970) postulated that later normal movement may have occurred by reactivation of existing faults, but that the movement was not sufficient to noticeably displace the overlying Permian strata. Hills (1970) further postulated that late movement along the faults may have created a conduit for fresh water for dissolution of Permian evaporate beds. The faults and fractures in the vicinity of the site do not appear to be active. Tension fractures being somewhat more open may be able to hold water longer and

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thereby account for the enhanced vegetation and development of erosional features such as playas along fractures. A magnitude 5 earthquake beneath the Drinkard Oilfield, approximately seven miles southeast of the facilities, demonstrates that the region is not totally without seismic activity.

### **Regional Stratigraphy**

Regionally, the Precambrian basement is overlain by marine Cambro-Ordovician platform carbonates and Silurian-Devonian carbonates and shales. These sediments are truncated unconformably by Permian deposits consisting of marine shale, limestone, sandstone, marl, and evaporites. Permian age deposits are unconformably overlain by the Triassic Chinle Group. The Triassic Chinle Group is described as a series of fluvial and lacustrine mudstone, siltstone, sandstone, and silty dolomite strata. Cretaceous sediment strata were deposited as a shallow sea transgressed across the region, and unconformably overlie the Chinle Group. As the shallow sea regressed much of the Cretaceous section was eroded away prior to deposition of the overlying Tertiary Ogallala Formation. The depositional facies of the Ogallala Formation is a series of fluvial valley fills with both valley fills and interfluvies overlain by eolian sediments. The Quaternary Blackwater Draw Formation, which overlies the Tertiary Ogallala Formation, consists of windblown sands, silts, and clays.

In the Eunice area, the Ogallala formation consists mainly of unconsolidated to poorly consolidated, very fine to medium-grained sand and gravel, with minor amount of silt and clay up to 30 feet thick under the site. Locally the "c" horizon of the modern soil is called the caprock caliche. The caprock is a hard, erosion resistant, pedogenic calcrete that is typically five to ten feet thick but may exceed 20 feet in some areas. In areas, the caliche is actually forming in, and incorporating, Holocene sediments, and often "Caprock" is a misnomer, as the caprock can be found as a deeper stratum in these areas. The upper-most unit, the Blackwater Draw Formation, consists of reddish brown, very fine to fine grained eolian sand with minor amounts of clay and caliche.

### **Groundwater Investigation**

Prior reported investigation activities consist of the installation of two monitor wells at each location. MW-01s for both sites were installed on October 16, 2007 near the southeast (downgradient) corners of the release area. The results of these wells indicated impacted water quality with both sites exhibiting chloride and total dissolved solids (TDS) concentrations exceeding New Mexico Water Quality Control Commission Domestic Water Supply (DWS) standards. Hydrocarbons and targeted volatile organic compounds were not detected in either well. MW-02s were installed upgradient of both sites on December 3, 2007. Both of these wells had chloride and TDS values within the DWS standards. Copies of all boring logs associated with both locations are presented in Appendix A.

On June 29, 2009, LAI installed MW-03s in the downgradient direction, with locations concurred upon by the OCD (Appendix B). Again, both wells exhibited chloride and TDS values below DWS standards. Details of each site investigation are presented in the following sections.

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#### **Elliott B-9 #1,4,5 Tank Battery**

This is the east-most of the two facilities. The three monitor wells associated with this facility are in a nearly straight line following the apparent groundwater gradient based upon a combined site Surfer® plot (Figure 3). Gauging data on June 30, 2009 indicates a slight groundwater mound exists under MW-01. Groundwater elevation is between 3,345.26 feet (MW-03) and 3,346.30 feet (MW-01). Groundwater gradient direction is towards the east-southeast based upon the plot of the two facilities, but may be more southerly than the near linear monitor well configuration suggests. Groundwater gradient slope between the two facilities is approximately 0.00109 ft/ft.

Chloride and TDS concentrations exhibited during June 2009 were below DWS standards for MW-02 and MW-03, while MW-01 exhibited 660 milligrams/liter (mg/l, parts per million) and 1,840 mg/l, respectfully (Figures 4 & 5).

#### **Elliot B-9 #2&3 Tank Battery**

This is the western of the two facilities. The three monitor wells associated with this facility are in a "dog-leg" configuration (Figure 3). Gauging data on June 30, 2009 indicates generally laminar groundwater flow. Groundwater elevation is between 3,346.30 feet (MW-03) and 3,347.44 feet (MW-01). Groundwater gradient direction is towards the east-southeast with an onsite slope of approximately 0.0021 ft/ft.

Chloride and TDS concentrations exhibited during June 2009 were below DWS standards for MW-02 and MW-03, while MW-01 exhibited 4,500 mg/l and 7,790 mg/l, respectfully (Figures 4 & 5).

### **Remedial Options**

In the Eunice, NM area, groundwater discharge rates are generally very low. Recovering five gallons per hour (gph) per well is often beyond well production capacity in this region. However, groundwater extraction is not the primary concern at this site.

A New Mexico OSE permit to extract groundwater requires the point of diversion be used for a beneficial purpose. Hindering the design of a remediation program is the fact that there is no viable beneficial use of extracted groundwater as there are no livestock or croplands in the vicinity of the sites. Extracting and disposing chloride-impacted groundwater to protect the remaining groundwater is not considered a beneficial use.

JHHC intend to include all site monitor wells in the quarterly sampling plan, with the next event tentatively scheduled for October 2009. The acquisition of added data will assist in the design and implementation of an effective remediation effort.

LAI and JHHC respectfully request a 180 day extension to negotiate groundwater extraction for remediation with the Office of the State Engineer, and to design remediation system consistent with OSE requirements.

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## Conclusions

- Groundwater gradient slope between the two facilities is towards the east-southeast at approximately 0.00109 ft/ft.
- Elliott B-9 #1,4,5 Tank Battery has chloride and TDS concentrations exceeding DWS values in MW-01, 660 mg/l and 1,840 mg/l, respectfully. MW-02 (upgradient) and MW-03 (downgradient) are within DWS values.
- Elliot B-9 #2&3 Tank Battery has chloride and TDS concentrations exceeding DWS values in MW-01, 4,500 mg/l and 7,790 mg/l, respectfully. MW-02 (upgradient) and MW-03 (downgradient) are within DWS values.

Table 1  
 Monitor Well Completion and Gauging Summary  
 John H. Hendrix Corporation  
 Elliott B-9 Tank Battery #1, #4 and #5 (1R0483)  
 Unit C (NE/4,NW/4), Section 9, Township 22 South, Range 37 East  
 Lea County, New Mexico

Well Information				Groundwater Data								
Well ID	Date Drilled	Drilled Depth (bgs)	Well Diameter (inches)	Surface Elevation	Screen Interval (bgs)	Casing Stickup	TOC Elevation	Date Gauged	Well Depth from TOC	Depth to Fluid	Depth to Water	Corrected Water Elevation
MW-1	10/16/2007	90	2	3,424.90	67.03 - 86.34	2.29	3,427.19	10/16/2007	90.27	--	77.97	3,349.22
								4/7/2008		--	81.08	3,346.11
								9/4/2008		--	78.35	3,348.84
								6/3/2009		--	80.90	3,346.29
								6/30/2009		--	80.89	3,346.30
MW-2	12/3/2007	91	2	3,423.50	70.50 - 89.81	3.06	3,426.56	12/4/2007	92.84	--	78.79	3,347.77
								4/7/2008		--	81.10	3,345.46
								9/4/2008		--	78.63	3,347.93
								6/3/2009		--	80.87	3,345.69
								6/30/2009		--	80.81	3,345.75
MW-3	6/29/2009	89	2	3,424.40	69 - 89	3.14	3,427.54	6/30/2009	92.28	--	82.28	3,345.26

*Notes*

bgs - below ground surface

TOC - top of casing

Wells drilled and constructed by Scarborough Drilling, Inc., Lamesa, Texas, Schedule 40 threaded PVC casing and screen.

