BW - 8

SUBSIDENCE MONITORING REPORTS

Chavez, Carl J, EMNRD

From: Zbrozek, Michael <mzbrozek@geo-logic.com>
Sent: Tuesday, July 16, 2019 11:51 AM
To: Chavez, Carl J, EMNRD
Cc: Ayarbe, John; susan@thestandardenergy.com; 'Pieter Bergstein (pieter@bergsteinenterprises.com)'
Subject: [EXT] Subsidence monitoring Salty Dog Brine Station 06/2019
Attachments: SALTY DOG BRINE-34616.pdf

Good afternoon Carl,

In accordance with Condition 2.B.1 of DP BW-8 (OCD 03/24/2019), Salty Dog (PAB services) has been monitoring for potential land subsidence in the area of the brine well. Salty dog is required to report these data to OCD within 15 days of receipt. Basin Surveys of Hobbs, New Mexico surveyed each monitoring point semiannually after their installation; to the nearest 0.10 foot. The initial survey was conducted on March 23, 2018 using the nearest U.S. Geological Survey (USGS) benchmark referenced to NMSPCE (NAD 83).

The survey data for the most recent monitoring event (6/10/2019), reported in the table below, show no indication of land subsidence. The semiannually surveyed elevations are within ±0.02 foot of the initial survey, and have not showed any deviation from the December 2019 survey. Salty Dog, will continue to monitor for subsidence in this area.

First Semiannual Surface Subsidence Monitoring, 2019

Survey Monitoring Point	Elevation (feet msl)		
	Initial 3/23/2018	Second Semiannual 12/15/2018	First Semiannual monitoring **06/10/2019**
SMP-01	**3,810.11**	3,810.10	3,810.10
SMP-02	**3,809.01**	3,809.00	3,809.00
SMP-03	**3,808.80**	3,808.81	3,808.81
SMP-04	**3,806.32**	3,806.32	3,806.32
SMP-05 (brine well)	**3,811.72**	3,811.72	3,811.72

Thank you Carl, please contact John or myself if you have any questions. Have a great day.

Michael C Zbrozek
Geologist

Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company
6020 Academy Road NE, Suite 100
Albuquerque, New Mexico 87109
Office: (505) 822-9400 | Direct: (505) 353-9106 | Mobile: (303) 895-7521
MZbrozek@dbstephens.com or MZbrozek@geo-logic.com

www.dbstephens.com | www.geo-logic.com

SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST, N.M.P.M.,
LEA COUNTY, NEW MEXICO.

ALL COORDINATES ARE BASED ON NMSPCE (NAD83)

NAME	SECTION CALLS	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEVATION TOP CASING	ELEVATION CONCRETE
SMP-1	2153' FSL & 2020' FEL	615475.977	836301.437	N32°41'17.960"	W103°22'28.520"	3810.10'	3810.38'
SMP-2	2032' FSL & 2058' FEL	615354.850	836264.338	N32°41'16.795"	W103°22'28.966"	3809.00'	3809.41'
SMP-3	2350' FSL & 2089' FEL	615673.004	836230.083	N32°41'19.945"	W103°22'29.334"	3808.81'	3809.18'
SMP-4	2291' FSL & 1776' FEL	615615.830	836543.487	N32°41'19.352"	W103°22'25.673"	3806.32'	3806.72'
SMP-5	2216' FSL & 1972' FEL	615539.029	836348.733	N32°41'18.609"	W103°22'27.960"	3811.72'	
DBS-9	2520' FSL & 1831' FEL	615844.539	836485.906	N32°41'21.593"	W103°22'26.317"		
DBS-10	1389' FSL & 1060' FEL	614720.368	837270.028	N32°41'10.428"	W103°22'17.269"	3807.48'	3805.44'
BENCH MARK		615608.14	836310.07	N32°41'19.27"	W103°22'28.40"	3808.62'	

I HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM FIELD NOTES OF AN ACTUAL SURVEY AND MEETS OR EXCEEDS ALL REQUIREMENTS FOR LAND SURVEYS AS SPECIFIED BY THIS STATE.

GARY L. JONES, N.M. P.S. No. 7977
T.C. MCDANIEL, N.M.P.S. No. 5074

GARY L. JONES 7977 NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR

200 0 200 400 FEET

DANIEL B. STEPHENS & ASSOCIATES, INC

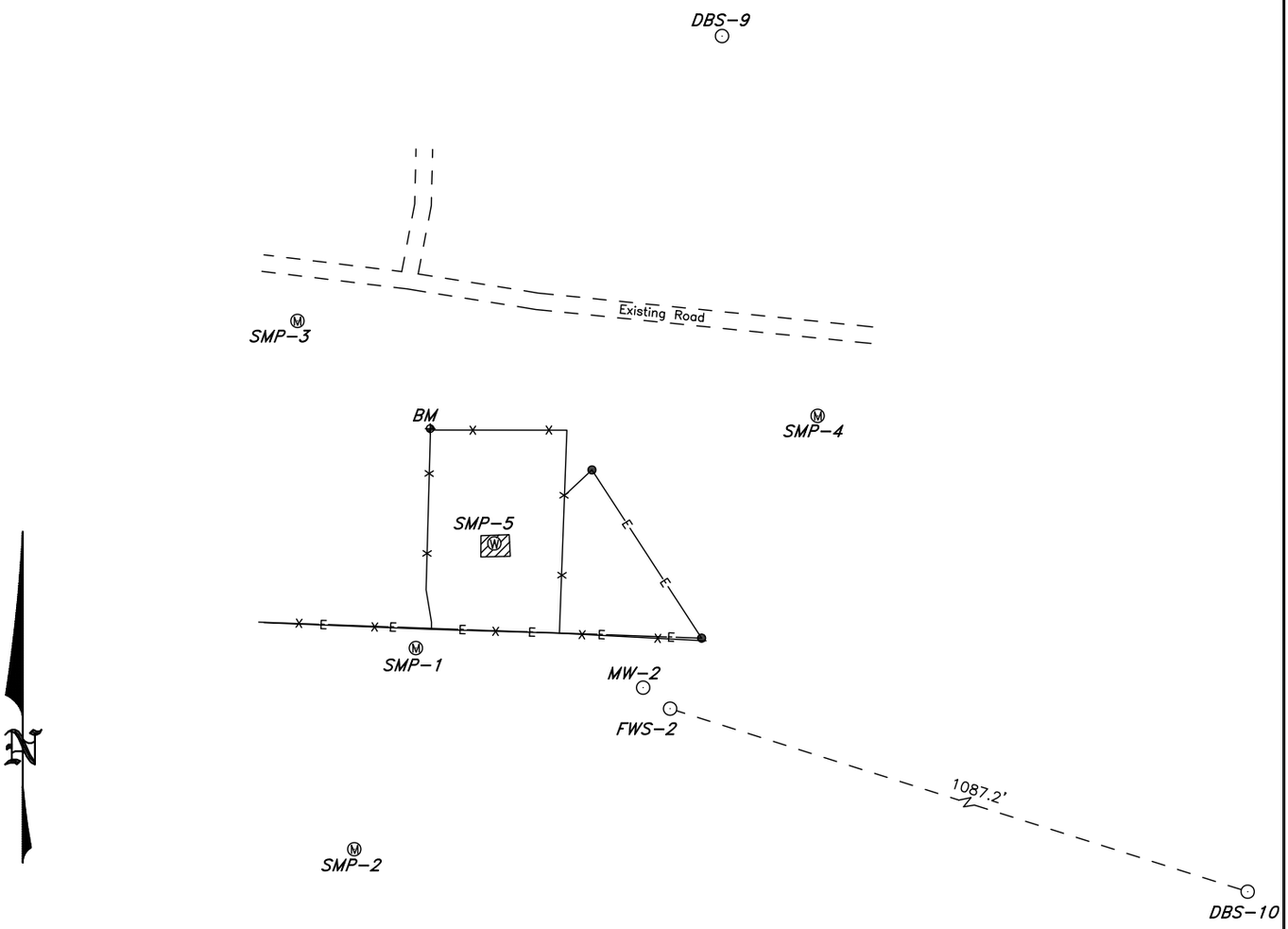
REF: SALTY DOG BRINE FACILITY

MONITOR WELLS AND SUSTENANCE MONITORING POINTS
LOCATED IN SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST,
N.M.P.M., LEA COUNTY, NEW MEXICO.

basin surveys
focused on excellence in the oilfield
P.O. Box 1786
1120 N. West County Rd.
Hobbs, New Mexico 88241
(575) 393-7316 – Office
(575) 392-2206 – Fax
basinsurveys.com

W.O. Number: 34616	Drawn By: K. GOAD	Date: 06-12-2019	Survey Date: 06-10-2019	Sheet 1 of 1 Sheets

SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST, N.M.P.M.,
LEA COUNTY, NEW MEXICO.



ALL COORDINATES ARE BASED ON NMSPCE (NAD83)

NAME	SECTION CALLS	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEVATION TOP CASING	ELEVATION CONCRETE
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GARY L. JONES, N.M. P.S. No. 7977
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REF: SALTY DOG BRINE FACILITY

MONITOR WELLS AND SUSTENANCE MONITORING POINTS
LOCATED IN SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST,
N.M.P.M., LEA COUNTY, NEW MEXICO.

W.O. Number: 34616	Drawn By: K. GOAD	Date: 06-12-2019	Survey Date: 06-10-2019	Sheet 1 of 1 Sheets

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, June 26, 2018 4:11 PM
To: Ayarbe, John
Cc: Pieter Bergstein (pieter@bergsteinenterprises.com); susan@thestandardenergy.com; McVey, Mike; Griswold, Jim, EMNRD
Subject: RE: Installation of Monitor Well and Subsidence Survey Monitoring Points - Salty Dog Brine Station (BW-8)

John:

The New Mexico Oil Conservation Division (OCD) is in receipt of your electronic file and is working to place it into the OCD Administrative Record.

OCD will contact you if there are any issues on the documentation.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us
"Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?" (To see how, go to: http://www.emnrd.state.nm.us/OCD **and see "Publications")**

From: Ayarbe, John <jayarbe@geo-logic.com>
Sent: Tuesday, June 26, 2018 3:57 PM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>
Cc: Pieter Bergstein (pieter@bergsteinenterprises.com) <pieter@bergsteinenterprises.com>; susan@thestandardenergy.com; McVey, Mike <mmcvey@geo-logic.com>
Subject: Installation of Monitor Well and Subsidence Survey Monitoring Points - Salty Dog Brine Station

Carl,

Attached is an electronic copy of the letter report documenting the installation of a downgradient monitor well and subsidence survey monitoring points at the Salty Dog Brine Station.

Please let me know if you would like a hardcopy mailed to you or OCD, and if you need us to upload the file to the OCD Imaging online system.

Please let Mike or I know if you have questions.

Thanks

John P. Ayarbe
Senior Hydrogeologist

Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company
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www.dbstephens.com | www.geo-logic.com

June 25, 2018

Mr. Carl Chavez
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Delivered via e-mail: CarlJ.Chavez@State.nm.us

Re: Installation of Monitor Well and Subsidence Survey Monitoring Points
Salty Dog Brine Station (API No. 30-025-26307)

Dear Mr. Chavez:

On behalf of PAB Services, Inc., Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this letter report documenting the installation of five survey monuments and one groundwater monitor well at the Salty Dog Brine Station (Salty Dog) located in Lea County, New Mexico. The well was installed to monitor groundwater conditions at the downgradient extent of the chloride plume in the brine well area. The five survey monuments were installed to monitor for potential land subsidence in the area of the brine well, satisfying Condition 2.B.1 of discharge permit (DP) BW-8.

DBS&A contracted with Peterson Drilling and Testing, Inc. (Peterson) to provide drilling services associated with installation of the monitor well and subsidence survey monument points. DBS&A provided oversight during installation, directing and documenting construction activities. Work activities were conducted between March 12 and 14, 2018. Construction of the subsidence survey monitoring points followed the design presented in the *Work Plan for Surface Subsidence Monitoring and Solution Cavern Characterization* (DBS&A, 2014), with the exception of minor design changes to accommodate field conditions.

Figure 1 shows the locations of the monitor well (DBS-10) and the survey monuments. Attachment 1 provides photographs and descriptions of daily work activities. Attachment 2 provides lithologic logs and construction diagrams for the monitor well and survey monuments.

The following sections provide background information and describe the installation of the new groundwater monitor well and survey monuments.

Background

Salty Dog is a brine water production and loading station consisting of fresh water supply wells, a brine production well, and a concrete truck loading pad with two brine filling stations. Produced brine is pumped from the brine well to a bermed tank battery consisting of six 750-barrel (bbl) aboveground storage tanks (ASTs), where the brine is stored for sale. The brine well is located approximately 0.5 mile southwest of the brine filling station and is permitted as a UIC Class III well (Brine Supply Well #1 [API No. 30-025-26307]). Brine is produced from the

in situ extraction of salt at the brine well. The brine well is approximately 3,000 feet deep and has been in operation since the early 1980s. The Salty Dog brine well is configured for reverse-circulation brine recovery, where fresh water is circulated down the casing annulus into the Salado Formation—a Permian Age sedimentary rock unit composed of halite (salt) and other evaporative beds. Fresh water dissolves the salt, and the brine is extracted through the center tubing of the well.

In May 2008, the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department issued Salty Dog an Administrative Compliance Order (ACO) (ACO-2008-02) to address chloride-impacted groundwater at the site. Two chloride plumes exist at the site: (1) the former brine pond area plume and (2) the brine well area plume. Salty Dog has been operating groundwater extraction systems to provide hydraulic containment and remove chloride-impacted groundwater since 2012. While the downgradient extent of chloride-impacted groundwater has been defined in the former brine pond area, it has not been defined in the brine well area. The new groundwater monitor well (DBS-10) was installed to help define the downgradient extent of chloride-impacted groundwater in the brine well area. Before installation of DBS-10, well MW-5 was the farthest downgradient monitor well in the brine well area. Since February 2008, the chloride concentration at well MW-5 has ranged from 710 to 1,500 milligrams per liter (mg/L) (DBS&A, 2018).

Surface Subsidence Survey Monitoring Points

Condition 2.B.1 of DP BW-08 requires Salty Dog to monitor for potential land subsidence in the area of the brine well (OCD, 2013). Five survey monuments were installed to help meet this condition. Figure 1 shows the locations of the subsidence survey monitoring points, which include three points located approximately 200 feet from the brine well, one point located approximately 60 feet from the brine well, and one point that is a metal tab welded to the brine well casing. Construction and placement of the monitoring points were conducted in accordance with DBS&A (2014). DBS&A identified locations for the monuments in the field; locations were selected where vehicle traffic is minimal.

Engineering Analytics, Inc. of Fort Collins, Colorado prepared the design used to construct the four survey monuments placed around the brine well (SMP-1 through SMP-4) (DBS&A, 2014). The design allows for the detection of subsurface movement that could be attributable to a brine cavern collapse, while avoiding the measurement of movements associated with near-surface disturbances, such as the shrinking and swelling of surface soil. Attachment 2 provides construction diagrams for the four survey monuments, which were constructed as follows:

- Each survey monument was placed in a 6.5-inch-diameter borehole that was advanced using the air-rotary drilling method.
- Boreholes were terminated once competent sandstone was encountered, as determined by DBS&A. Competent sandstone units were encountered at approximately 15 to 17 feet below ground surface (feet bgs) at each of the four boring locations (Attachment 2). The competent

sandstone units are well indurated and were used to anchor the rods associated with the subsidence survey monitoring points due to their rigidity.

- Survey monuments consist of a stainless steel rod placed within a 1-inch-diameter, Schedule (SCH) 40 polyvinyl chloride (PVC) sleeve, with a stainless steel anchor plate welded to the bottoms of the rods. The rods protrude through the tops of the PVC sleeves and serve as the monitoring points at the land surface. The spaces between the PVC sleeves and rods are filled with grease to allow the rods to move freely within the PVC sleeves.
- Anchor plates and bottom 2-foot sections of rods were cemented into the competent sandstone units. The remaining annular space was filled with the following to land surface:
  - Approximately 2 feet of 12/20 silica sand to allow for movement of the rod
  - Approximately 2 feet of a mixture of sand and bentonite chips
  - Approximately 0.5 foot of ⅜-inch bentonite chips to serve as a seal
  - Cement grout to land surface to hold the PVC sleeve in place while allowing the rod to move independently
- Flush-mounted well vaults and four steel bollards were placed around each survey monument for protection.

Basin Surveys of Hobbs, New Mexico surveyed the locations and elevations of the subsidence survey monitoring points after installation (Attachment 3). The survey was conducted on March 23, 2018, and used the nearest U.S. Geological Survey (USGS) benchmark referenced to NMSPCE (NAD83).

In accordance with Condition 2.B.1 of DP BW-8, Salty Dog will have each surface subsidence survey monitoring point surveyed semiannually to at least the nearest 0.1 foot (OCD, 2013). Survey results will be submitted to OCD within 15 days of the survey and will be included in the annual Class III well reports.

Monitor Well Installation

A new groundwater monitor well designated DBS-10, was installed in the brine well area. The well was placed 300 feet downgradient of MW-5, as requested by OCD (Figure 1). The purpose of the well is to help define the downgradient extent of chloride-impacted groundwater in the brine well area.

The well was constructed in a 6.5-inch-diameter borehole that was advanced using the air-rotary drilling method. Once groundwater was encountered, the water level in the borehole was allowed to stabilize before well construction. The water level stabilized to 62.10 feet bgs. The well casing and screen were suspended in the borehole while the filter pack and annular seal materials were emplaced. The well was completed to a depth of 85 feet bgs and was constructed of 2-inch-diameter SCH 40 PVC. Additional well specifications are as follows:

- 20 feet of 0.020-inch slotted screen, with 5 feet of screen set above the water table and the bottom sealed with a threaded PVC end cap
- Centralizer placed at the top of the screen
- Filter pack consisting of 12/20 silica sand installed from the bottom of the borehole to 5 feet above the top of screen
- Well seal consisting of approximately 37 feet of ⅜-inch coated bentonite pellets placed above the filter pack
- Cement grout extending from approximately 15 feet bgs to ground surface
- Surface completion consisting of a 2.5-foot-tall stickup with a locking well plug (J-plug), covered by a 6-inch-diameter protective steel riser with a locking cap and a 0.5-foot-thick concrete well pad protected by 4 steel bollards

After well construction, DBS-10 was developed by pumping until produced water contained little to no sand and was visually clear of suspended solids. Given the small volumes of water produced, well development water was discharged to the land surface.