Table 1  
 Monitor Well Completion and Gauging Summary  
 John H. Hendrix Corporation  
 Elliott B-9 Tank Battery #2 and #3 (1R0484)  
 Unit D (NW/4,NW/4), Section 9, Township 22 South, Range 37 East  
 Lea County, New Mexico

Well Information								Groundwater Data				
Well ID	Date Drilled	Drilled Depth (bgs)	Well Diameter (inches)	Surface Elevation	Screen Interval (bgs)	Casing Stickup	TOC Elevation	Date Gauged	Well Depth from TOC	Depth to Fluid	Depth to Water	Corrected Water Elevation
MW-1	10/16/2007	90	2	3,425.80	66.13 - 85.07	2.61	3,428.41	10/16/2007	85.00	--	79.44	3,348.97
								4/7/2008		--	82.13	3,346.28
								9/4/2008		--	82.11	3,346.30
								6/3/2009		--	81.94	3,346.47
								6/30/2009		--	81.97	3,346.44
MW-2	12/3/2007	90	2	3,425.40	66.13 - 85.44	2.59	3,427.99	12/4/2007	86.07	--	79.48	3,348.51
								4/7/2008		--	80.75	3,347.24
								9/4/2008		--	80.73	3,347.26
								6/3/2009		--	80.57	3,347.42
								6/30/2009		--	80.55	3,347.44
MW-3	6/29/2009	86	2	3,424.70	66 - 86	2.34	3,427.04	6/30/2009	89.93	--	80.74	3,346.30

*Notes*

bgs - below ground surface

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Wells drilled and constructed by Scarborough Drilling, Inc., Lamesa, Texas, Schedule 40 screw-threaded PVC casing and screen.

Table 2  
Water Quality Parameters Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #1, #4 and #5 (1R0483)  
Unit C (NE/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Water Quality	Collection Date	Alkalinity, Total	Chloride	Nitrate	Sulfate	Total Dissolved Solids
<b>NMWQCC Standard (mg/L)</b>		--	<b>250</b>	<b>10</b>	<b>600</b>	<b>1000</b>
MW-01	10/16/2007	215	<b>1710</b>	1.83	223	<b>3,300</b>
	4/8/2008	200	<b>2070</b>	--	214	<b>3,980</b>
	9/4/2008	320	<b>936</b>	--	141	<b>2,240</b>
	6/3/2009	278	<b>660</b>	--	130	<b>1,840</b>
MW-02	10/16/2007	204	57	--	88	542
	4/8/2008	240	61.7	--	87.2	535
	9/4/2008	260	33.3	--	68.1	438
	6/3/2009	288	56	--	79.0	492
MW-03	6/30/2009	--	188	--	--	875

**Notes**

Alkalinity analyzed via EPA Method 310.1.

Anions analyzed via EPA Method 300.

TDS analyzed via EPA Method 160.1.

All values reported in Milligrams per liter (mg/L, parts per million).

< - Indicates the value is less than Method Detection Limit (MDL).



Table 2  
Water Quality Parameters Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #2 and #3 (1R0484)  
Unit D (NW/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Water Quality	Collection Date	Alkalinity, Total	Chloride	Nitrate	Sulfate	Total Dissolved Solids
<b>NMWQCC Standard (mg/L)</b>		--	250	10	600	1,000
MW-01	10/16/2007	271	3,500	9.87	243	6,610
	4/8/2008	273	4,410	--	226	7,980
	9/4/2008	340	3,400	--	177	6,440
	6/3/2009	342	4,500	--	202	7,790
MW-02	10/16/2007	188	222	--	205	973
	4/8/2008	210	229	--	203	920
	9/4/2008	280	194	--	173	856
	6/3/2009	259	204	--	188	892
MW-03	6/30/2009	--	100	--	--	622

**Notes**

Alkalinity analyzed via EPA Method 310.1.

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Table 1  
Monitor Well Completion and Gauging Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #1, #4 and #5 (1R0483)  
Unit C (NE/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Well Information								Groundwater Data				
Well ID	Date Drilled	Drilled Depth (bgs)	Well Diameter (inches)	Surface Elevation	Screen Interval (bgs)	Casing Stickup	TOC Elevation	Date Gauged	Well Depth from TOC	Depth to Fluid	Depth to Water	Corrected Water Elevation
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*Notes*

bgs - below ground surface

TOC - top of casing

Wells drilled and constructed by Scarborough Drilling, Inc., Lamesa, Texas, Schedule 40 threaded PVC casing and screen.

Table 1  
Monitor Well Completion and Gauging Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #2 and #3 (1R0484)  
Unit D (NW/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Well Information				Groundwater Data								
Well ID	Date Drilled	Drilled Depth (bgs)	Well Diameter (inches)	Surface Elevation	Screen Interval (bgs)	Casing Stickup	TOC Elevation	Date Gauged	Well Depth from TOC	Depth to Fluid	Depth to Water	Corrected Water Elevation
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								4/7/2008		--	80.75	3,347.24
								9/4/2008		--	80.73	3,347.26
								6/3/2009		--	80.57	3,347.42
								6/30/2009		--	80.55	3,347.44
MW-3	6/29/2009	86	2	3,424.70	66 - 86	2.34	3,427.04	6/30/2009	89.93	--	80.74	3,346.30

*Notes*

bgs - below ground surface

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Table 2  
Water Quality Parameters Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #1, #4 and #5 (1R0483)  
Unit C (NE/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Water Quality	Collection Date	Alkalinity, Total	Chloride	Nitrate	Sulfate	Total Dissolved Solids
<b>NMWQCC Standard (mg/L)</b>		--	<b>250</b>	<b>10</b>	<b>600</b>	<b>1000</b>
MW-01	10/16/2007	215	<b>1710</b>	1.83	223	<b>3,300</b>
	4/8/2008	200	<b>2070</b>	--	214	<b>3,980</b>
	9/4/2008	320	<b>936</b>	--	141	<b>2,240</b>
	6/3/2009	278	<b>660</b>	--	130	<b>1,840</b>
MW-02	10/16/2007	204	57	--	88	542
	4/8/2008	240	61.7	--	87.2	535
	9/4/2008	260	33.3	--	68.1	438
	6/3/2009	288	56	--	79.0	492
MW-03	6/30/2009	--	188	--	--	875

**Notes**

Alkalinity analyzed via EPA Method 310.1.

Anions analyzed via EPA Method 300.

TDS analyzed via EPA Method 160.1.

All values reported in Milligrams per liter (mg/L, parts per million).

< - Indicates the value is less than Method Detection Limit (MDL).

Table 2  
Water Quality Parameters Summary  
John H. Hendrix Corporation  
Elliott B-9 Tank Battery #2 and #3 (1R0484)  
Unit D (NW/4,NW/4), Section 9, Township 22 South, Range 37 East  
Lea County, New Mexico

Water Quality	Collection Date	Alkalinity, Total	Chloride	Nitrate	Sulfate	Total Dissolved Solids
<b>NMWQCC Standard (mg/L)</b>		--	250	10	600	1,000
MW-01	10/16/2007	271	3,500	9.87	243	6,610
	4/8/2008	273	4,410	--	226	7,980
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	6/3/2009	342	4,500	--	202	7,790
MW-02	10/16/2007	188	222	--	205	973
	4/8/2008	210	229	--	203	920
	9/4/2008	280	194	--	173	856
	6/3/2009	259	204	--	188	892
MW-03	6/30/2009	--	100	--	--	622

**Notes**

Alkalinity analyzed via EPA Method 310.1.