The DBS&A field geologist providing oversight described drill cuttings at 5-foot intervals. The descriptions include lithology, color, texture, and observed hydrologic conditions including static water level. Lithologic descriptions are included in the well completion logs provided in Attachment 2. Basin Surveys surveyed the well location on March 23, 2018 (Attachment 3).

Well DBS-10 will be monitored during the next semiannual groundwater monitoring event. Groundwater levels and chloride concentrations are reported semiannually in accordance with DP BW-8.

Closing

This letter report documents monitor well and survey monument installation activities conducted at Salty Dog in March 2018. If you have any questions or comments, please feel free to call us at (505) 822-9400.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John Ayarbe, P.G.
Senior Hydrogeologist

Michael D. McVey, C.P.G., P.G.
Senior Hydrogeologist

JA/MDM/rpf
Attachments

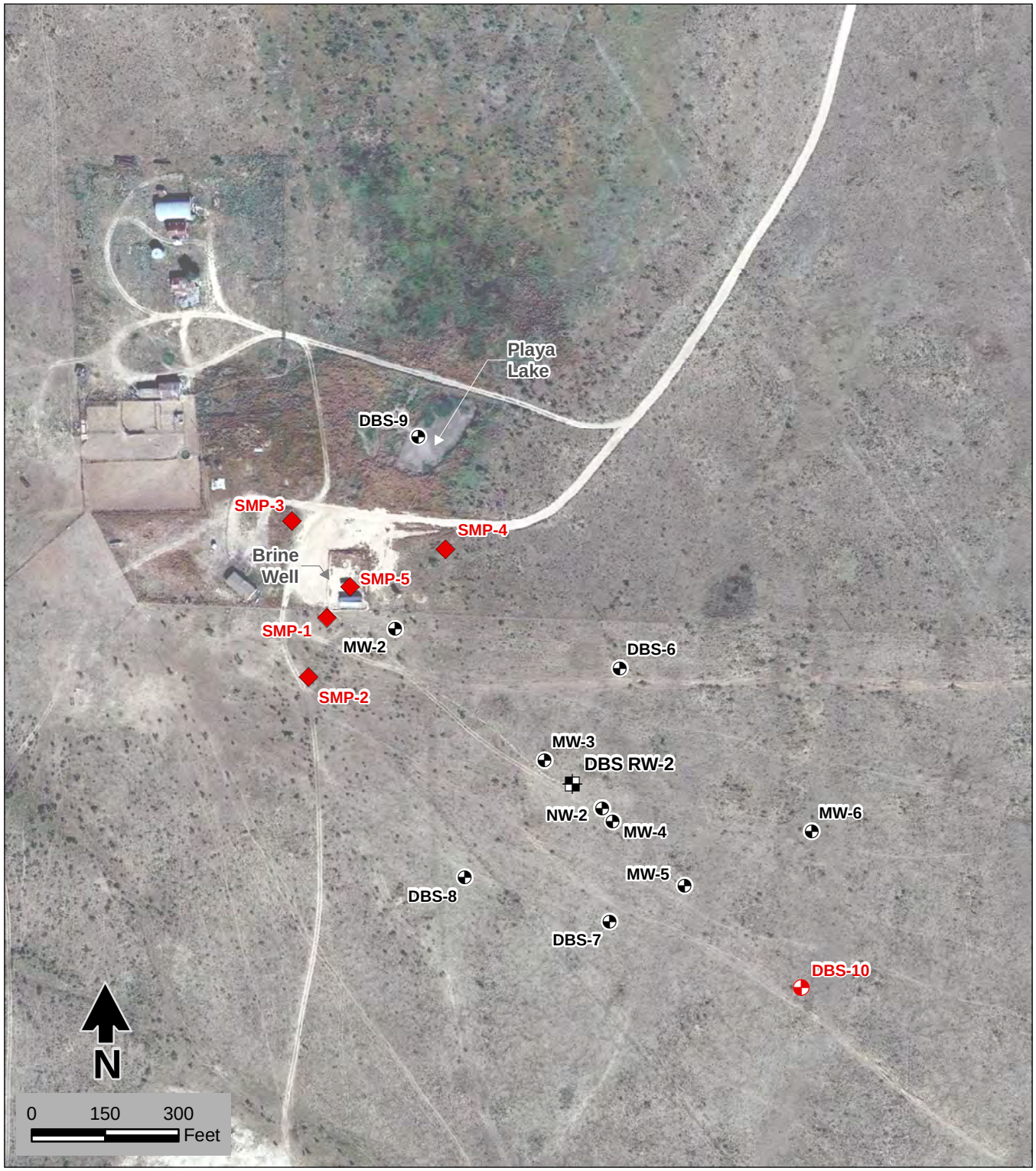
References

Daniel B. Stephens & Associates, Inc. (DBS&A). 2014. *Work plan for surface subsidence monitoring and solution cavern characterization, Salty Dog Brine Station.* Prepared for New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division, Environmental Bureau. September 17, 2014.

DBS&A. 2018. *Semiannual groundwater monitoring and O&M report, July 1 through December 31, 2017, Salty Dog Brine Station, Lea County, New Mexico*. Prepared for New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division, Environmental Bureau. March 30, 2018.

Oil Conservation Division, New Mexico Energy, Minerals and Natural Resources Department (OCD). 2013. *Discharge Permit (BW-8) Standard Energy, UIC Class III Brine Well Brine Supply Well No.1 API No. 30-025-26307 UL: J Section 5 Township 19 South, Range 36 East, Lea County, New Mexico.* November 8, 2013.

Figure



Explanation

New location

- Monitor well
- Survey monument

Existing location

- Recovery well
- Monitor well

Source: Google Earth aerial photograph dated November 2017

SALTY DOG BRINE STATION

New Monitor Well and Land Subsidence Survey Monitoring Point Locations

Daniel B. Stephens & Associates, Inc.

6/11/2018

JN ES08.0118

Figure 1

S:\Projects\ES08.0118.06_Salty_Dog_2016\GIS\MXD\Field Program 2018\Figure 1\Fig1_Ltr_Report.mxd

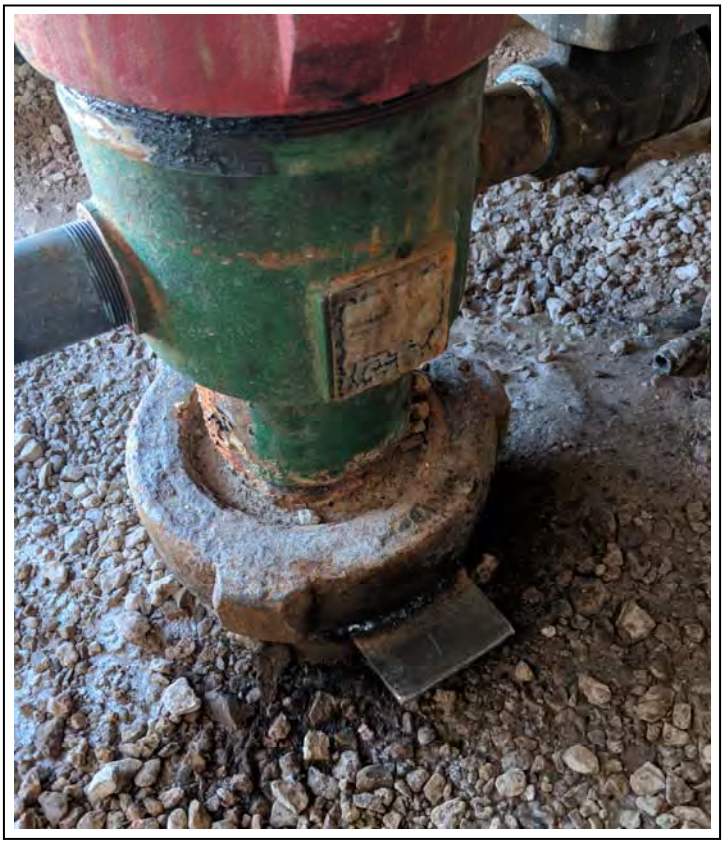
Attachment 1

Photographs

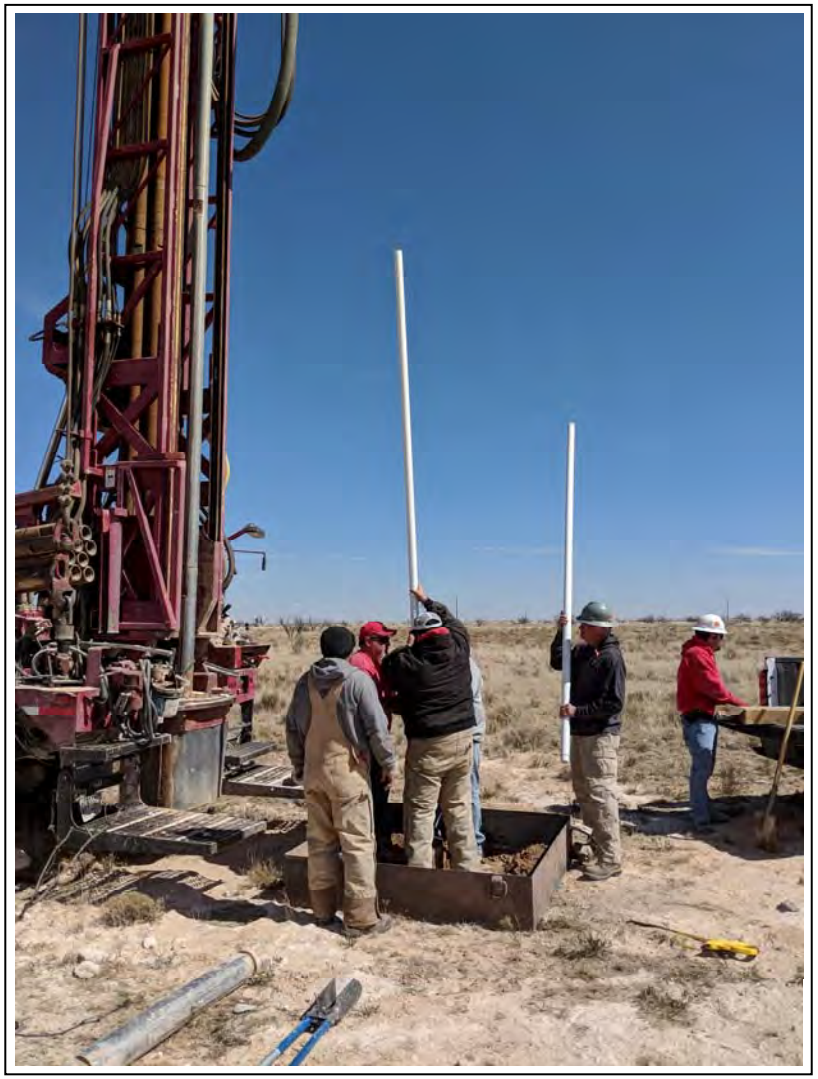
1. Peterson assembling a survey monument consisting of a stainless steel rod inside a PVC sleeve. The crew greased the inside of the sleeve to allow the rod to move freely within the sleeve.

2. Installation of survey monument SMP-3. The monument was centered and suspended within the borehole, and the anchor plate and sleeve were carefully placed before installing cement grout to anchor the monument in sandstone.

3. Installation of survey monument SMP-1: anchor plate being grouted. Sand was then placed on top of the grout to fill the annular space. Then the sleeve was cut and grouted at the land surface.



4. Survey monument SMP-5, consisting of a stainless steel plate welded directly onto the brine well casing.



5. Monitor well DBS-10: Peterson suspending and assembling 2-inch-diameter SCH 40 PVC well casing.

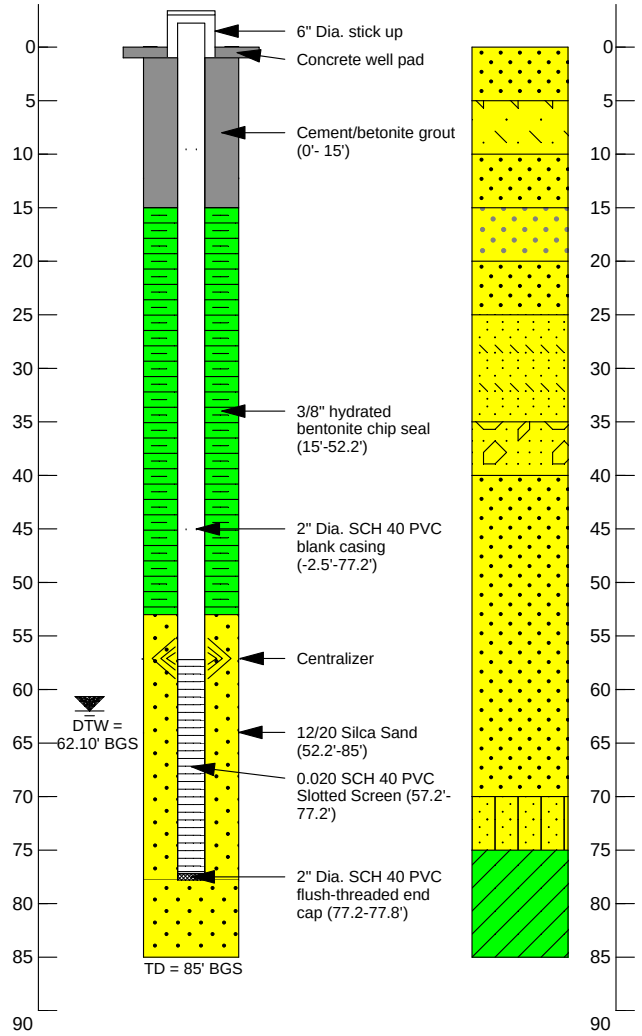
6. Monitor well DBS-10: silica sand being poured down the borehole, extending from bottom of borehole to approximately 5 feet above the top of well screen. Bentonite chips were then placed on top of the silica sand filter pack, extending to depth of 15 feet bgs. Cement grout was then used to fill the remainder of the annulus.

7. Monitor well DBS-10: Peterson constructing the well pad.

Attachment 2

Boring Logs

S:\Projects\ES08.0118_Salty_Dog_2018_Deliverables_Sub Mnmnts_WellInstall Report 2018_Attch2_Borehole Logs\Logplot



Graphic Log	Depth Interval (ft bgs)	USCS Symbol/ RockUnit	Comments and Lithology
		SP	Caliche and sand - very pale brown (10yr 8/2), caliche with medium grained sand and trace silt, well sorted, non-plastic, dry.
		GP-SP	Caliche with gravel and sand - Pink (7.5yr 7/3), fine sand and minor silt, subangular sand, well sorted, poorly graded, weakly plastic, dry.
		SP	Sand - pink (7.5yr 8/3), fine grained sand, weakly indurated sandstone cuttings, well sorted, poorly graded, dry.
		SS	Sandstone - pinkish (7.5 7/4), well indurated fine sand with trace chert, sand grains subangular, well sorted, cuttings angular with calcareous cement. Retool hammer bit.
		SP	Sand - pinkish white (7.5yr 8/2), weakly indurated fine sand with silt and chert. Retool to 6.5" air rotary.
		SW	Sand - pinkish gray (5yr 7/2), fine to coarse grained sand with trace silt, subrounded, weakly consolidated, poorly sorted, weakly plastic, dry.
		SW	Sand with gravel - pinkish gray (5yr 6/2), poorly indurated sandstone with chert, sand fine to medium grained, subrounded, poorly sorted, dry. Retool Hammer Bit.
		SW-SM	Sand and silt - reddish brown (5yr 6/3), moderately indurated sandstone with silt, fine to medium grained, subrounded, non-plastic, dry.
		SP	Sand with trace silt - light reddish brown (5yr 6/4), sand fine grained, rounded, well sorted, cuttings poorly indurated, moist.
		SP	As Above
		SP	As Above - moist
		SP	Sand with trace silt - light reddish brown (5yr 6/4), moderately indurated sandstone, sand medium grained, subrounded, well sorted, cuttings well indurated, moist.
		SP	Sand with silt - reddish brown (5yr 5/3), moderately indurated sandstone, sand medium grained with trace fines, sand subround to round, well sorted, nonplastic, moist.
		SP	Sand with trace silt - brown (7.5yr 5/3), sandstone, medium grained sand with trace silt, grains subangular, well sorted weakly plastic, wet. Tag WL. Retool 6.5" air rotary to drill out hole.
		SM	Silty sand - brown (7.5yr 4/3), sand fine to medium grained, sand subangular to rounded, poorly sorted weakly plastic, wet.
		CL	Sandy claystone - dark brown (7.5yr 3/2), clay with fine to medium sand, subrounded, poorly sorted, plastic, wet.
		CL	Sandy claystone - dark brown (7.5yr 3/2), clay with fine to medium sand, subrounded, poorly sorted, plastic, wet.

Geologist: M. Zbrozek
Driller: Peterson Drilling, Inc.
Date started: 03.13.2018
Date completed: 03.13.2018

Drilling method: Air Rotary
Bit diameter: 6" I.D. / 7" O.D.
Sampling: Cuttings

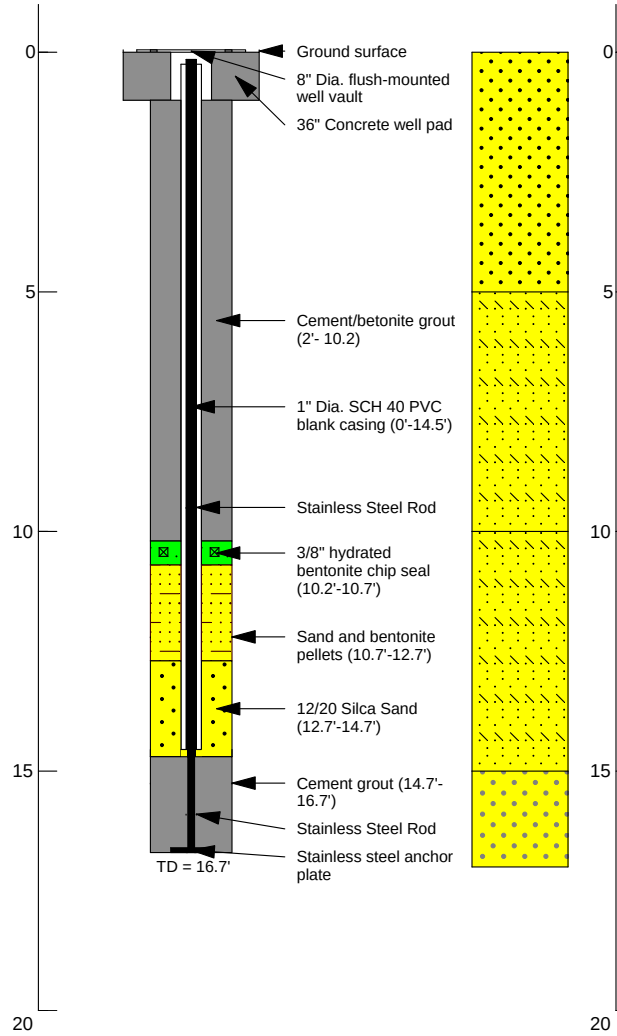
Coordinates are New Mexico State Plane, NAD 83
Elevation expressed in feet above mean sea level (feet msl).

Northing: 614720.4
Easting: 837270.0
Elevation (Top of Casing):3807.48'

SALTY DOG BRINE STATION
DBS-10

Daniel B. Stephens & Associates, Inc.
6/22/2018 ES08.0118.06

S:\Projects\ES08.0118_Salty_Dog_2018_Deliverables_Sub Mnmnts_WellInstall Report 2018_Attch2_Borehole Logs\Logplot\SMP



Graphic Log	Depth Interval (ft bgs)	USCS Symbol/ RockUnit	Comments and Lithology
	0-5	SP	Caliche and sand - very pale brown (10yr 8/2), medium sand with trace silt, well sorted, weakly plastic, dry.
	5-10	SW	Sand - pink (7.5yr 8/3), fine to medium grained sand with some caliche, poorly sorted, poorly indurated, non-plastic, dry.
	10-15	SW	As above with increasing soft sandstone cuttings, sand fine to medium grained with minor silt, poorly sorted.
	15-17	SS	Sandstone - pink (7.5yr 7/3), well indurated sandstone, fine grained sand with trace chert, subangular, well sorted, cuttings angular with calcareous cement.

Geologist: M. Zbrozek
Driller: Peterson Drilling, Inc.
Date started: 03.12.2018
Date completed: 03.13.2018

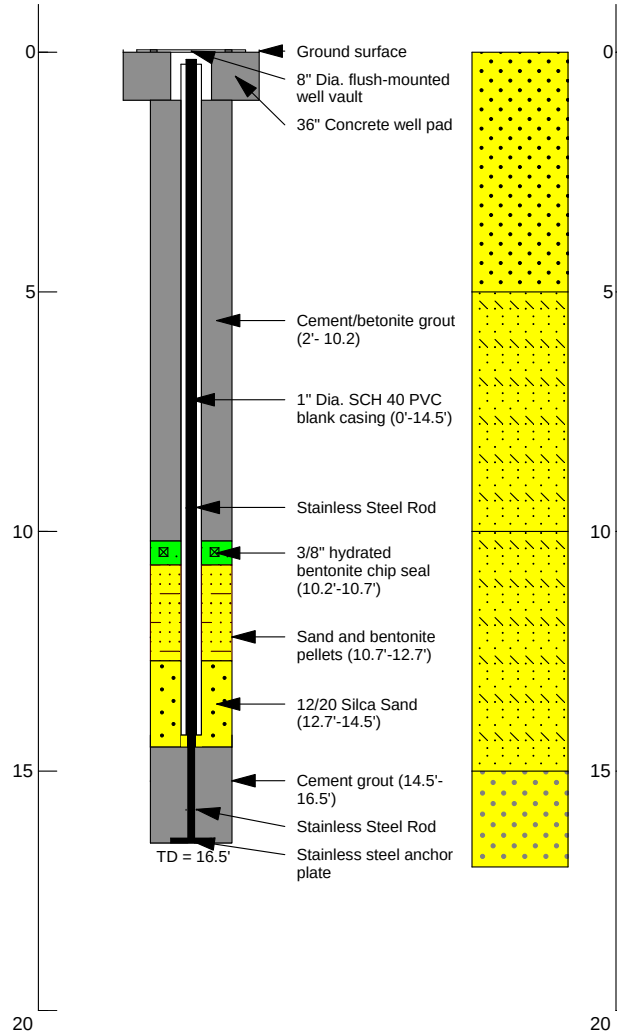
Drilling method: Air Rotary
Bit diameter: 6" I.D. / 7" O.D.
Sampling: Cuttings

Coordinates are New Mexico State Plane, NAD 83
Elevation expressed in feet above mean sea level (feet msl).

Northing: 83630.4
Easting: 615476.0
Elevation (Top of Casing): 3810.1'

SALTY DOG BRINE STATION
SMP-1

S:\Projects\ES08.0118_Salty_Dog_2018_Deliverables_Sub Mnmnts_WellInstall Report 2018_Attch2_Borehole Logs\Logplot



Graphic Log	Depth Interval (ft bgs)	USCS Symbol/ RockUnit	Comments and Lithology
	0-5	SP	Caliche and sand - pinkish white (7.5yr 8/2), caliche with medium sand with trace silt, well sorted, poorly consolidated, weakly plastic, dry.
	5-10	SW	Sand - pink (7.5yr 8/4), fine to medium grained sand, poorly sorted, poorly indurated, non-plastic, dry.
	10-15	SW	As above with increasing soft sandstone cuttings.
	15-17	SS	Sandstone - pink (7.5 7/3), well indurated sandstone, fine grained sand with trace chert, subangular, well sorted, cuttings angular with calcareous cement.

Geologist: M. Zbrozek
Driller: Peterson Drilling, Inc.
Date started: 03.13.2018
Date completed: 03.14.2018

Drilling method: Air Rotary
Bit diameter: 6" I.D. / 7" O.D.
Sampling: Cuttings

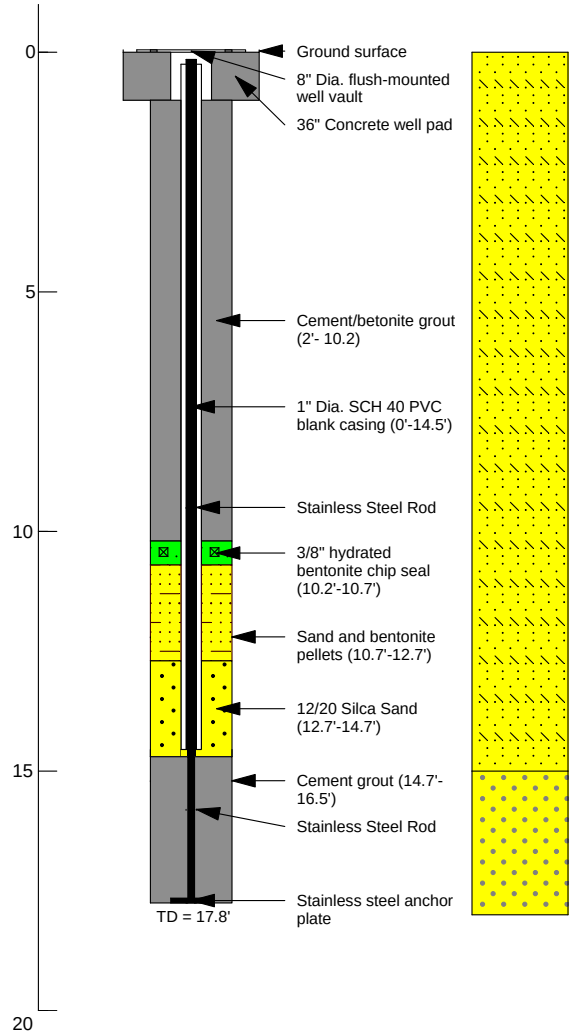
Coordinates are New Mexico State Plane, NAD 83
Elevation expressed in feet above mean sea level (feet msl).

Northing: 836264.3
Easting: 615354.9
Elevation (Top of Casing):3809.0'

SALTY DOG BRINE STATION
SMP-2

Daniel B. Stephens & Associates, Inc.
6/20/2018 ES08.0118.06

S:\Projects\ES08.0118_Salty_Dog_2018_Deliverables_Sub Mnmnts_WellInstall Report 2018_Attch2_Borehole Logs\Logplot



Graphic Log	Depth Interval (ft bgs)	USCS Symbol/ RockUnit	Comments and Lithology
	0-5	SW	Caliche and sand - pinkish white (7.5yr 8/2), caliche with fine to medium grained sand with trace silt, poorly sorted, poorly consolidated, weakly plastic, dry.
	5-10	SW	Sand - pink (7.5yr 8/4), fine to medium grained sand, poorly sorted, poorly indurated, non-plastic, dry.
	10-15	SW	As above with increasing soft sandstone cuttings.
	15-18	SS	Sandstone - pink (7.5 7/3), well indurated sandstone with trace chert, fine grained sand, subangular, well sorted, cuttings angular with calcareous cement.

Geologist: M. Zbrozek
Driller: Peterson Drilling, Inc.
Date started: 03.12.2018
Date completed: 03.13.2018

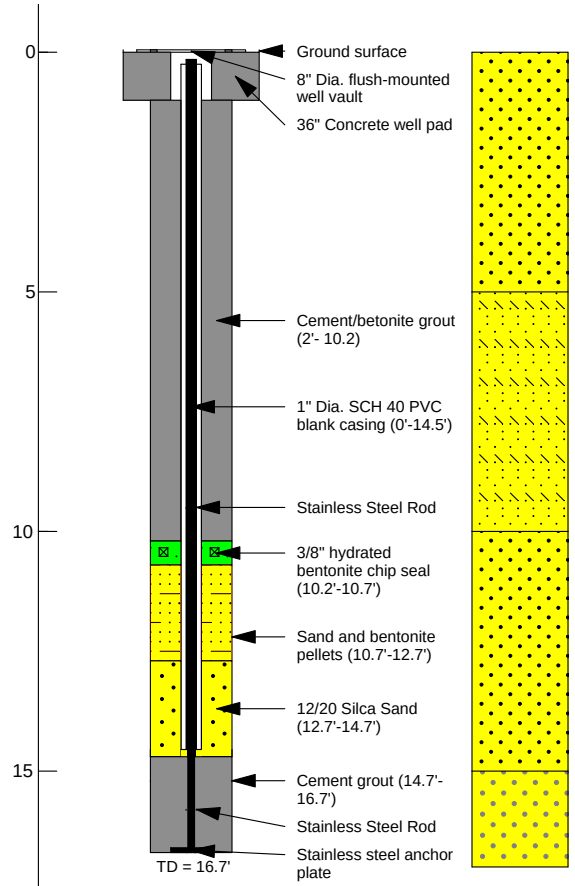
Drilling method: Air Rotary
Bit diameter: 6" I.D. / 7" O.D.
Sampling: Cuttings

Coordinates are New Mexico State Plane, NAD 83
Elevation expressed in feet above mean sea level (feet msl).

Northing: 836230.1
Easting: 615673.0
Elevation (Top of Casing):3808.8'

SALTY DOG BRINE STATION
SMP-3

S:\Projects\ES08.0118_Salty_Dog_2018_Deliverables_Sub Mnmnts_WellInstall Report 2018_Attch2_Borehole Logs\Logplot



Depth Interval (ft bgs)	USCS Symbol/ RockUnit	Comments and Lithology
0-5	SP	Caliche and sand - very pale brown (10yr 8/2), caliche with medium grained sandand trace silt, well sorted, poorly consolidated, weakly plastic, dry.
5-10	SW	As above with increasing fine and medium grained sand, sand subangular, poorly sorted, dry.
10-15	SP	Poorly graded sand - pink (7.5yr 8/3), fine grained sand, weakly indurated sandstone cuttings, well sorted, poorly graded, dry.
15-17	SS	Sandstone - pinkish (7.5 7/4), well indurated sandstone with trace chert, fine grained sand, subangular, well sorted. Cuttings angular with calcareous cement.

Geologist: M. Zbrozek
Driller: Peterson Drilling, Inc.
Date started: 03.12.2018
Date completed: 03.13.2018

Drilling method: Air Rotary
Bit diameter: 6" I.D. / 7" O.D.
Sampling: Cuttings

Coordinates are New Mexico State Plane, NAD 83
Elevation expressed in feet above mean sea level (feet msl).

Northing: 836543.5
Easting: 615615.8
Elevation (Top of Casing):3806.3'

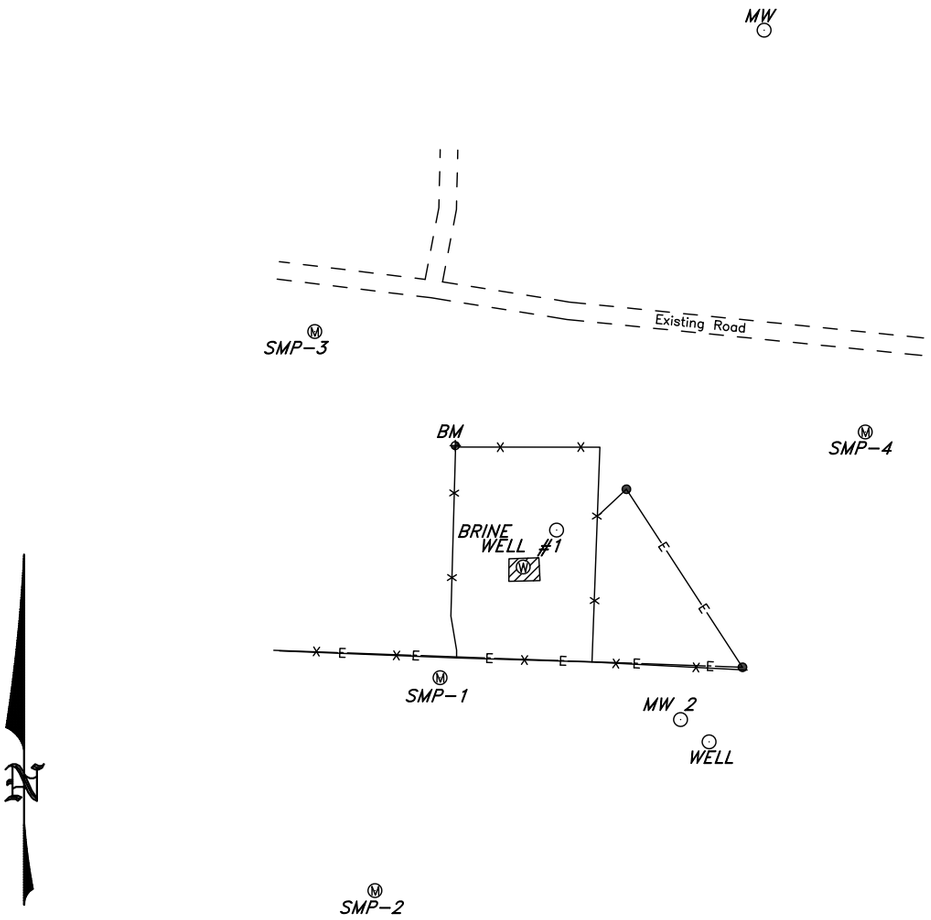
SALTY DOG BRINE STATION
SMP-4

Daniel B. Stephens & Associates, Inc.
6/10/2018 ES08.0118.06

Attachment 3

Survey

SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST, N.M.P.M.,
LEA COUNTY, NEW MEXICO.



ALL COORDINATES ARE BASED ON NMSPCE (NAD83)

NAME	SECTION CALLS	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEVATION TOP CASING	ELEVATION CONCRETE
BRINE WELL #1	2216' FSL & 1972' FEL	615539.0	836348.7	N32°41'18.6"	W103°22'28.0"	3811.7'	
SMP-1	2153' FSL & 2020' FEL	615476.0	836301.4	N32°41'18.0"	W103°22'28.5"	3810.1'	3810.4'
SMP-2	2032' FSL & 2058' FEL	615354.9	836264.3	N32°41'16.8"	W103°22'29.0"	3809.0'	3809.4'
SMP-3	2350' FSL & 2089' FEL	615673.0	836230.1	N32°41'19.9"	W103°22'29.3"	3808.8'	3809.2'
SMP-4	2291' FSL & 1776' FEL	615615.8	836543.5	N32°41'19.4"	W103°22'22.7"	3806.3'	3806.7'
DBS-10	1389' FSL & 1060' FEL	614720.4	837270.0	N32°41'10.4"	W103°22'17.3"	3807.5'	3805.4'
BENCH MARK		615608.1	836310.1	N32°41'19.3"	W103°22'28.4"		

I HEREBY CERTIFY THAT THIS PLAT WAS PREPARED FROM FIELD NOTES OF AN ACTUAL SURVEY AND MEETS OR EXCEEDS ALL REQUIREMENTS FOR LAND SURVEYS AS SPECIFIED BY THIS STATE.

GARY L. JONES, N.M. P.S. No. 7977
T.H. McLEAN, N.M.P.S. No. 5074

GARY L. JONES NEW MEXICO 7977 REGISTERED PROFESSIONAL LAND SURVEYOR

200 0 200 400 FEET

DANIEL B. STEPHENS & ASSOCIATES, INC

REF: SALTY DOG BRINE FACILITY

MONITOR WELLS LOCATED IN
SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST,
N.M.P.M., LEA COUNTY, NEW MEXICO.

basin surveys
focused on excellence in the oilfield
P.O. Box 1786
1120 N. West County Rd.
Hobbs, New Mexico 88241
(575) 393-7316 – Office
(575) 392-2206 – Fax
basinsurveys.com

W.O. Number: 33610	Drawn By: K. GOAD	Date: 03-29-2018	Survey Date: 03-23-2018	Sheet 1 of 1 Sheets

SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST, N.M.P.M.,
LEA COUNTY, NEW MEXICO.