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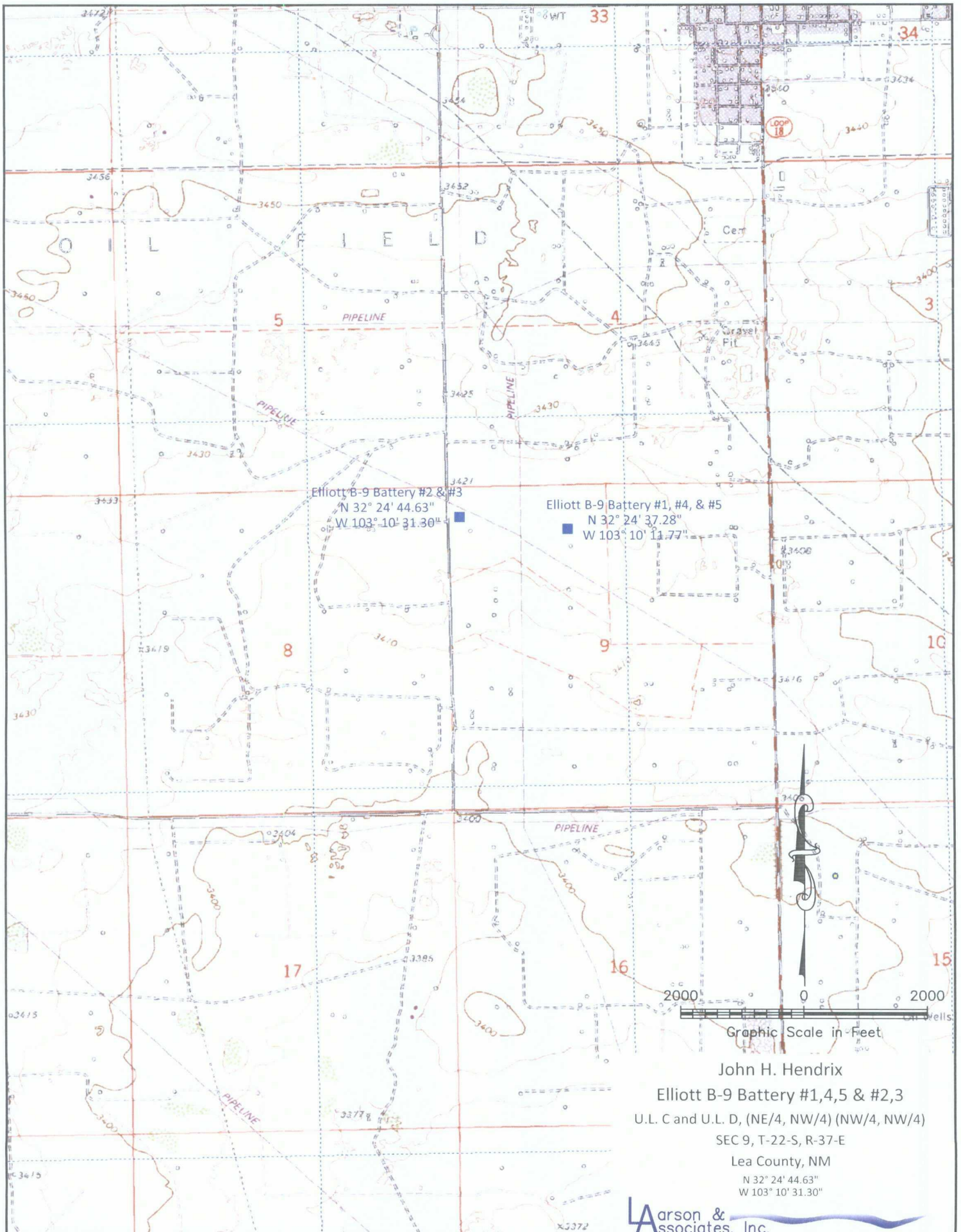


Figure 1- Topographic Map

John H. Hendrix  
 Elliott B-9 Battery #1,4,5 & #2,3  
 U.L. C and U.L. D, (NE/4, NW/4) (NW/4, NW/4)  
 SEC 9, T-22-S, R-37-E  
 Lea County, NM  
 N 32° 24' 44.63"  
 W 103° 10' 31.30"

Larson &  
 Associates, Inc.  
 Environmental Consultants



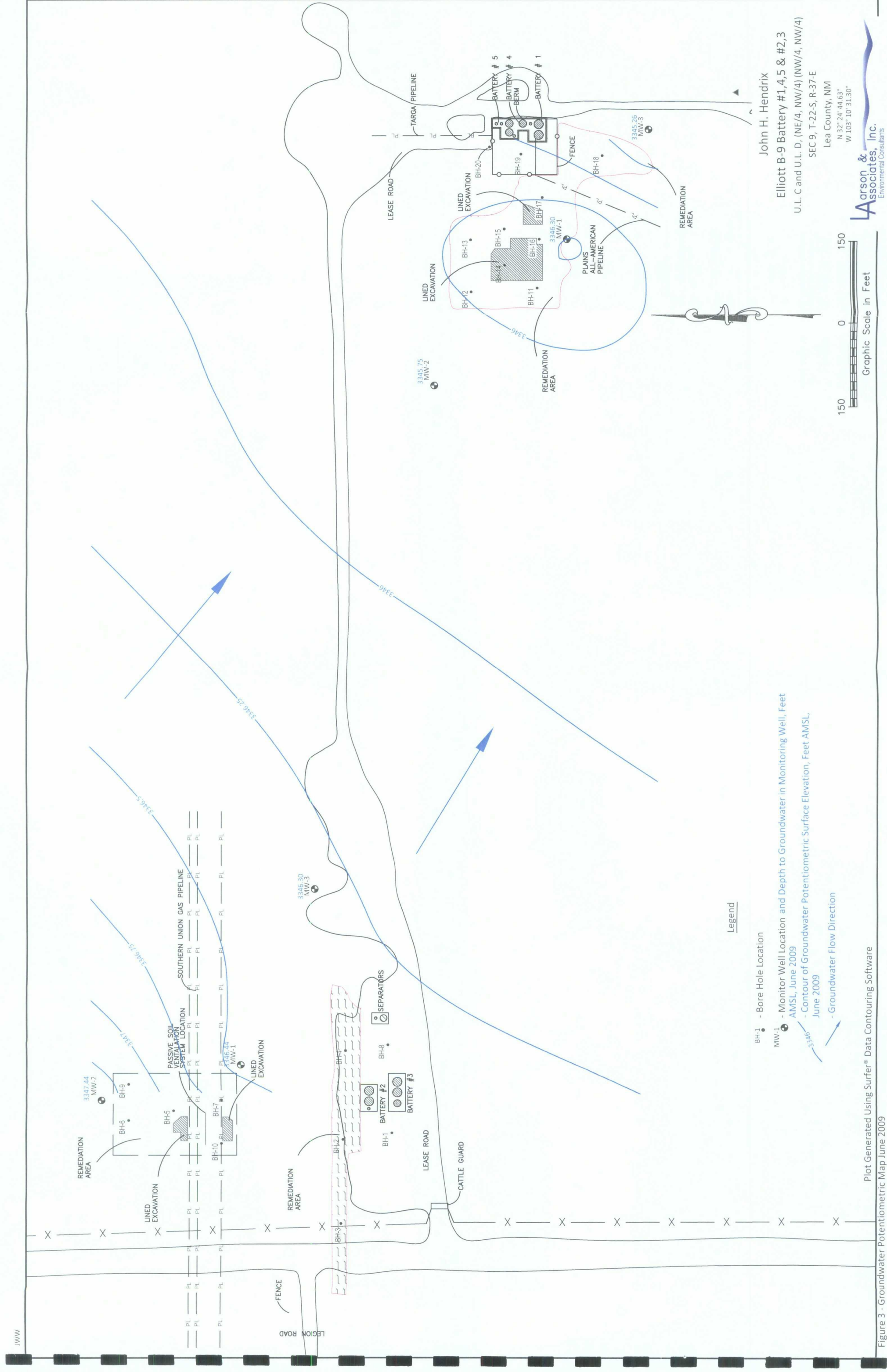


John H. Hendrix  
Elliott B-9 Battery #1,4,5 & #2,3  
U.L. C and U.L. D, (NE/4, NW/4) (NW/4, NW/4)  
SEC 9, T-22-S, R-37-E  
Lea County, NM  
N 32° 24' 44.63"  
W 103° 10' 31.30"