ALL COORDINATES ARE BASED ON NMSPCE (NAD83)

NAME	SECTION CALLS	NORTHING	EASTING	LATITUDE	LONGITUDE	ELEVATION TOP CASING	ELEVATION CONCRETE
BRINE WELL #1	2216' FSL & 1972' FEL	615539.0	836348.7	N32°41'18.6"	W103°22'28.0"	3811.7'	
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DBS-10	1389' FSL & 1060' FEL	614720.4	837270.0	N32°41'10.4"	W103°22'17.3"	3807.5'	3805.4'
BENCH MARK		615608.1	836310.1	N32°41'19.3"	W103°22'28.4"		

200 0 200 400 FEET

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DANIEL B. STEPHENS & ASSOCIATES, INC

REF: SALTY DOG BRINE FACILITY

MONITOR WELLS LOCATED IN
SECTION 5, TOWNSHIP 19 SOUTH, RANGE 36 EAST,
N.M.P.M., LEA COUNTY, NEW MEXICO.

W.O. Number: 33610	Drawn By: K. GOAD	Date: 03-29-2018	Survey Date: 03-23-2018	Sheet 1 of 1 Sheets

Chavez, Carl J, EMNRD

From: McVey, Michael <mmcVey@dbstephens.com>
Sent: Thursday, November 10, 2016 9:41 AM
To: Chavez, Carl J, EMNRD
Cc: Ayarbe, John; pieter@bergsteinenterprises.com
Subject: RE: BW-8 Subsidence Monitoring Work Plan & Cavern Characterization Report
Attachments: Salty Dog Work Plan_9-17-2014.pdf; 3rd Qtr 2016 Monitoring_Salty Dog_11-09-2016.pdf

Carl,

Thanks for following up with me. The Work Plan for Surface Subsidence Monitoring and Solution Cavern Characterization was submitted to Jim in September 2014. I've attached a copy of that work plan for your review.

The change from quarterly groundwater monitoring (as stipulated in the new discharge permit for the Salty Dog Brine Station)to semiannual groundwater monitoring was proposed by DBS&A in the 2nd Qtr 2016 Monitoring report and in the 3rd Qtr Monitoring report that was just submitted to Tomas on November 9, 2016. I've attached a pdf of the 3rd Qtr Monitoring report for your review.

Please let me know if you have any questions. We're looking for approval of the Work Plan for Surface Subsidence Monitoring and Solution Cavern Characterization and approval to change to semiannual groundwater monitoring as I discussed with Jim.

Thanks,

Michael D. McVey
Senior Hydrogeologist

Daniel B. Stephens & Associates, Inc.
Hydrology | Engineering | Geoscience

Providing solutions for water, natural resources, and the environment

6020 Academy Road NE, Suite 100 | Albuquerque, New Mexico 87109
T (505) 822-9400 | D (505) 353-9130 | F (505) 822-8877
mmcvey@dbstephens.com | www.dbstephens.com

Facebook | LinkedIn | YouTube | Google+

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Thursday, November 10, 2016 9:01 AM
To: McVey, Michael
Cc: Griswold, Jim, EMNRD
Subject: BW-8 Subsidence Monitoring Work Plan & Cavern Characterization Report

Mike:

Good morning. I met with Jim Griswold this morning and he requested that I follow-up on the above subject reports with you.

OCD could not locate the above subject reports.

Could you please send pdf versions of the reports to me for review.

Thank you.

Mr. Carl J. Chavez
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

"Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?" (To see how, go to: http://www.emnrd.state.nm.us/OCD and see "Publications")

September 17, 2014

Mr. Jim Griswold
New Mexico Oil Conservation Division
Environmental Bureau
1220 South St. Francis Drive
Santa Fe, NM 87505-4225

Re: Work Plan for Surface Subsidence Monitoring and Solution Cavern Characterization
Salty Dog Brine Station

Dear Mr. Griswold:

On behalf of PAB Services, Inc., Daniel B. Stephens & Associates, Inc. (DBS&A) is pleased to submit the enclosed work plan for surface subsidence monitoring and solution cavern characterization at the Salty Dog Brine Station in Lea County, New Mexico. The work plan was prepared in accordance with the requirements of Conditions 2.B.1 and 2.B. 2 of discharge permit (DP) BW-8.

Please do not hesitate to call us at (505) 822-9400 if you have any questions or require additional information.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John Ayarbe, P.G.
Senior Hydrogeologist

Michael D. McVey, C.P.G., P.G.
Senior Hydrogeologist

JA/rpf
Enclosures
cc: Pieter Bergstein, PAB Services, Inc.
Brenda Patterson, Aqueous Operating
Terry Wallace, Salty Dog, Inc.

Work Plan for
Surface Subsidence Monitoring and
Solution Cavern Characterization
Salty Dog Brine Station

Prepared for **New Mexico Energy, Minerals and Natural Resources Department**
Oil Conservation Division

September 17, 2014

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

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7 Subsurface Anomalies Identified by Geophysical Methods at the I&W Site

Work Plan for
Surface Subsidence Monitoring and
Solution Cavern Characterization
Salty Dog Brine Station

1. Introduction

Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this work plan on behalf of PAB Services, Inc. (PAB) to satisfy Conditions 2.B.1 and 2.B. 2 of recently renewed discharge permit BW-8 (DP BW-8). The Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department (NMEMNRD) renewed DP BW-8 on November 8, 2013, permitting continued operation of the Salty Dog Brine Station (Salty Dog) and the associated Underground Injection Control (UIC) Class III well (Brine Supply Well #1 [API No. 30-025-26307]) (NMEMNRD, 2013). The facility is located in Lea County, New Mexico, approximately 11 miles west of Hobbs, New Mexico along Highway 180 (Figure 1).

This work plan describes the proposed technical approach to be used to satisfy Conditions 2.B.1 and 2.B.2 of DP BW-8, including (1) the design of survey monuments and establishment of a program to monitor for potential surface subsidence, and (2) investigation activities to characterize the size and shape of the solution cavern created by brine production. Section 2 provides pertinent background information, such as the history of the facility, site geology, and brine well construction. Sections 3 and 4 present the proposed plans for surface subsidence monitoring and solution cavern characterization, respectively. Reporting is discussed in Section 5. Section 6 presents a schedule for the proposed work.

2. Background

Salty Dog is a brine water production and loading station, consisting of a fresh water supply well, a brine production well, and a concrete truck loading pad with two brine filling stations. Fresh water is stored in two 1,000-barrel (bbl) fresh water aboveground storage tanks (ASTs). Brine is stored at a bermed tank battery consisting of six 750-bbl ASTs. Figure 1 shows the

locations of the Salty Dog facilities. The brine well is located approximately 0.5 mile southwest of the brine station. Figure 2 presents a 2014 aerial photograph of the brine station showing the layout of the current facility infrastructure.

Brine is produced from the in situ extraction of salt at the UIC Class III well (Brine Supply Well #1 [API No. 30-025-26307]). The physical location of the brine well is 1,980 feet from south line (FSL) and 1,980 feet from east line (FEL) (NW/4 SE/4, Unit Letter J) in Section 5, Township 19 South, Range 36 East, New Mexico Principal Meridian (NMPM) (Figure 1). The brine well was installed in June 1979. The original discharge permit for the brine well (GWB-2) appears to have been issued on December 18, 1982 (OCD, 1994). The discharge permit was last renewed on November 8, 2013 (NMEMNRD, 2013).

Figure 3 shows a generalized schematic of the brine well illustrating its construction, tubing depths, and the penetrated geologic units. The brine well was drilled to a total depth of 2,958 feet below ground surface (bgs). Surface casing (8⅝-inch) extends from land surface to a depth of 1,877 feet bgs and is cemented in place. The well is completed open hole from 1,877 to 2,958 feet bgs. The well was originally completed with open-ended 2⅞-inch tubing, hung to a depth of 2,887 feet bgs and perforated from 2,872 to 2,887 feet bgs (NRE, 1982). In August 1999, holes in the surface casing were repaired, and a 5½-inch casing liner was installed and cemented to 1,829 feet bgs; open-ended 2⅞-inch tubing was hung to a depth of 2,534 feet bgs (Salty Dog, 1999). The tubing is currently set at 2,665 feet bgs.

The Salty Dog brine well is configured for reverse circulation brine recovery, where fresh water is circulated down the casing annulus into the Salado Formation—a Permian Age sedimentary rock unit composed of halite (salt) and other evaporative beds. Fresh water dissolves the salt, and the brine is extracted through the center tubing of the well (Figure 3). The total dissolved solids (TDS) concentrations of the fresh water and produced brine are approximately 600 milligrams per liter (mg/L) and 320,000 to 350,000 mg/L, respectively (Martin, 1982; Unichem, 1987).

Figure 3 shows the geologic stratigraphy at the brine well. The Ogallala Formation is the uppermost geologic unit, extending from land surface to a depth of approximately 150 feet bgs. At the Salty Dog site, the Ogallala Formation consists primarily of sand, with the upper 40 feet

containing appreciable amounts of caliche. Regional groundwater is present within the formation under a water-table condition and is considered part of the Ogallala Aquifer. This groundwater is used as the fresh water supply for the brine station, and is pumped from an on-site well (Figure 2). Depth to groundwater is approximately 60 feet bgs (DBS&A, 2009a). The Rustler Formation underlies the Ogallala Formation and consists of redbed and anhydrite sequences from approximately 150 to 1,800 feet bgs and 1,800 to 2,000 feet bgs, respectively. The Salado Formation is present from approximately 2,000 to 2,900 feet bgs.

In addition to the fresh water pumped from the supply well, chloride-impacted groundwater recovered at two on-site groundwater extraction wells is used as injection water at the brine well. Figure 4 shows the locations of the two extraction wells (RW-1 and RW-2).

3. Surface Subsidence Monitoring Plan

Condition 2.B.1 of DP BW-8 requires surface subsidence monitoring at the Salty Dog Brine Station. DBS&A proposes to install four survey monuments near the brine well to be surveyed semiannually by a licensed professional surveyor to satisfy this condition.

Figure 5 shows the proposed locations of the survey monuments. One survey monument would be placed about 50 feet from the brine well; the other three monuments would be placed about 200 feet from the brine well. A 2009 sonar survey identified a maximum radius of a solution cavern along an azimuth of 200 degrees (Section 4.1). Two of the proposed survey monuments are positioned along this direction (SMP-1 and SMP-2).

Figure 6 provides a design schematic for the survey monuments prepared by Engineering Analytics, Inc., a geotechnical engineering firm based in Fort Collins, Colorado. Each monument will be constructed from stainless steel rod sleeved within 1-inch-diameter SCH 80 polyvinyl chloride (PVC) pipe, with the top of the rod serving as the surface subsidence monitoring point. The stainless steel rod will be anchored in 2 feet of concrete at a depth of approximately 25 to 30 feet bgs. Final depths will be determined in the field and selected such that the stainless steel rods are anchored in hard and well-indurated sand that often appears as stone due to the presence of appreciable amounts of caliche. Several monitor and recovery wells have been completed within the Ogallala Aquifer at the site. Lithologic data collected at

these wells show the presence of sandstone or well-indurated sand units at depths of up to approximately 40 feet bgs (DBS&A, 2009a and 2009b). At RW-2, the closest existing well to the brine well, hard and well-indurated sand exists between 20 and 35 feet bgs (DBS&A, 2009b).

The space between the PVC pipe and stainless steel rod will be filled with grease to allow the rod to move independent of the PVC pipe and surface completion (Figure 6). The survey monuments have been designed to detect ground movement at depth, which would more likely be associated with a cavern collapse than near-surface disturbances that are not associated with cavern subsidence (e.g., shrinking and swell of surface soil). Each monument will be constructed in an approximately 8¾-inch-diameter borehole, advanced using the air-rotary drilling method or other comparable drilling technology.

After installation, the location and elevation of each survey monument will be established relative to the nearest U.S. Geological Survey (USGS) benchmark. A licensed New Mexico land surveyor will survey the elevation of each monument semiannually to at least the nearest 0.01 foot. Survey results will be submitted to OCD within 15 days of the survey and included in the Annual Class III Well Reports.

In accordance with DP BW-8, if subsidence is measured at or greater than 0.1 foot, Salty Dog will suspend operations at the brine well and conduct an analysis to determine the cause of the movement and integrity of the cavern.

4. Solution Cavern Characterization Program

Condition 2.B.2 of DP BW-8 requires a characterization program to delineate the size and shape of the solution cavern using a geophysical method. The following sections summarize a previous characterization effort and the proposed geophysical approach to satisfy Condition 2.B.2.

4.1 Previous Characterization Survey

In 2009, SOCON Sonar Well Services, Inc. of Conroe, Texas conducted a sonar survey at the Salty Dog brine well in an attempt to determine the extent of the solution cavern (SOCON,

2009). The sonar survey was performed to satisfy an OCD requirement (NMEMNRD, 2008), and was run from a depth of 1,871 to 1,903 feet bgs, a vertical distance of 32 feet. Available lithologic information shows that the top of the Salado Formation is at a depth of approximately 2,000 feet bgs, indicating that the section surveyed was the anhydrite sequence of the Rustler Formation (Figure 3). Survey results show a cavern volume of 720 bbls, with a maximum radius of 41 feet at a depth of 1,882 feet bgs along an azimuth of 200 degrees.

OCD has estimated a volume of 1,022,196 bbls for the Salty Dog solution cavern based on brine production records (NMEMNRD, 2012). The volume determined from the sonar survey (720 bbls) accounts for less than 1 percent of this estimated volume.

4.2 Proposed Geophysical Approach

DBS&A proposes to use the digital high-resolution magnetotellurics (HRMT) method to determine the size and shape of the Salty Dog solution cavern. The selection of this approach is based on the general success of the method at the former I&W brine facility in Carlsbad, New Mexico. OCD has conducted extensive testing of several geophysical methods to delineate the solution cavern at the I&W site, including two-dimensional (2D) seismic reflection (August 2009), sonar logging (September 2010), electrical resistivity (April 2011), and digital HRMT (March 2011 and April 2013) (NMEMNRD, 2012). Because the geologic environment at the I&W site is similar to that at the Salty Dog Brine Station, DBS&A relied heavily on available information regarding the geophysical surveys conducted at the I&W site when selecting an appropriate cavern characterization approach.

Each of the four geophysical methods used at the I&W site identified one or more subsurface anomalies, as shown in Figure 7. The following is a brief summary of the findings from the I&W site:

- Sonic logging reportedly identified the upper part of a cavity approximately 150 feet in diameter and 25 feet high, but was unable to delineate the cavern at depth, possibly due to the presence of insoluble residues or broken rubble (NMEMNRD, 2012).

- Seismic data interpretation indicated a pear-shaped anomaly measuring about 610 feet north to south and up to 420 feet across; evidence of the most extensive dissolution was around the brine extraction well (RESPEC, 2009).

- Electrical resistivity data interpretation indicated a J-shaped low-resistivity anomaly approximately 900 feet north to south and approximately 85 feet wide that was coincident with the sonar anomaly (Figure 7). The survey also identified four smaller anomalies that were interpreted to represent brine-saturated areas of the Rustler Formation that were either highly fractured or brecciated, rather than open void space (Land and Veni, 2011).

- HRMT data indicated a roughly oval-shaped anomaly approximately 1,660 feet north to south and 790 feet wide (DMT, 2011 and 2013).

Only the HRMT approach identified a large anomaly at the I&W site that might approach the volume indicated by historical production data (Figure 7). OCD has estimated a cavern volume of 1,050,386 bbls based on brine production at the former I&W facility (NMEMNRD, 2012).

HRMT is a passive electromagnetic (EM) system commonly used for oil and gas exploration. It relies on natural EM waves (telluric currents) generated by the interaction of the earth's magnetic field with solar wind. A large-amplitude, very-low-frequency EM signal enters the earth perpendicular to the land surface, propagating into the subsurface. The amplitude and phase of individual frequencies intersect conductive formations, are modified, and are reflected back to the land surface. The air-ground interface marks a large impedance mismatch to the reflected EM waves, generating a series of higher-frequency EM waves: telluric (electric field) and geomagnetic (magnetic field). These electric and magnetic fields are recorded, and their frequency, amplitude, and phase responses are analyzed to map subsurface conditions.

DBS&A proposes to contract with DMT Technologies, LLC (DMT) in Broken Arrow, Oklahoma to perform the HRMT survey. This is the same company that conducted the HRMT survey at the I&W site. The HRMT survey will be performed using a rectangular grid of survey stations. DMT (or other contractor, if necessary), will establish the grid based on professional judgment and initial field findings at the time of the survey. Station density will be sufficient to obtain an

accurate cavern volume. Each station will be surveyed, either by a licensed New Mexico land surveyor or using a global positioning system (GPS) unit accurate to within 0.01 foot.

A best effort will be made to accurately determine the volume of the Salty Dog brine cavern; however, the results of an HRMT survey, or any geophysical survey, are interpretive. While best judgments are used in developing data interpretations, the accuracy of the HRMT survey cannot be guaranteed.

5. Reporting

After the completion of field activities and receipt of the final geophysical survey report, DBS&A will prepare a Subsidence Monitoring and Solution Cavern Characterization Report. This report will document the construction of the survey monuments and present results of the cavern characterization, including estimates of its volume and lateral extent. The final report will be submitted to the OCD, and will provide the following:

- As-built diagrams of the survey monuments, including surveyed locations and elevations
- A figure showing the locations of the survey monuments
- The report prepared by the geophysical survey contractor and associated data
- Calculation of the solution cavern volume based on brine production records and a comparison of this volume to results of the geophysical survey
- Figures illustrating the extent and depth of the cavern based on the geophysical survey
- Conclusions and recommendations

6. Schedule

Upon OCD approval of this work plan, DBS&A will work with PAB to (1) contract a driller for the installation of the survey monuments, (2) contract DMT to perform the geophysical survey, (3) contract a licensed land surveyor to perform the surveying, and (4) obtain any necessary access agreements from adjacent landowners.

DBS&A anticipates that the installation of the subsidence survey monuments and geophysical survey can begin within approximately 30 days of receiving signed access agreements and that the geophysical survey and data processing can be completed within approximately 45 days.

DBS&A will prepare a draft report for initial review within 30 days of receipt of the geophysical survey report.

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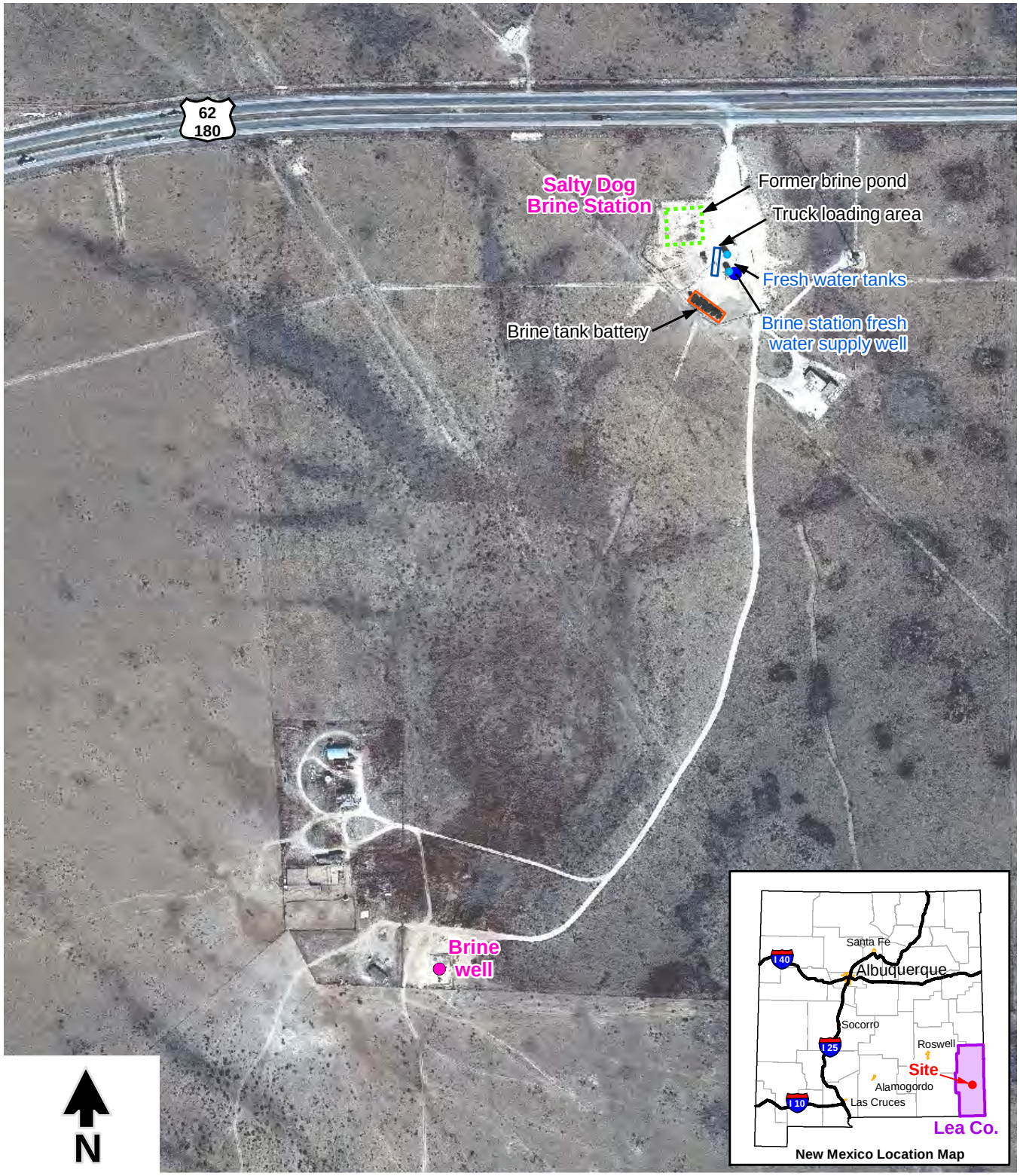
Figures



Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

Explanation

- Water supply well
- Brine well
- Fresh water tank

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG01_SITE_LOCATION_AND_FACILITIES.MXD

Daniel B. Stephens & Associates, Inc.
9/10/2014
JN ES08.0118.05

SALTY DOG BRINE STATION
Site Location and Facilities

Figure 1

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG02_SITE_2014_AERIAL_PHOTO.MXD

Source: USDA Farm Service Agency, DigitalGlobe, NMRGIS, February 14, 2014

Figure 2

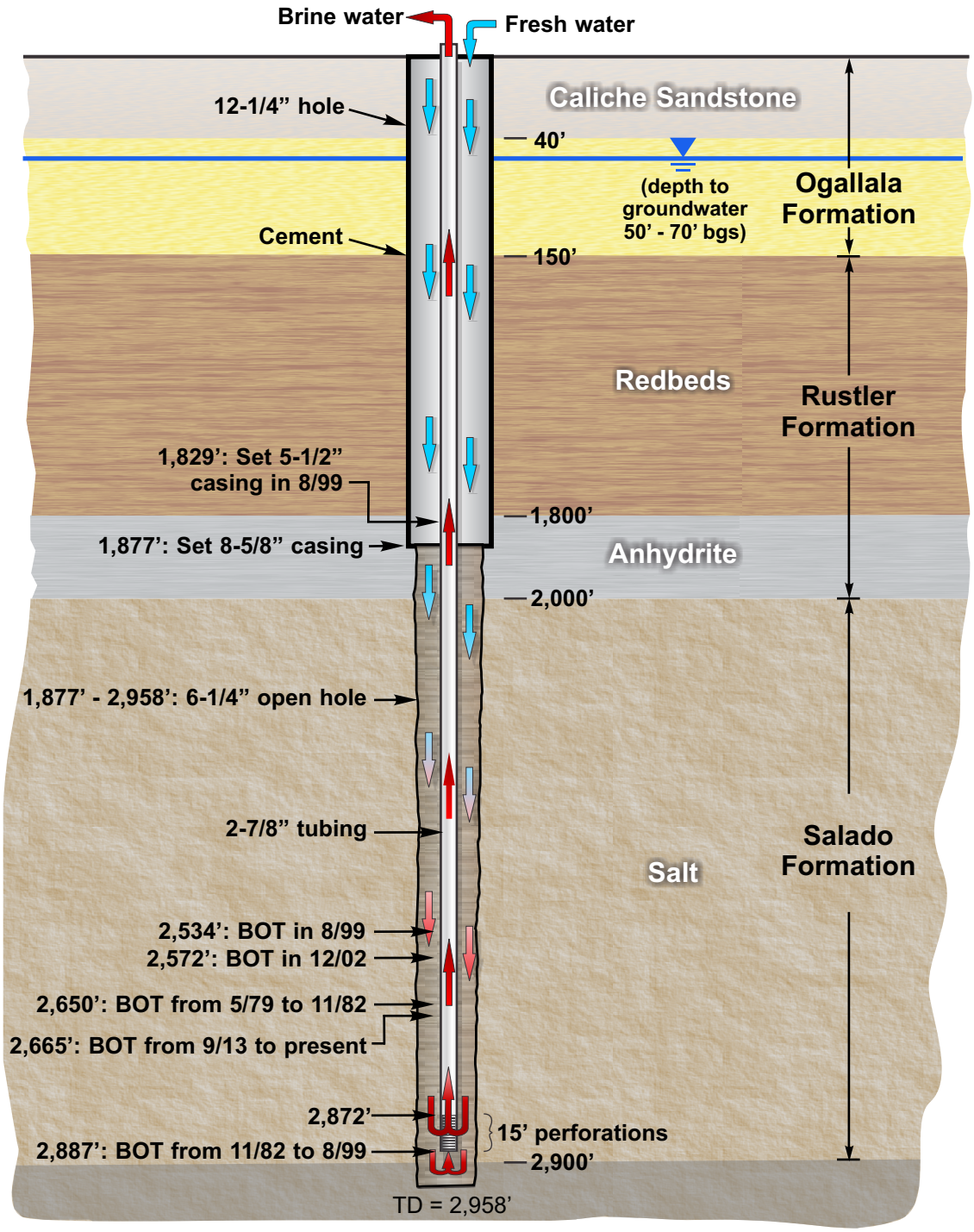
SALTY DOG BRINE STATION

2014 Aerial Photograph of Salty Dog Brine Station

Daniel B. Stephens & Associates, Inc.

9/10/2014 JN ES08.0118.05

Salty Dog Brine Well



Notes:

1. BOT = Bottom of tubing
2. Figure not to scale

Sources:

1. Completion data based on OCD well reports
2. Lithology from Salty Dog (1988)

SALTY DOG BRINE STATION

Generalized Brine Well Schematic

Daniel B. Stephens & Associates, Inc.

9-17-14

JN ES08.0118.05

Figure 3

S:\PROJECTS\ES08.0118.05 SALTY DOG DP BW-8\VR DRAWINGS\FIG03 GENERALIZED BRINE WELL SCHEMATIC.CDR

Explanation

- Monitor well
- Recovery well
- Water supply well
- Brine well
- Brine tank battery
- Truck loading area
- Former brine pond
- Fresh water tank

Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG04_SITE_MONITOR_AND_EXTRACTION_WELL_LOCS.MXD

Daniel B. Stephens & Associates, Inc.
9/17/2014
JN ES08.0118.05

SALTY DOG BRINE STATION
Monitor and Extraction Well Locations

Figure 4

Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

Explanation

- Proposed subsidence monitoring point
- Recovery well
- Brine well

SALTY DOG BRINE STATION

Proposed Subsidence Monitoring Station Locations

Daniel B. Stephens & Associates, Inc.

9/17/2014

JN ES08.0118.05

Figure 5

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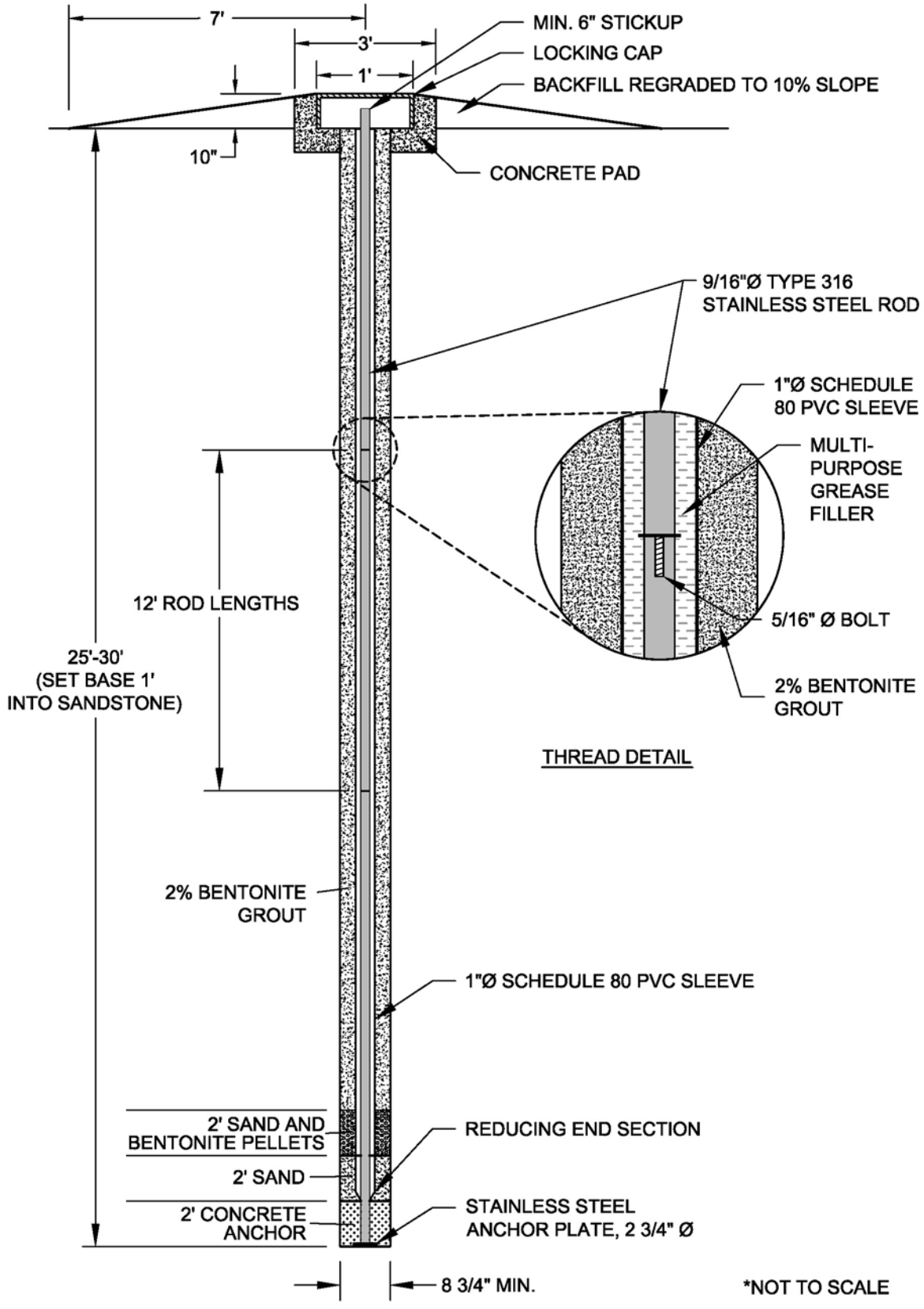


Source:

Prepared by Engineering Analytics, Inc. (2014)

SALTY DOG BRINE STATION

Subsidence Survey Monument Design

Daniel B. Stephens & Associates, Inc.

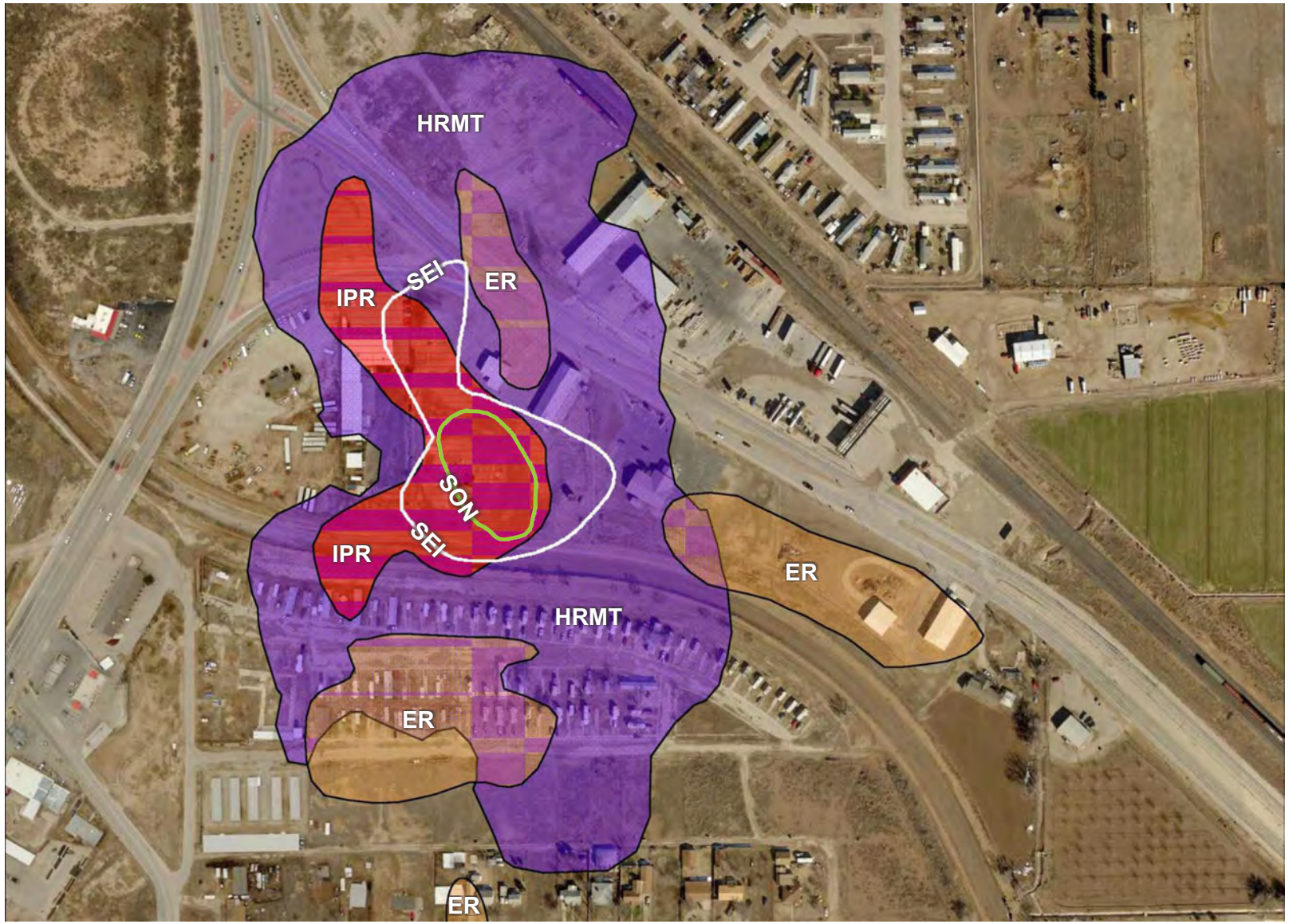
8-22-14

JN ES08.0118.05

Figure 6

S:\PROJECTS\ES08.0118.05 SALTY DOG DP BW-8\VR DRAWINGS\FIG06 SUBSIDENCE SURVEY MONUMENT DESIGN.CDR

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\VR_DRAWINGS\FIG07_SEISMIC_SONIC_MAGNETOTELLURICS_IP-RESISTIVITY.CDR



Explanation

HRMT = High-resolution magnetotellurics
ER = Electrical resistivity
IPR = Induced polarization resistivity
SEI = Seismic
SON = Sonic

Source:
New Mexico Energy, Minerals &
Natural Resources Department (2012)

SALTY DOG BRINE STATION

Subsurface Anomalies Identified by Geophysical Methods at the I&W Site

Figure 7

Daniel B. Stephens & Associates, Inc.
9-17-14
JN ES08.0118.05

November 9, 2016

Dr. Tomas Oberding
New Mexico Oil Conservation Division
Environmental Bureau
1220 South St. Francis Drive
Santa Fe, New Mexico 87505-4225

Re: Third Quarter 2016 Groundwater Monitoring and O&M Report, Salty Dog Brine Station

Dear Dr. Oberding:

On behalf of PAB Services, Inc., Daniel B. Stephens & Associates, Inc. (DBS&A) is pleased to submit the enclosed groundwater monitoring and operation and maintenance (O&M) report for the Salty Dog brine station located in Lea County, New Mexico. The report documents results of third quarter 2016 groundwater monitoring activities completed at the site on September 13 and 14, 2016, as well as groundwater extraction system O&M information.