**Laarson & Associates, Inc.**  
Environmental Consultants

Figure 2 - Site Map









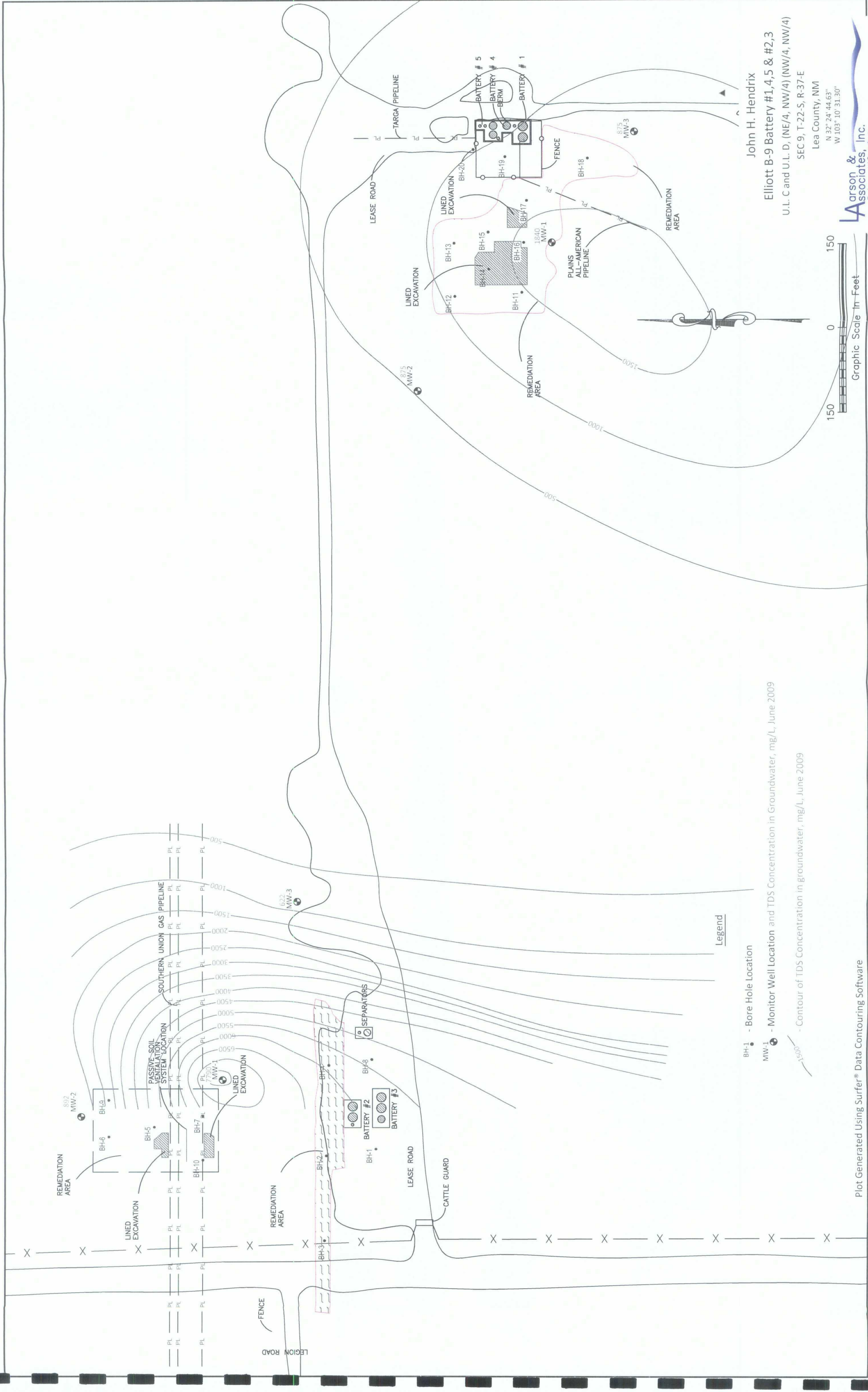
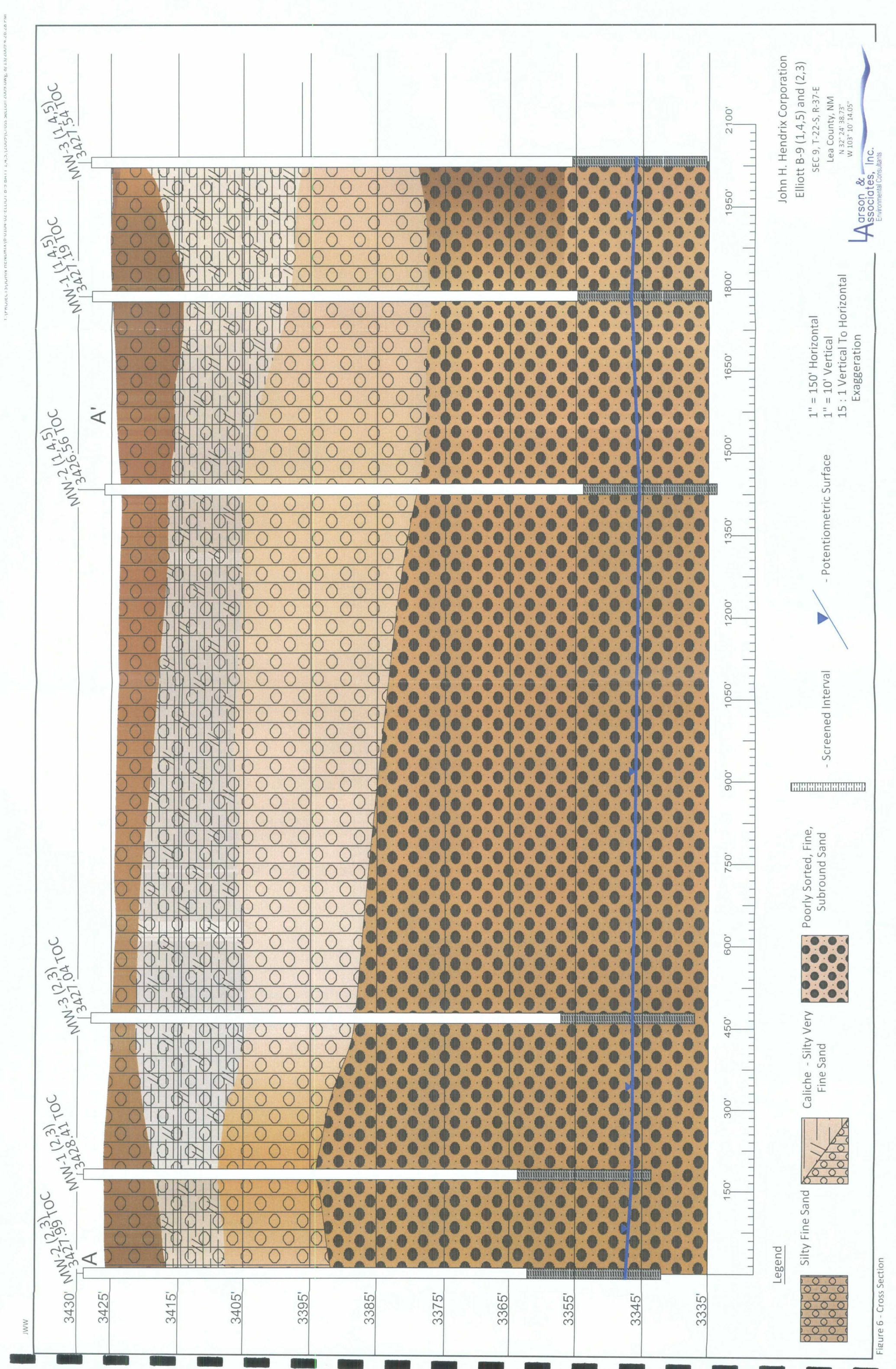