Please note that we recommend reducing the monitoring and reporting frequency from quarterly to semiannually. We are seeking your approval for this reduction and will continue quarterly monitoring and reporting until we receive that approval. The Settlement Agreement & Stipulated Revised Final Oder NM-OCD 2008-2A allows Salty Dog to request that the monitoring schedule be reduced. This is stipulated on page 15 under subsection f.vi of item 15. We respectively request the reduction on behalf of Salty Dog for the reasons described in the report.

Please do not hesitate to call us at (505) 822-9400 if you have any questions or require additional information.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John Ayarbe, P.G.
Senior Hydrogeologist

Michael D. McVey, P.G.
Senior Hydrogeologist

JA/MDM/rpf
Enclosure
cc: Pieter Bergstein, PAB Services, Inc.
Jim Sayre, Salty Dog, Inc.

Third Quarter 2016

Groundwater Monitoring and

O&M Report

Salty Dog Brine Station

Lea County, New Mexico

Prepared for **New Mexico Energy, Minerals and Natural Resources Department**
Oil Conservation Division

November 9, 2016

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

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Appendix

A Laboratory Analytical Report

B Field Notes

Third Quarter 2016 Groundwater Monitoring and O&M Report
Salty Dog Brine Station, Lea County, New Mexico

1. Introduction

Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this groundwater monitoring and operations and maintenance (O&M) report for submission to the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) Environmental Bureau on behalf of PAB Services, Inc. (PAB) for the Salty Dog brine station (the site) located in Lea County, New Mexico (Figure 1). The report summarizes activities conducted at the site on September 13 and 14, 2016.

The site consists of a northern portion, where the brine pond was located prior to closure in October 2008, and a southern portion, where the brine well is located. The brine pond area and the brine well area are separated by approximately 2,500 feet, joined by a dirt road (Figure 1). Injection water for the brine well comes from two fresh water supply wells (FWS-1 and FWS-2) and remedial pumping at recovery wells in both the former brine pond area (RW-1) and brine well area (RW-2). Groundwater extraction at RW-1 is limited due to pumping from FWS-1. However, pumping at FWS-1 provides hydraulic containment and removal of chloride-impacted groundwater in the former brine pond area.

Brine that is produced for sale is stored at a tank battery on the southern boundary of the former brine pond area. The tank battery consists of six 750-barrel aboveground storage tanks (ASTs) surrounded by a berm. A concrete truck loading pad with two brine filling stations is located north of the tank battery. An operations shed is located adjacent to the loading pad to the west.

Six monitor wells (PMW-1, DBS-1R, and DBS-2 through DBS-5), one nested well (NW-1), one fresh water supply well (FWS-1), and one recovery well (RW-1) are located in the former brine pond area. Nine monitor wells (MW-2 through MW-6, DBS-6 through DBS-9), one nested well (NW-2), one fresh water supply well (FWS-2), and one recovery well (RW-2) are located in the brine well area (Figure 1).

DBS&A installed groundwater extraction systems at the site in early April 2012 to provide hydraulic containment and removal of chloride-impacted groundwater in the former brine pond and brine well areas. The extraction systems consist of submersible pumps, conveyance lines, electrical power, and controls to extract impacted groundwater from the recovery wells. Extracted groundwater is conveyed to the on-site ASTs for reinjection at the brine well.

2. Scope of Work

The scope of work for groundwater monitoring consisted of (1) measuring fluid levels in and collecting groundwater samples from 11 monitor wells, and (2) performing maintenance on the groundwater extraction systems, as necessary. Groundwater samples were submitted to Hall Environmental Analysis Laboratory (HEAL) in Albuquerque, New Mexico for chloride analysis using U.S. Environmental Protection Agency (EPA) method 300.0. The monitor wells included in the quarterly sampling were selected in consultation with Jim Griswold on October 4, 2010; Mr. Griswold was the OCD Project Manager for the site at that time. The selected monitor wells are shown in Figures 2 through 5.

3. Monitoring Activities

3.1 Fluid Level Measurement

On September 13, 2016, DBS&A measured water levels in monitor wells DBS-1R, DBS-2 through DBS-5, and PMW-1 in the former brine pond area (Figure 2) and DBS-6, DBS-8, DBS-9, MW-3, and MW-5 in the brine well area (Figure 3) using a properly decontaminated electronic water level meter. Table 1 reports water level measurements and groundwater elevations.

During this monitoring event, the average depths to water beneath the former brine pond area and brine well area were 68.3 feet below ground surface (bgs) and 63.2 feet bgs, respectively. On average, water levels in the former brine pond area declined by approximately 0.9 foot since the last monitoring event in June 2016, while water levels in the brine well area declined by 0.4 foot.

Figures 2 and 3 present potentiometric surface maps for the former brine pond area and the brine well area, respectively. The direction of groundwater flow beneath the former brine pond area remains to the southeast at a gradient of approximately 0.006 foot per foot (ft/ft) (Figure 2)—increasing slightly since the previous monitoring event. A broad cone of depression was observed in the vicinity of the fresh water supply well (FWS-1) due to increased fresh water production when depth to water level measurements were recorded. The direction of groundwater flow beneath the brine well area remains to the southeast at a gradient of approximately 0.004 ft/ft (Figure 3)—decreasing slightly relative to the previous monitoring event.

3.2 Groundwater Sampling

On September 14, 2016, groundwater samples were collected from monitor wells DBS-1R, DBS-2 through DBS-6, DBS-8, DBS-9, MW-3, MW-5, and PMW-1 following standard sampling procedures developed from EPA guidance. Before sampling, each well was purged of a minimum of three casing volumes using a submersible pump so that a representative groundwater sample was collected. While purging, DBS&A measured water quality field parameters consisting of temperature, specific conductance, and pH. Samples were collected once three casing volumes were purged. Sample containers were then filled, labeled, and placed in an ice-filled cooler. Groundwater samples were submitted under chain of custody to HEAL for chloride analysis.

Samples of the brine well injection water and the produced brine were also collected to meet requirements under discharge permit BW-8. Analytical results of these samples will be reported in the 2016 Annual Class III Well Report.

4. Analytical Results

Table 2 summarizes chloride analytical results for the 11 groundwater samples. Figures 4 and 5 show the distribution of chloride in groundwater beneath the former brine pond area and the brine well area, respectively. The laboratory report and chain of custody documentation are

provided in Appendix A. Field notes recorded during groundwater monitoring activities are provided in Appendix B.

4.1 Former Brine Pond Area Wells

Since the last monitoring event in June 2016, minor to no changes in chloride concentrations were observed at monitor wells DBS-2 through DBS-5 (Table 2). DBS-1R and PMW-1 continue to exhibit chloride concentrations above the New Mexico Water Quality Control Commission (NMWQCC) standard of 250 milligrams per liter (mg/L) (Figure 4). The chloride concentration at DBS-1R showed a slight decrease from 570 mg/L to 360 mg/L, while the concentration at PMW-1 increased slightly, from 8,500 mg/L to 9,300 mg/L.

The chloride plume in the former brine pond area remains bounded by the existing monitor well network (Figure 4). Pumping from PAB's fresh water supply well FSW-1 provides hydraulic containment of the chloride plume. The chloride concentration at downgradient monitor well DBS-4 remains below the NMWQCC standard, as do chloride concentrations at the two cross-gradient monitor wells, DBS-2 and DBS-3.

4.2 Brine Well Area Wells

Since the last monitoring event in June 2016, minor changes in chloride concentrations were observed at most of the monitor wells in the brine well area (Table 2). Monitor wells MW-3 (the well closest to extraction well RW-2), MW-5 (the farthest downgradient well), and DBS-6 (the northernmost cross-gradient well) continue to exhibit chloride concentrations above the NMWQCC standard (Figure 5). The chloride concentration at MW-3 decreased from 9,400 mg/L to 9,100 mg/L. The chloride concentration at MW-5 increased from 970 mg/L to 1,000 mg/L. The chloride concentration at DBS-6 decreased from 300 mg/L to 290 mg/L.

During previous monitoring events, monitor well DBS-9 (an upgradient monitor well) has exhibited chloride concentrations above the NMWQCC standard; however, during this reporting period, the chloride concentration at DBS-9 was 190 mg/L, below the NMWQCC standard

(Table 2). DBS-9 was installed in the playa located northeast of the brine well to help characterize groundwater impacts from documented releases in 2002 and 2005.

5. Groundwater Extraction System O&M

Remedial groundwater extraction in the former brine pond and brine well areas began in April 2012 by pumping from recovery wells RW-1 and RW-2. Extracted groundwater volumes at RW-1 and RW-2 are reported in Table 3.

Production from the fresh water supply well (FWS-1) also supports hydraulic containment and removal of chloride-impacted groundwater in the former brine pond area.

5.1 Former Brine Pond Area

Other than some brief shutdowns to address a few maintenance issues, the groundwater extraction system at RW-1 operated continually until approximately March 2015 (Table 3). Pumping from the nearby fresh water supply well (FWS-1) is inhibiting the effectiveness of RW-1 as an extraction well by lowering groundwater levels at this well. PAB attempted to set the pump at RW-1 to a deeper depth in the well so that pumping from RW-1 could continue, but the pump is already set near the bottom of the well. Although pumping from RW-1 has ceased, pumping at FWS-1 provides containment of the chloride plume in the former brine pond area. The average pumping rate at FWS-1 during the third quarter 2016 was approximately 5 gallons per minute (gpm).

Monitor wells DBS-1R and PMW-1 are the only wells that exhibit chloride concentrations above the NMWQCC standard. Pumping of the fresh water supply well is preventing the downgradient migration of the chloride groundwater plume; although the chloride concentrations in wells DBS-1R and PMW-1 remain elevated, they have decreased from historical highs (Table 2) and are expected to continue to decrease through time with continued pumping at the fresh water supply well. The chloride concentration at downgradient monitor well DBS-4 is well below the NMWQCC standard.

5.2 Brine Well Area

The groundwater extraction system at RW-2 has been operated continually since April 6, 2012 with the exception of addressing a few maintenance issues. A total of 18,453,822 gallons of chloride-impacted groundwater have been pumped from RW-2 (Table 3). Historically, pumping of recovery well RW-2 at flow rates of 2.5 to 4.3 gpm produced little drawdown in the brine well area. However, after increasing the average pumping rate to 66 gpm after the second quarter 2015 monitoring event (Table 3), a cone of depression became evident, thereby improving hydraulic containment and removal of the chloride plume.

The average pumping rate at RW-2 during this reporting period was approximately 6 gpm. A cone of depression was not observed during this monitoring event (Figure 3), although RW-2 was pumping at the time water level measurements were recorded.

The chloride plume remains undefined downgradient and cross-gradient to the north of the recovery well (RW-2). Since April 2009, chloride concentrations in the northernmost cross-gradient well (DBS-6) have fluctuated between 290 and 410 mg/L. Since February 2008, chloride concentrations in the downgradient well (MW-5) have fluctuated between 970 and 1,500 mg/L. The chloride concentration in monitor well MW-3, the well closest to the extraction well (RW-2), decreased by almost half between September and December 2015, but has been showing a slight rebound since that time (Table 2).

5.3 Facility and System Maintenance

On June 13, 2016 the pump at RW-2 was damaged during a lightning storm. Operations manager Jim Sayre promptly replaced the pump on June 15, 2016. The pump at FWS-2, upgradient from RW-2 (Figure 1), was also damaged and subsequently replaced.

5.4 Future Extraction System Operation

Pumping of the fresh water supply well (FWS-1) has lowered groundwater levels at RW-1, precluding groundwater extraction at this well. Pumping of FWS-1 provides hydraulic

containment and removal of the chloride plume. Future monitoring data will be used to evaluate the effectiveness of FWS-1 in providing hydraulic containment and removal of chloride-impacted groundwater in the former brine pond area.

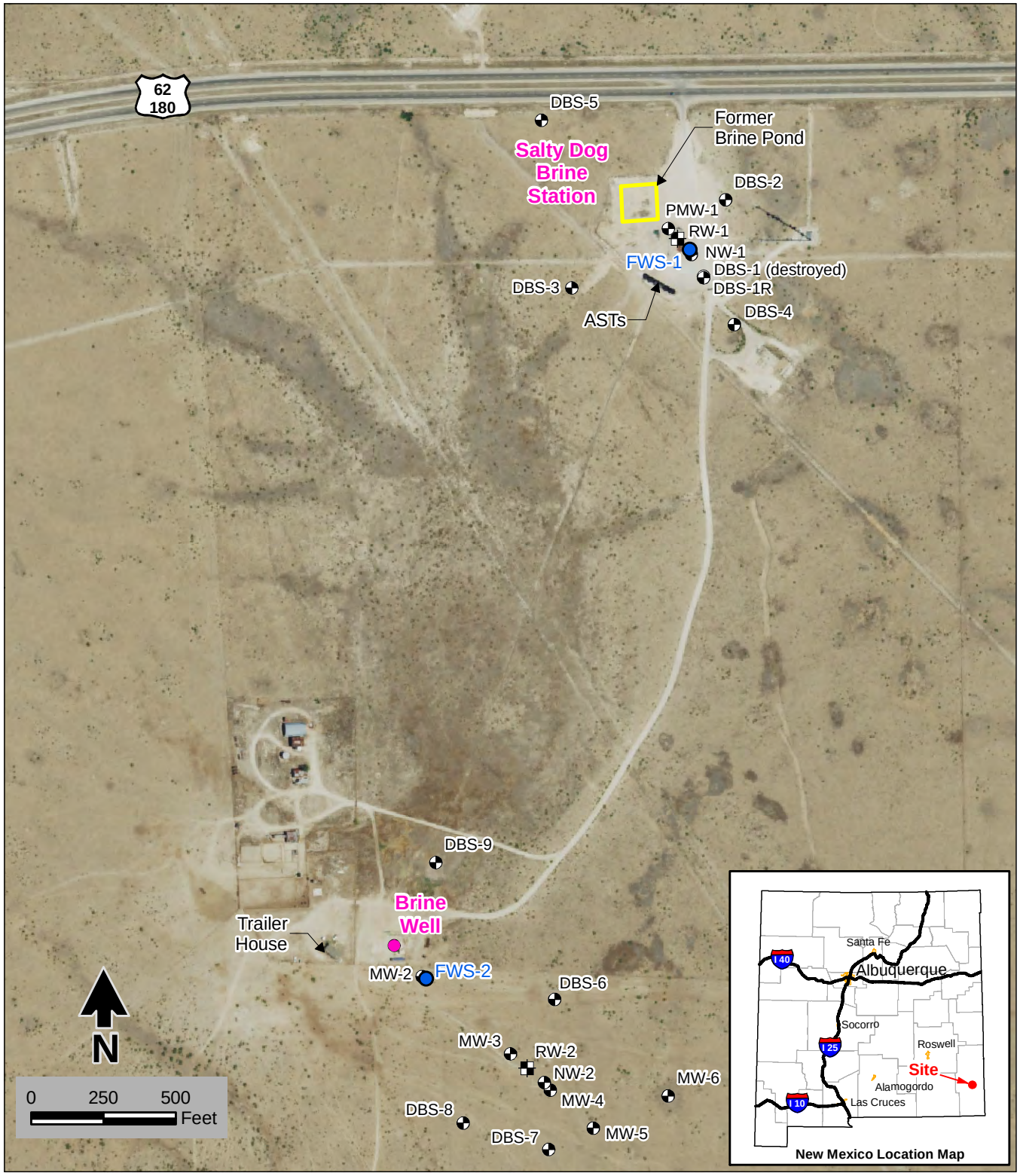
Pumping of extraction well RW-2 will continue. Increased pumping at RW-2 since the second quarter of 2015 provides improved hydraulic containment and removal of the chloride plume in the brine well area. Future monitoring data will be used to evaluate the effectiveness of RW-2 in providing hydraulic containment and removal of chloride-impacted groundwater in the former brine well area.

6. Recommendations

Based on the current groundwater monitoring results and site O&M activities, DBS&A has the following recommendations:

- Continue groundwater extraction at FWS-1 and RW-2 to provide hydraulic containment of the chloride plumes in the former brine pond area and brine well area, respectively.
- Reduce the monitoring and reporting frequency from quarterly to semiannually. Groundwater extraction from FWS-1 and RW-2 has shown continued containment of the chloride plume in both the former brine pond and brine well areas. Although chloride concentrations at monitor wells immediately adjacent to FWS-1 and RW-2 are elevated, chloride concentrations at the downgradient and cross-gradient monitor wells generally meet the NMWQCC standard and remain stable. Implementation of this recommendation requires OCD approval.

Figures



Note: AST = Aboveground storage tank

Source: National Agriculture Imagery Program (NAIP), May 10, 2014

Explanation

- Fresh water supply well
- Monitor well
- Recovery well
- Well destroyed

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Daniel B. Stephens & Associates, Inc.