Figure 5 - TDS Concentration Map June 2009

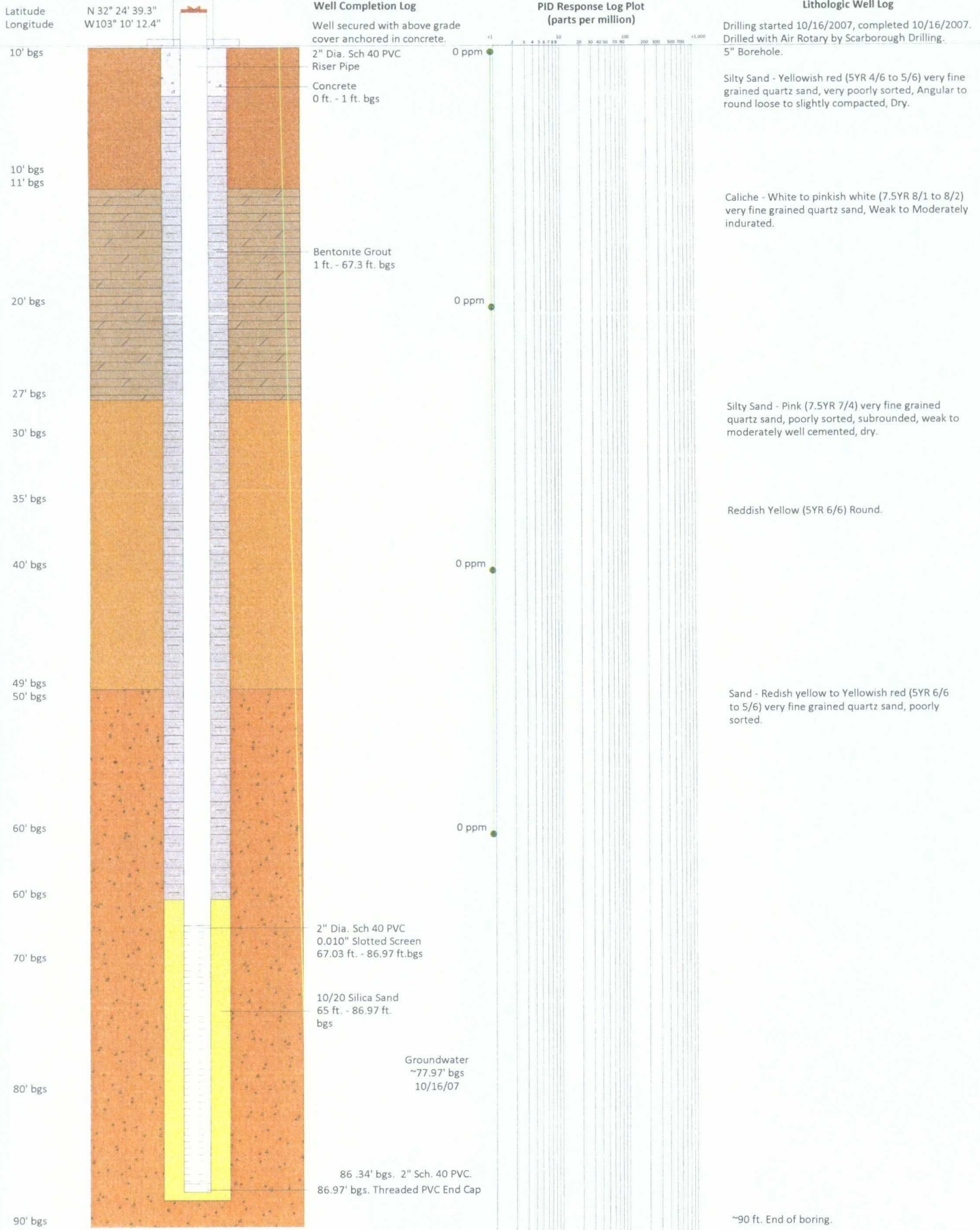
John H. Hendrix  
Elliott B-9 Battery #1, 4, 5 & #2, 3  
U.L.C and U.L.D. (NE/4, NW/4) (NW/4, NW/4)  
SEC 9, T-22-S, R-37-E  
Lea County, NM

N 32° 24' 44.63"  
W 103° 10' 31.30"





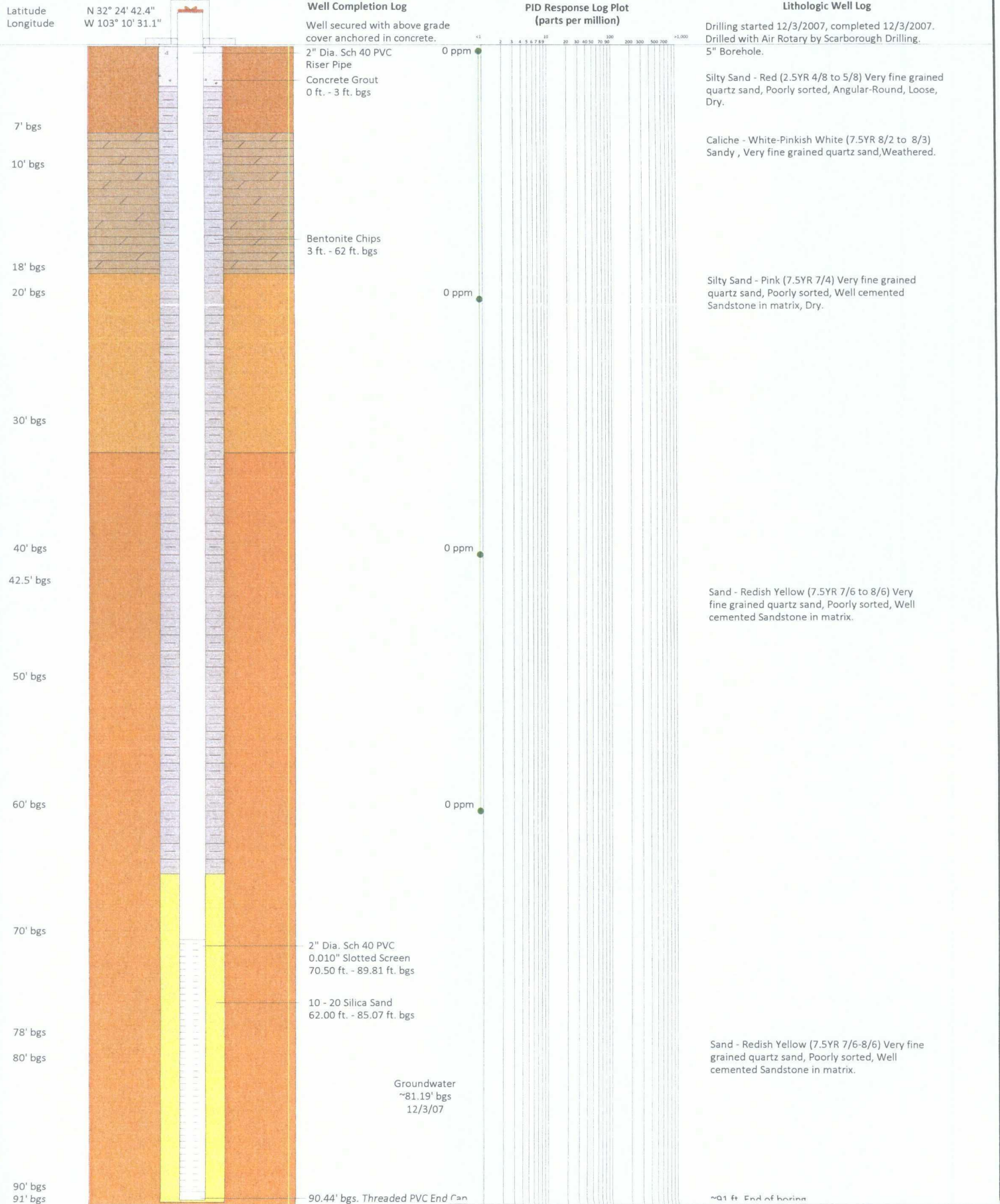




MW-1 Boring &amp; Completion Log

John Hendrix Corporation - Elliot B-9 Battery # 1, 4, & 5  
#1R0483

**Larson & Associates, Inc.**  
Environmental Consultants



John Hendrix Corporation - Elliot B-9 Battery # 1, 4, & 5  
#1R0483

**Larson & Associates, inc.**  
Environmental Consultants



Latitude N 32° 24' 37.28"  
 Longitude W 103° 10' 11.77"  
 TOC Elevation : 3427.54'

## Well Completion Log

PID Response Log Plot  
(parts per million)

## Lithologic Well Log

Drilling started 6/29/2009, completed 6/29/2009.  
 Drilled with Air Rotary by Ken Cooper Harrison & Cooper  
 SM - Red (2.5YR 4/6) silty very fine sand, angular

SP - Yellowish Brown (5YR 5/8) very fine sand,  
 angular, no fines  
 SP - Yellowish Brown (5YR 5/8) fine subround sand

SM/CA - Pink (5YR 8/3) silty to fine subround sand  
 with carbonate, about 5% fines

SM/CA - White (5YR 8/1) silty to fine subround  
 sand with carbonate, about 5% fines

SM/CA - Pinkish White (5YR 8/2) silty to fine  
 subround sand with carbonate, about 10% fines

Lithology change at 29'  
 SM - Pink (5YR 7/4) subangular very fine sand with  
 about 20% silt

SM/CA - Pink (5YR 7/4) subangular very fine sand  
 with about 20% silt, increasing carbonate  
 content noted

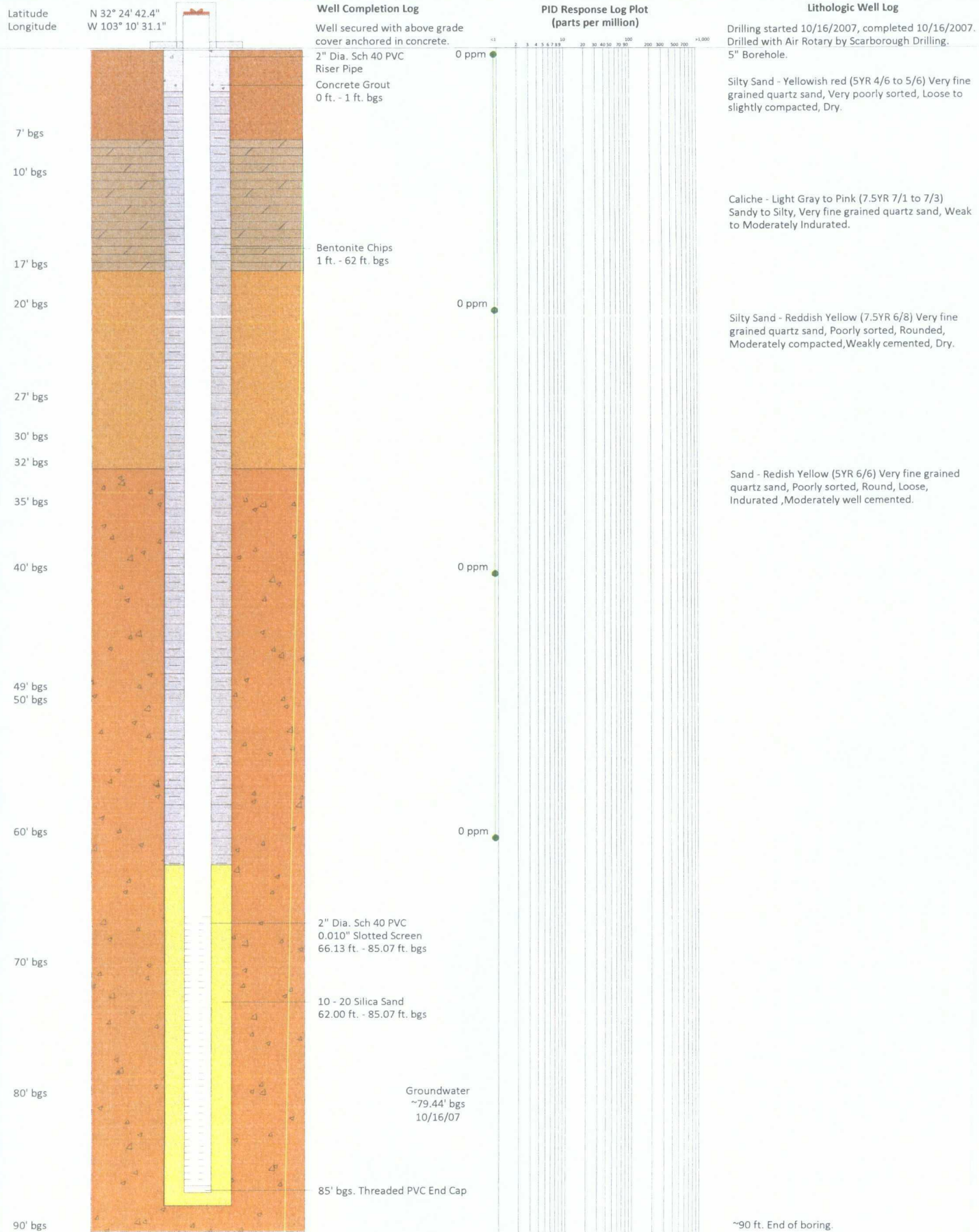
SS/SP - Light Reddish Brown (5YR 6/4) subround  
 fine sand and carbonate indurated sandstone