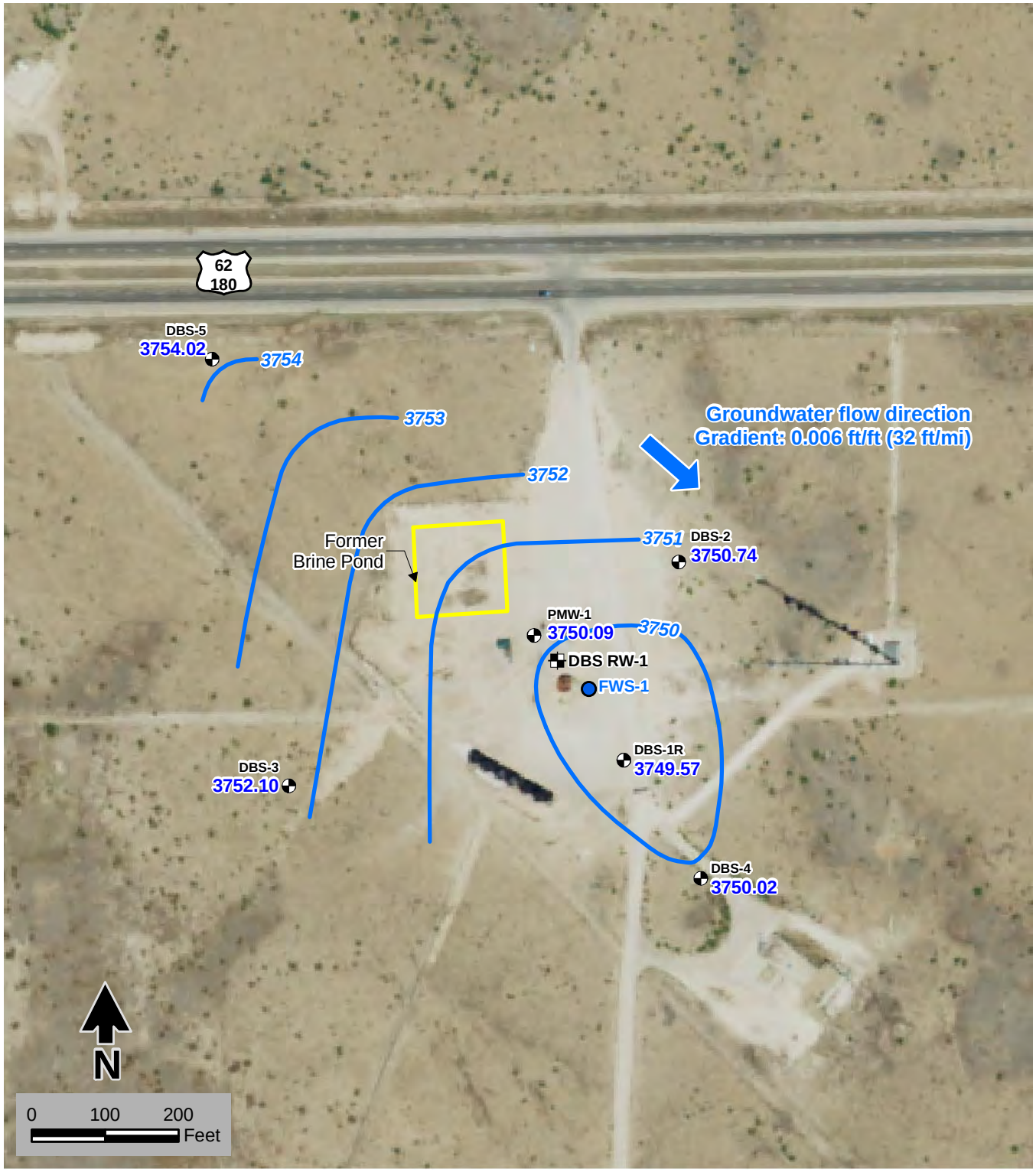
10/26/2016

JN ES08.0118.06

SALTY DOG BRINE STATION

Site Location Map

Figure 1



Source: National Agriculture Imagery Program (NAIP), May 10, 2014

Explanation

DBS-3 Well designation

3752.10 Groundwater elevation, ft msl

- Monitor well
- Recovery well
- Fresh water supply well
- Potentiometric surface elevation contour (ft msl), dashed where inferred
- Groundwater flow direction

SALTY DOG BRINE STATION

Former Brine Pond Area Potentiometric Surface Elevations September 2016

Daniel B. Stephens & Associates, Inc.

11/7/2016 JN ES08.0118.06

Figure 2

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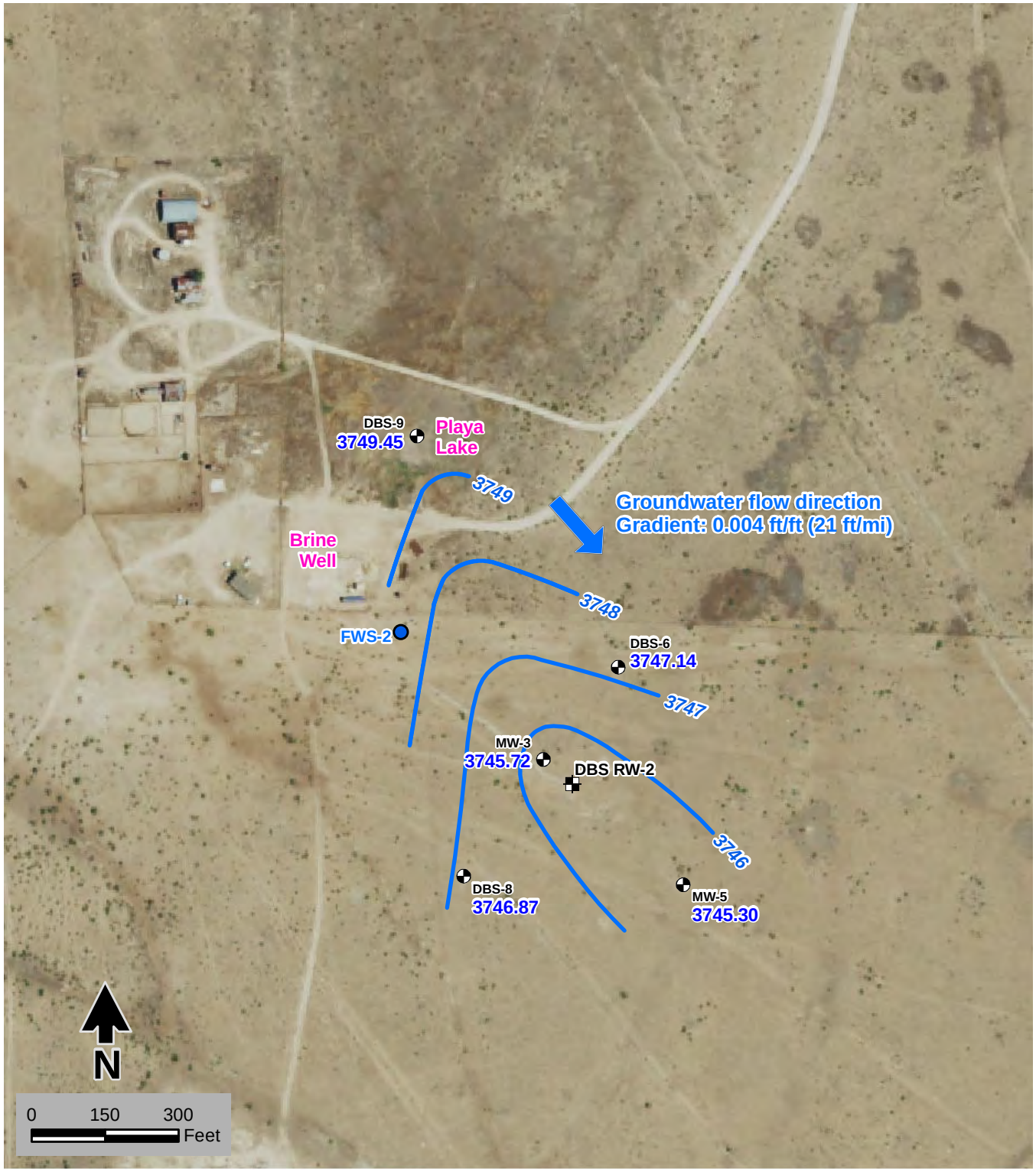

Source: National Agriculture Imagery Program (NAIP), May 10, 2014

Explanation

MW-5 Well designation

3745.49 Groundwater elevation, ft msl

- Monitor well
- Recovery well
- Fresh water supply well
- Potentiometric surface elevation contour (ft msl), dashed where inferred
- Groundwater flow direction

SALTY DOG BRINE STATION

Playa Lake and Brine Well Area Potentiometric Surface Elevations September 2016

Daniel B. Stephens & Associates, Inc.

11/7/2016 JN ES08.0118.06

Figure 3

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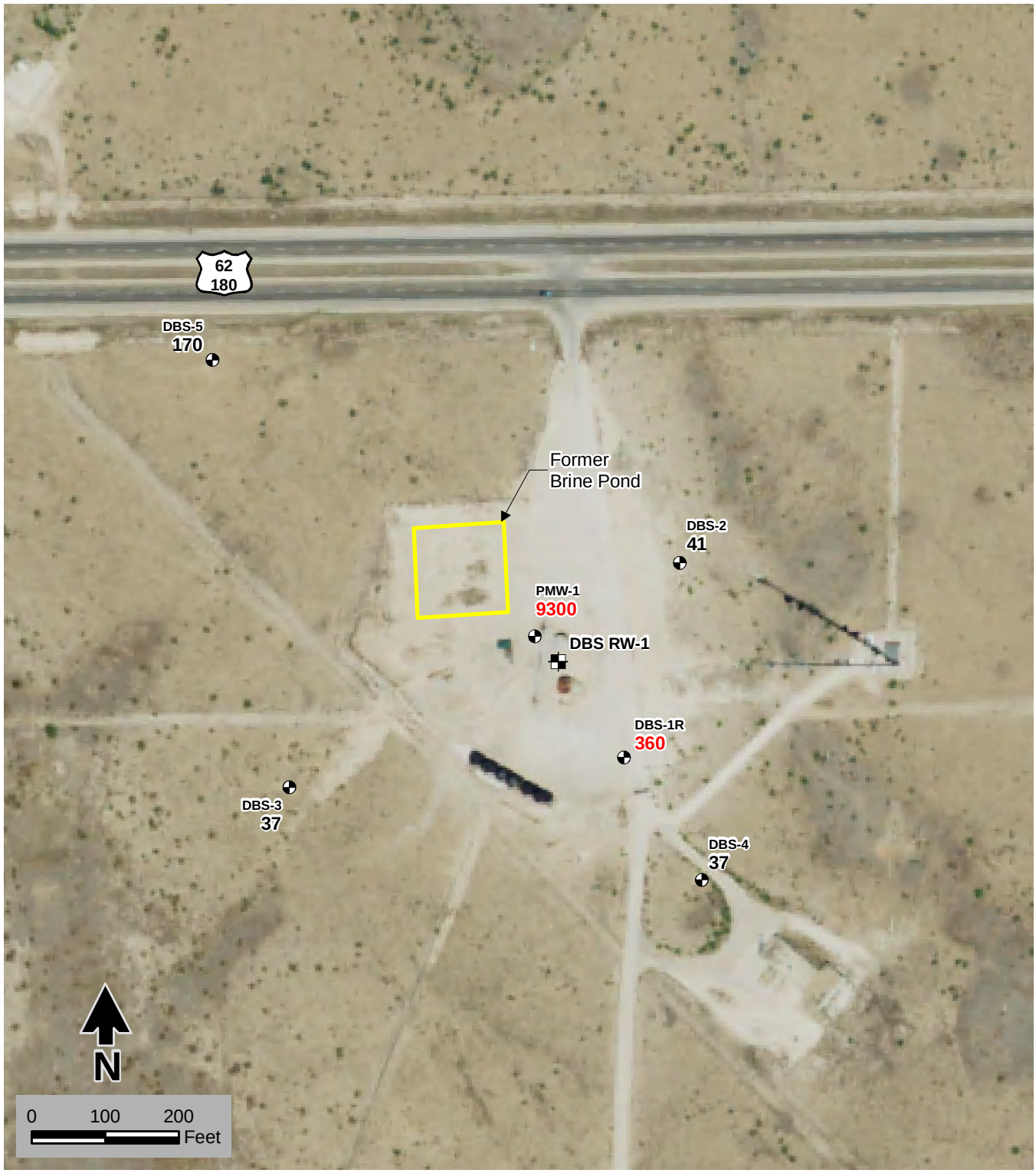


Source: National Agriculture Imagery Program (NAIP), May 10, 2014

Explanation

DBS-5 Well designation

170 Chloride concentration (mg/L)

Monitor well

Recovery well

Red indicates concentration equal to or greater than the NMWQCC standard.

SALTY DOG BRINE STATION

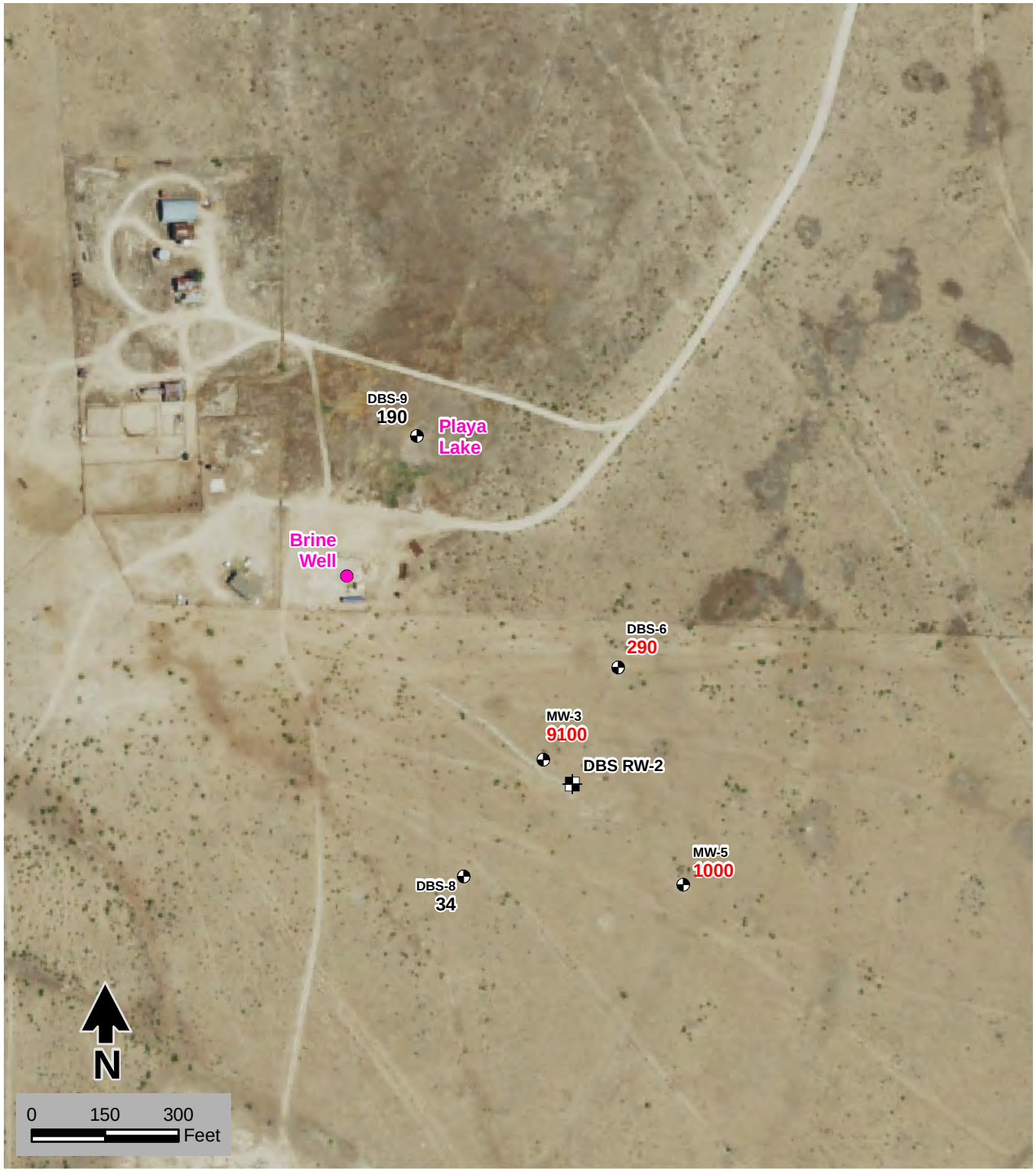
Former Brine Pond Area
Chloride Concentrations in Groundwater
September 2016

Daniel B. Stephens & Associates, Inc.

10/27/2016 JN ES08.0118.06

Figure 4

S:\PROJECTS\ES08.0118.01_SALTY_DOG_INC\GIS\MXDS\REPORT2016_3Q\FIG04_CL_GW_201609_BRINE_STATION.MXD



Source: National Agriculture Imagery Program (NAIP), May 10, 2014

Explanation

DBS-8 Well designation

34 Chloride concentration (mg/L)

Monitor well

Recovery well

Red indicates concentration equal to or greater than the NMWQCC standard.

SALTY DOG BRINE STATION

Playa Lake and Brine Well Area
Chloride Concentrations in Groundwater
September 2016

Daniel B. Stephens & Associates, Inc.