SP - Pink (5YR 7/3) subround fine sand w/ <5% fines

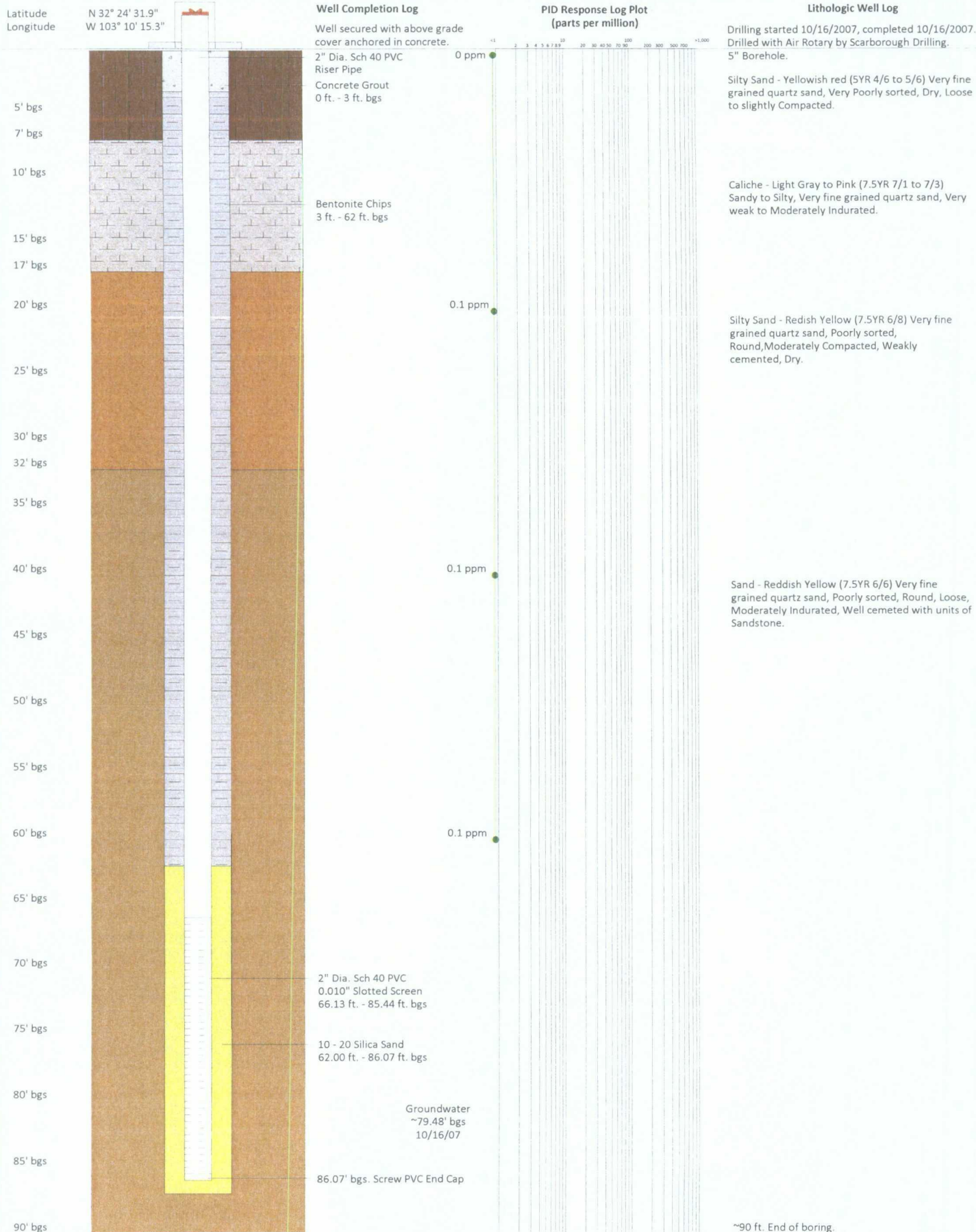
SP - Reddish Yellow (5YR 6/6) well rounded fine  
 sand poorly sorted/ well graded  
 80' SP - Reddish Yellow (5YR 6/6) well rounded fine  
 sand poorly sorted/ well graded, moisture noted  
 90' SP - Reddish Yellow (5YR 6/6) well rounded fine  
 sand poorly sorted/ well graded, moisture noted  
 Total depth at 89'

John H. Hendrix Corporation  
 Elliot Lease B-9 Battery #1,4,5  
 U.L. D, (NE/4, NW/4)  
 Sec. 9, T-22-S, R-37-E  
 Lea County, New Mexico

Larson &  
 Associates, Inc.  
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John Hendrix Corporation - Elliot B-9 Battery # 2 & 3  
#1R0484



Latitude N 32° 14' 43.30"  
 Longitude W 103° 10' 27.62"  
 TOC Elevation : 3427.04'

## Well Completion Log

PID Response Log Plot  
(parts per million)

## Lithologic Well Log

Drilling started 6/29/2009, completed 6/29/2009.  
 Drilled with Air Rotary by Ken Cooper Harrison & Cooper

5" Borehole  
 0' - 2' Concrete  
 2" Sch 40 PVC  
 CASING

~ 2' - 64'  
 Bentonite

10' bgs

20' bgs

30' bgs

40' bgs

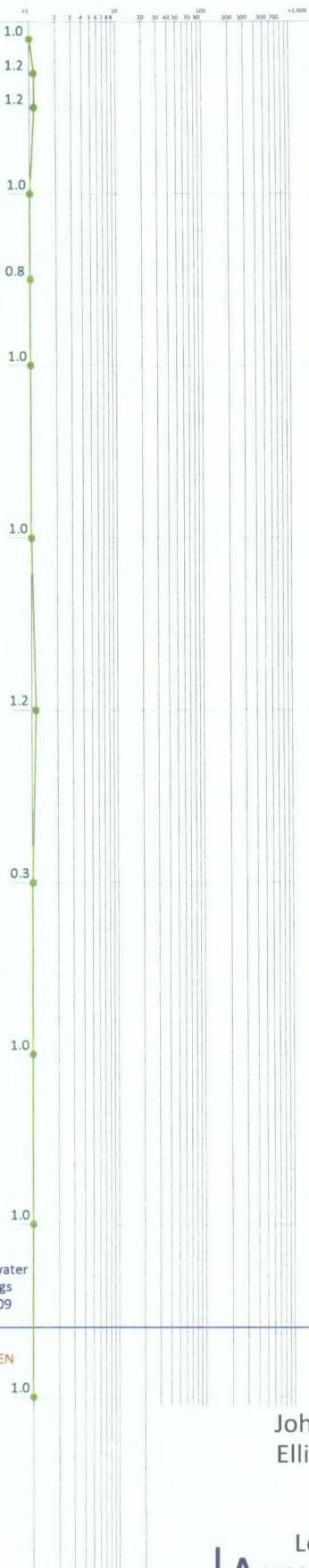
50' bgs

60' bgs

70' bgs

80' bgs

90' bgs



SP - Strong Brown (7.5YR 5/6) subround very fine sand with <10% silt  
 SP/CA - Reddish Brown and White ( 5YR 5/4 to 5YR 8/1) bimodal very fine sand and caliche beds  
 SM/CA - Pink (5YR 8/3) calcareous silty very fine sand about 15% fines

SM - Reddish Yellow (5YR 6/6) silty very fine sand about 20% subangular sand

SM - Reddish Yellow (5YR 6/6) silty very fine sand about 20% subangular sand

SM/CA - Pink (5YR 8/3) silty about 15% subround very fine sand, carbonate indurated

SM/CA - Pink (5YR 8/3) silty about 15% subround very fine sand, carbonate indurated

SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, <2% fines

SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, <2% fines

SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, no fines

SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, no fines, moist sand

80' SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, no fines, moist sand

90' SP - Reddish Yellow (5YR 6/6) rounded fine to medium sand, no fines, moist sand

Total depth at 90'

64' TOP OF SAND

66' TOP OF SCREEN

20/40 Silica Sand  
 Filter Pack

Groundwater  
 ~76' bgs  
 6/29/09

20' - 0.010 SLOTTED PVC SCREEN

CAP

John H. Hendrix Corporation  
 Elliot Lease B-9 Battery #2,3  
 U.L. D, (NE/4, NW/4)  
 Sec. 9, T-22-S, R-37-E  
 Lea County, New Mexico

**L**arson &  
 Associates, Inc.  
 Environmental Consultants

## William Green

---

**From:** Hansen, Edward J., EMNRD [edwardj.hansen@state.nm.us]  
**Sent:** Monday, June 01, 2009 4:16 PM  
**To:** cdoranhaynes@jhhc.org  
**Cc:** Mark Larson; William Green; VonGonten, Glenn, EMNRD  
**Subject:** RE: Workplans for 1R-483 and 1R-484, Elliot B-9 Tank Battery #1, #4 and #5, and Elliot B-9 Tank Battery #2 & #3, respectfully

Dear Ms. Haynes:

The New Mexico Oil Conservation Division (OCD) has received the groundwater monitoring wells installation workplan for the above-referenced John H. Hendrix Corp. sites, dated June 1, 2009, and has conducted a review of the plan. The workplan substantially meets the requirements of 19.15.29 NMAC. Therefore, the OCD hereby approves the workplan.

Please be advised that OCD approval of this workplan does not relieve the owner/operator of responsibility should operations pose a threat to ground water, surface water, human health or the environment. In addition, OCD approval does not relieve the owner/operator of responsibility for compliance with any OCD, federal, state, or local laws and/or regulations.

Please keep in mind that additional wells may need to be installed to determine the full extent of the release.

If you have any questions regarding this matter, please contact me at 505-476-3489.

Edward J. Hansen  
Hydrologist  
Environmental Bureau

---

**From:** William Green [mailto:wgreen@laenvironmental.com]  
**Sent:** Monday, June 01, 2009 1:25 PM  
**To:** Hansen, Edward J., EMNRD  
**Cc:** cdoranhaynes@jhhc.org; Mark Larson  
**Subject:** Workplans for 1R-483 and 1R-484, Elliot B-9 Tank Battery #1, #4 and #5, and Elliot B-9 Tank Battery #2 & #3, respectfully

Dear Mr. Hansen,

Attached is a workplan to install monitor wells at the two referenced sites. If you have any questions please feel free to email me or call me at the phone numbers listed below. I will schedule a driller as soon as your approval is received.

Sincerely,

William D. Green, PG No. 136

**Larson & Associates, Inc.**  
507 N. Marienfeld, Suite 200  
Midland, Texas 79701



# CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240


ANALYTICAL RESULTS FOR  
LARSON & ASSOCIATES, INC.  
ATTN: MICHELLE GREEN  
507 N. MARIEFELD, SUITE 200  
MIDLAND, TX 79701

Receiving Date: 06/03/09  
Reporting Date: 06/10/09  
Project Number: 6-0104-02  
Project Name: ELLIOTT B-9 #1, 4 & 5  
Project Location: NOT GIVEN

Sampling Date: 06/03/09  
Sample Type: GROUND WATER  
Sample Condition: COOL & INTACT @ 4°C  
Sample Received By: ML  
Analyzed By: AB/HM

LAB NO.	SAMPLE ID	Cl <sup>-</sup> (mg/L)	SO <sub>4</sub> (mg/L)	TDS (mg/L)	CO <sub>3</sub> (mg/L)	HCO <sub>3</sub> (mg/L)
Analysis Date:		06/05/09	06/09/09	06/08/09	06/09/09	06/09/09
H17548-1	MW-1	660	130	1,840	0	278
H17548-2	MW-2	56	79.0	492	0	288
Quality Control		490	42.7	NR	NR	988
True Value QC		500	40.0	NR	NR	1000
% Recovery		98.0	107	NR	NR	98.8
Relative Percent Difference		< 0.1	3.0	4.1	NR	1.2

METHOD: Standard Methods, EPA	4500-ClB	375.4	160.1	310.1	310.1
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Chemist

  
Date

H17548 Larson & Associates

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# CARDINAL LABORATORIES

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July 3, 2009

Michelle Green  
Larson & Associates, Inc.  
507 North Marienfeld, Suite 202  
Midland, TX 79701

Re: Elliot B-9 Battery 1, 4, & 5

Enclosed are the results of analyses for sample number H17723, received by the laboratory on 06/30/09 at 2:20 pm.

Cardinal Laboratories is accredited through Texas NELAP for:

Method SW-846 8021	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method SW-846 8260	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method TX 1005	Total Petroleum Hydrocarbons

Certificate number T104704398-08-TX. Accreditation applies to solid and chemical materials and non-potable water matrices.

Total Number of Pages of Report: 3 (includes Chain of Custody)

Sincerely,

Celey D. Keene  
Laboratory Director



# CARDINAL LABORATORIES

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ANALYTICAL RESULTS FOR  
LARSON & ASSOCIATES, INC.  
ATTN: MICHELLE GREEN  
507 N. MARIENFELD, SUITE 202  
MIDLAND, TX 79701

Receiving Date: 06/30/09  
Reporting Date: 07/02/09  
Project Number: 6-0104-02  
Project Name: ELLIOTT B-9 BATTERY 1, 4 & 5  
Project Location: ELLIOT B-9 BATTERY 1, 4, & 5

Sampling Date: 06/30/09  
Sample Type: GROUND WATER  
Sample Condition: COOL & INTACT @ 6°C  
Sample Received By: ML  
Analyzed By: HM

LAB NO.	SAMPLE ID	Cl <sup>-</sup> (mg/L)	TDS (mg/L)
Analysis Date:		07/01/09	07/01/09
H17723-1	MW-3	188	875
Quality Control		500	NR
True Value QC		500	NR
% Recovery		100	NR
Relative Percent Difference		< 0.1	<0.1

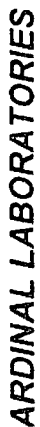
METHOD: Standard Methods, EPA	4500-Cl <sup>-</sup> B	160.1
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Chemist

07/13/09  
Date

H17723 Larson & Associates

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**(575) 393-2326 Fax (575) 393-2476**

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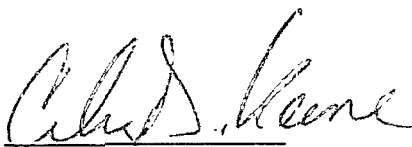
PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240


ANALYTICAL RESULTS FOR  
LARSON & ASSOCIATES, INC.  
ATTN: MICHELLE GREEN  
507 N. MARIEFELD, SUITE 200  
MIDLAND, TX 79701

Receiving Date: 06/03/09  
Reporting Date: 06/10/09  
Project Number: 6-0104-03  
Project Name: ELLIOTT B-9 #2 & 3  
Project Location: NOT GIVEN

Sampling Date: 06/03/09  
Sample Type: GROUND WATER  
Sample Condition: COOL & INTACT @ 2°C  
Sample Received By: ML  
Analyzed By: AB/HM

LAB NO.	SAMPLE ID	Cl <sup>-</sup> (mg/L)	SO <sub>4</sub> (mg/L)	TDS (mg/L)	CO <sub>3</sub> (mg/L)	HCO <sub>3</sub> (mg/L)
Analysis Date:		06/05/09	06/09/09	06/08/09	06/09/09	06/09/09
H17546-1	MW-1	4,500	202	7,790	0	342
H17546-2	MW-2	204	188	892	0	259
Quality Control		490	42.7	NR	NR	988
True Value QC		500	40.0	NR	NR	1000
% Recovery		98.0	107	NR	NR	98.8
Relative Percent Difference		< 0.1	3.0	1.7	NR	1.2
METHOD: Standard Methods, EPA		4500-Cl <sup>-</sup> B	375.4	160.1	310.1	310.1

  
Cheryl Keene  
Chemist

  
Date

H17546 Larson & Associates

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# ARDINAL LABORATORIES

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July 3, 2009

Michelle Green  
Larson & Associates, Inc.  
507 North Marienfeld, Suite 202  
Midland, TX 79701

Re: Elliot B-9 Battery 2, 3

Enclosed are the results of analyses for sample number H17724, received by the laboratory on 06/30/09 at 2:20 pm.

Cardinal Laboratories is accredited through Texas NELAP for:

Method SW-846 8021	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method SW-846 8260	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method TX 1005	Total Petroleum Hydrocarbons

Certificate number T104704398-08-TX. Accreditation applies to solid and chemical materials and non-potable water matrices.

Total Number of Pages of Report: 3 (includes Chain of Custody)

Sincerely,

Celey D. Keene  
Laboratory Director



# CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240


ANALYTICAL RESULTS FOR  
LARSON & ASSOCIATES, INC.  
ATTN: MICHELLE GREEN  
507 N. MARIENFELD, SUITE 202  
MIDLAND, TX 79701

Receiving Date: 06/30/09  
Reporting Date: 07/02/09  
Project Number: 6-0104-03  
Project Name: ELLIOTT B-9 BATTERY 2, 3  
Project Location: ELLIOT B-9 BATTERY 2, 3

Sampling Date: 06/30/09  
Sample Type: GROUND WATER  
Sample Condition: COOL & INTACT @ 5°C  
Sample Received By: ML  
Analyzed By: HM

LAB NO.	SAMPLE ID	Cl <sup>-</sup> (mg/L)	TDS (mg/L)
Analysis Date:		07/01/09	07/01/09
H17724-1	MW-3	100	622
Quality Control		500	NR
True Value QC		500	NR
% Recovery		100	NR
Relative Percent Difference		< 0.1	<0.1

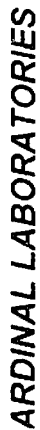
METHOD: Standard Methods, EPA	4500-Cl <sup>-</sup> B	160.1
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Cheryl Keene  
Chemist

07/03/09  
Date

H17724 Larson & Associates

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