10/24/2016 JN ES08.0118.06

Figure 5

S:\PROJECTS\ES08.0118.01_SALTY_DOG_INC\GIS\MXDS\REPORT\2016_3Q\FIG05_CL_GW_201609_BRINE_WELL.MXD

Tables

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 1 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
DBS-1	56.0–76.0	3,817.09	4/08/2009	62.38	3,754.71
			5/11/2011	64.70	3,752.39
			10/04/2011	Well destroyed	
DBS-1R	58.0–78.0	3,817.00 [b]	4/30/2012	63.60	3,753.40
			9/10/2012	65.65	3,751.35
			6/23/2013	64.40	3,752.60
			1/09/2014	67.23	3,749.77
			4/07/2014	66.36	3,750.64
			3/20/2015	67.17	3,749.83
			7/01/2015	67.92	3,749.08
			9/29/2015	67.07	3,749.93
			12/16/2015	67.54	3,749.46
			3/22/2016	66.61	3,750.39
			6/08/2016	66.23	3,750.77
			9/13/2016	67.43	3,749.57
DBS-2	58.0–78.0	3,820.50	4/08/2009	65.45	3,755.05
			5/11/2011	66.80	3,753.70
			10/04/2011	65.87	3,754.63
			2/08/2012	65.96	3,754.54
			4/30/2012	66.26	3,754.24
			9/10/2012	67.45	3,753.05
			6/23/2013	67.03	3,753.47
			1/09/2014	69.08	3,751.42
			4/07/2014	68.67	3,751.83
			3/20/2015	69.32	3,751.18
			6/30/2015	69.29	3,751.21
			9/29/2015	69.41	3,751.09
			12/16/2015	69.71	3,750.79
			3/22/2016	69.13	3,751.37
			6/08/2016	68.91	3,751.59
			9/13/2016	69.76	3,750.74

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft btoc = Feet below top of casing
ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 2 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
DBS-3	56.0–76.72	3,816.66	4/08/2009	60.67	3,755.99
			5/11/2011	61.25	3,755.41
			10/04/2011	61.25	3,755.41
			2/08/2012	61.11	3,755.55
			4/30/2012	61.41	3,755.25
			9/10/2012	61.81	3,754.85
			6/23/2013	62.08	3,754.58
			1/09/2014	63.30	3,753.36
			4/07/2014	63.43	3,753.23
			3/20/2015	63.93	3,752.73
			6/30/2015	63.99	3,752.67
			9/29/2015	64.17	3,752.49
			12/16/2015	64.41	3,752.25
			3/22/2016	63.88	3,752.78
			6/08/2016	63.92	3,752.74
			9/13/2016	64.56	3,752.10
DBS-4	56.0–76.0	3,820.37	4/08/2009	66.27	3,754.10
			5/11/2011	67.23	3,753.14
			10/04/2011	66.67	3,753.70
			2/08/2012	66.76	3,753.61
			4/30/2012	67.02	3,753.35
			9/10/2012	67.78	3,752.59
			6/23/2013	67.70	3,752.67
			1/09/2014	69.37	3,751.00
			4/07/2014	69.23	3,751.14
			3/20/2015	69.81	3,750.56
			6/30/2015	69.85	3,750.52
			9/29/2015	70.00	3,750.37
			12/16/2015	70.25	3,750.12
			3/22/2016	69.74	3,750.63
			6/08/2016	69.62	3,750.75
			9/13/2016	70.35	3,750.02

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft btoc = Feet below top of casing
ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 3 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
DBS-5	56.9–76.9	3,820.66	4/08/2009	62.99	3,757.67
			5/11/2011	63.45	3,757.21
			10/04/2011	63.41	3,757.25
			2/08/2012	63.46	3,757.20
			4/30/2012	63.70	3,756.96
			9/10/2012	63.92	3,756.74
			6/23/2013	64.30	3,756.36
			1/09/2014	65.28	3,755.38
			4/07/2014	65.48	3,755.18
			3/20/2015	65.9	3,754.76
			7/01/2015	66.18	3,754.48
			9/29/2015	66.25	3,754.41
			12/16/2015	66.47	3,754.19
			3/22/2016	66.08	3,754.58
			6/08/2016	66.16	3,754.50
			9/13/2016	66.64	3,754.02
DBS-6	56.7–76.7	3,812.65	4/07/2009	62.75	3,749.90
			5/11/2011	63.11	3,749.54
			10/04/2011	63.16	3,749.49
			2/08/2012	63.20	3,749.45
			4/30/2012	63.43	3,749.22
			9/10/2012	63.60	3,749.05
			6/23/2013	63.74	3,748.91
			1/09/2014	64.00	3,748.65
			4/07/2014	64.22	3,748.43
			3/19/2015	64.78	3,747.87
			7/01/2015	64.81	3,747.84
			9/29/2015	65.48	3,747.17
			12/16/2015	65.26	3,747.39
			3/22/2016	65.38	3,747.27

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft btoc = Feet below top of casing
ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 4 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
DBS-6 (cont.)	56.7–76.7	3,812.65	6/08/2016	65.37	3,747.28
			9/13/2016	65.51	3,747.14
DBS-7	55.1–75.1	3,810.21	4/07/2009	61.74	3,748.47
DBS-8	55.2–75.2	3,810.70	4/07/2009	61.20	3,749.50
			5/11/2011	61.67	3,749.03
			10/04/2011	61.71	3,748.99
			2/08/2012	61.77	3,748.93
			4/30/2012	62.00	3,748.70
			9/10/2012	62.15	3,748.55
			6/23/2013	62.28	3,748.42
			1/09/2014	62.47	3,748.23
			4/07/2014	62.67	3,748.03
			3/19/2015	63.19	3,747.51
			6/30/2015	63.25	3,747.45
			9/29/2015	63.82	3,746.88
			12/16/2015	63.58	3,747.12
			3/22/2016	63.76	3,746.94
			6/08/2016	63.72	3,746.98
			9/13/2016	63.83	3,746.87
DBS-9	48.0–68.0	3,806.26	4/08/2009	53.93	3,752.33
			5/11/2011	54.39	3,751.87
			10/04/2011	54.59	3,751.67
			2/08/2012	54.53	3,751.73
			4/30/2012	54.68	3,751.58
			9/10/2012	54.77	3,751.49
			6/23/2013	55.04	3,751.22
			1/09/2014	55.27	3,750.99
			4/07/2014	55.56	3,750.70
			3/19/2015	55.95	3,750.31
			7/01/2015	56.14	3,750.12
			9/29/2015	56.49	3,749.77

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft btoc = Feet below top of casing
ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 5 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
DBS-9 (cont.)	48.0–68.0	3,806.26	12/16/2015	56.52	3,749.74
			3/22/2016	56.51	3,749.75
			6/08/2016	56.64	3,749.62
			9/13/2016	56.81	3,749.45
NW-1s	52.95–72.95	3,817.33	4/08/2009	62.35	3,754.98
NW-1m	99.31–119.31	3,817.35	4/08/2009	62.25	3,755.10
NW-1d	149.45–169.45	3,817.35	4/08/2009	62.04	3,755.31
NW-2s	53.35–73.35	3,812.50	4/08/2009	63.08	3,749.42
NW-2m	93.72–113.72	3,812.45	4/08/2009	63.27	3,749.18
NW-2d	126.87–146.87	3,812.46	4/08/2009	66.41	3,746.05
PMW-1	63–78	3,821.17	6/23/2008	67.51	3,753.66
			4/08/2009	65.97	3,755.20
			5/11/2011	68.70	3,752.47
			10/04/2011	66.95	3,754.22
			2/08/2012	66.69	3,754.48
			4/30/2012	67.27	3,753.90
			9/10/2012	69.77	3,751.40
			6/23/2013	68.40	3,752.77
			1/09/2014	71.24	3,749.93
			4/07/2014	69.97	3,751.20
			3/20/2015	70.78	3,750.39
			7/01/2015	71.41	3,749.76
			9/29/2015	70.76	3,750.41
			12/16/2015	71.03	3,750.14
			3/22/2016	70.30	3,750.87
			6/08/2016	69.65	3,751.52
			9/13/2016	71.08	3,750.09
MW-1	120–140	NA	6/23/2008	59.90	NA
MW-2	127–147	3,812.68	6/23/2008	61.42	3,751.26
			4/07/2009	61.65	3,751.03

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft btoc = Feet below top of casing
ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 6 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
MW-3	NA	3,812.05	6/23/2008	62.06	3,749.99
			4/07/2009	62.02	3,750.03
			5/11/2011	62.91	3,749.14
			10/04/2011	62.91	3,749.14
			2/08/2012	62.95	3,749.10
			4/30/2012	63.39	3,748.66
			9/10/2012	63.50	3,748.55
			6/23/2013	63.36	3,748.69
			1/09/2014	63.55	3,748.50
			4/07/2014	63.88	3,748.17
			3/19/2015	64.27	3,747.78
			7/01/2015	64.34	3,747.71
			9/29/2015	67.94	3,744.11
			12/16/2015	64.75	3,747.30
			3/22/2016	64.84	3,747.21
			6/08/2016	64.89	3,747.16
			9/13/2016	66.33	3,745.72
MW-4	111–131	3,811.33	6/23/2008	62.12	3,749.21
			4/07/2009	62.51	3,748.82
MW-5	112–132	3,808.96	6/23/2008	60.60	3,748.36
			4/07/2009	60.79	3,748.17
			5/11/2011	61.17	3,747.79
			10/04/2011	61.72	3,747.24
			2/08/2012	61.23	3,747.73
			4/30/2012	61.50	3,747.46
			9/10/2012	61.65	3,747.31
			6/23/2013	61.75	3,747.21
			1/09/2014	61.90	3,747.06
			4/07/2014	62.18	3,746.78
			3/19/2015	62.96	3,746.00
			6/30/2015	62.71	3,746.25

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
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ft msl = Feet above mean sea level
NA = Not available

Table 1. Historical Fluid Level Measurements
Salty Dog Brine Station, Lea County, New Mexico
Page 7 of 7

Monitor Well	Screen Interval (ft bgs)	Top of Casing Elevation [a] (ft msl)	Date Measured	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)
MW-5 (cont.)	112–132	3,808.96	9/29/2015	63.92	3,745.04
			12/16/2015	63.02	3,745.94
			3/22/2016	63.14	3,745.82
			6/08/2016	63.47	3,745.49
			9/13/2016	63.66	3,745.30
MW-6	NA	3,810.17	6/23/2008	62.17	3,748.00
			4/07/2009	62.41	3,747.76

[a] Top of casing elevations surveyed by Pettigrew & Assoc. on May 28, 2009.
[b] Top of casing elevation surveyed by Pettigrew & Assoc. on June 13, 2012.
ft bgs = Feet below ground surface
ft msl = Feet above mean sea level
ft btoc = Feet below top of casing
NA = Not available

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 1 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
DBS-1	4/08/2009	**320**
	5/12/2011	**940**
	10/04/2011	Well destroyed
DBS-1R	5/01/2012	**3,000**
	9/11/2012	**3,200**
	6/25/2013	**3,300**
	1/10/2014	**1,000**
	4/08/2014	**1,700**
	3/20/2015	**1,200**
	7/01/2015	**860**
	9/30/2015	**670**
	12/17/2015	**760**
	3/23/2016	**560**
	6/09/2016	**570**
	09/14/2016	**360**
DBS-2	4/08/2009	14
	5/12/2011	25
	10/05/2011	18
	2/09/2012	22
	5/01/2012	24
	9/11/2012	44
	6/25/2013	36
	1/10/2014	45
	4/08/2014	22
	3/20/2015	29
	6/30/2015	28
	9/30/2015	40
	12/17/2015	35
	3/23/2016	46
	6/09/2016	41
	9/14/2016	41

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 2 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
DBS-3	4/08/2009	36
	5/12/2011	35
	10/05/2011	34
	2/09/2012	34
	5/01/2012	33
	9/11/2012	34
	6/24/2013	32
	1/10/2014	34
	4/08/2014	32
	3/20/2015	35
	6/30/2015	35
	9/30/2015	34
	12/17/2015	34
	3/23/2016	36
	6/09/2016	35
	9/14/2016	37
DBS-4	4/08/2009	38
	5/12/2011	33
	10/05/2011	32
	2/09/2012	32
	5/01/2012	31
	9/11/2012	32
	6/25/2013	31
	1/10/2014	32
	4/08/2014	30
	3/20/2015	33
	6/30/2015	31
	9/30/2015	33
	12/17/2015	35
	3/23/2016	38

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 3 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
DBS-4 (cont.)	6/09/2016	35
	9/14/2016	37
DBS-5	4/08/2009	65
	5/12/2011	140
	10/05/2011	140
	2/09/2012	140
	4/30/2012	150
	9/11/2012	160
	6/24/2013	160
	1/10/2014	180
	4/08/2014	160
	3/20/2015	140
	7/01/2015	140
	9/30/2015	150
	12/17/2015	160
	3/23/2016	150
	6/09/2016	150
	9/14/2016	170
DBS-6	4/07/2009	**380**
	5/12/2011	**410**
	10/05/2011	**400**
	2/09/2012	**380**
	4/30/2012	**400**
	9/11/2012	**390**
	6/24/2013	**340**
	1/10/2014	**390**
	4/07/2014	**400**
	3/19/2015	**370**
	7/01/2015	**360**
	9/30/2015	**370**
	12/17/2015	**380**

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 4 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
DBS-6 (cont.)	3/23/2016	**310**
	6/09/2016	**300**
	9/14/2016	**290**
DBS-7	4/07/2008	**570**
DBS-8	4/07/2009	58
	5/12/2011	36
	10/05/2011	140
	2/09/2012	41
	4/30/2012	41
	9/10/2012	42
	6/24/2013	45
	1/09/2014	38
	4/07/2014	36
	3/19/2015	36
	7/01/2015	34
	9/30/2015	35
	12/17/2015	33
	3/23/2016	35
	6/09/2016	34
	9/14/2016	34
DBS-9	4/08/2009	210
	5/12/2011	**600**
	10/05/2011	**440**
	2/09/2012	**290**
	4/30/2012	**330**
	9/11/2012	**320**
	6/24/2013	200
	1/10/2014	170
	4/07/2014	220
	3/19/2015	**260**
	7/01/2015	210

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 5 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
DBS-9 (cont.)	9/30/2015	**260**
	12/17/2015	230
	3/23/2016	200
	6/09/2016	190
	9/14/2016	190
NW-1s	4/08/2009	**630**
NW-1m	4/08/2009	57
NW-1d	4/08/2009	38
NW-2s	4/08/2009	**410**
NW-2m	4/08/2009	**570**
NW-2d	4/08/2009	**4,700**
PMW-1	2/27/2008	**9,500** [b]
	5/30/2008	**8,600** [b]
	6/23/2008	**12,700**
	4/08/2009	**11,000**
	5/12/2011	**13,000**
	10/05/2011	**12,000**
	2/09/2012	**12,000**
	5/01/2012	**12,000**
	9/11/2012	**14,000**
	6/25/2013	**14,000**
	1/10/2014	**11,000**
	4/08/2014	**12,000**
	3/20/2015	**8,500**
	7/01/2015	**8,600**
	9/30/2015	**9,700**
	12/17/2015	**9,800**
	3/23/2016	**8,200**
	6/09/2016	**8,500**
	9/14/2016	**9,300**

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
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Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
MW-1	5/30/2008	75 [b]
	6/23/2008	243
MW-2	2/27/2008	120 [b]
	5/30/2008	80 [b]
	6/23/2008	**1,480**
	4/07/2009	**1,200**
MW-3	2/27/2008	**348** [b]
	5/30/2008	**360** [b]
	6/23/2008	**1,090**
	4/07/2009	**17,000**
	5/12/2011	**16,000**
	10/05/2011	**14,000**
	2/09/2012	**15,000**
	4/30/2012	**14,000**
	9/10/2012	**16,000**
	6/24/2013	**12,000**
	1/10/2014	**10,000**
	4/07/2014	**12,000**
	3/19/2015	**9,700**
	7/01/2015	**10,000**
	9/30/2015	**9,600**
	12/17/2015	**5,100**
	3/23/2016	**8,200**
	6/09/2016	**9,400**
	9/14/2016	**9,100**
MW-4	2/27/2008	**476** [b]
	5/30/2008	**512** [b]
	6/23/2008	**5,730**
	4/07/2009	**6,600**
MW-5	2/27/2008	**1,280** [b]
	5/30/2008	**1,220** [b]

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 2. Chloride Groundwater Analytical Data
Salty Dog Brine Station, Lea County, New Mexico
Page 7 of 7

Monitor Well	Date	Chloride Concentration (mg/L) [a]
NMWQCC Standard		*250*
MW-5 (cont.)	6/23/2008	**1,260**
	4/07/2009	**1,300**
	5/12/2011	**1,500**
	10/05/2011	**1,500**
	2/09/2012	**1,500**
	4/30/2012	**1,400**
	9/10/2012	**1,500**
	6/24/2013	**1,300**
	1/10/2014	**1,300**
	4/07/2014	**1,300**
	3/19/2015	**1,200**
	7/01/2015	**1,200**
	9/30/2015	**1,000**
	12/17/2015	**1,000**
	3/23/2016	**980**
	6/09/2016	**970**
	9/14/2016	**1,000**
MW-6	2/27/2008	32 [b]
	5/30/2008	36 [b]
	6/23/2008	31.4
	4/07/2009	25
Ranch Headquarters Supply Well	6/23/2008	35.4
Brine Station Fresh Water Supply Well	2/27/2008	**630** [b]
	5/30/2008	**590** [b]
	6/23/2008	**650**

Bold indicates that value exceeds the applicable standard.
[a] All samples analyzed using EPA method 300.0, unless otherwise noted.
[b] Samples analyzed using Standard Method 4500-Cl B.
mg/L = Milligrams per liter

Table 3. Cumulative Extracted Groundwater Volumes
Salty Dog Brine Station, Lea County, New Mexico

Recovery Well	Date	Days of Operation	Average Flow Rate (gpm)	Extracted Volume (gallons)
RW-1	4/07/2012	Groundwater extraction started		
	5/01/2012	24	2.1	73,740
	9/11/2012	154	2.9	636,237
	6/25/2013	441	4.1	2,599,392
	11/15/2013 [a]	585	3.6	3,060,181
	3/20/2015	1,075	2.4	3,668,511
	6/30/2015 [b]	1,167	—	3,668,511
	9/30/2015	1,259	—	3,668,511
FWS-1	12/17/2015	—	—	1,232,787
	3/22/2016	359	12.8	3,011,469
	6/08/2016	437	33.9	6,818,179
	9/13/2016	534	5.4	7,578,404
RW-2	4/06/2012	Groundwater extraction started		
	5/01/2012	25	2.5	91,450
	9/11/2012	158	4.3	963,789
	12/14/2012 [c]	252	3.9	1,406,748
	6/25/2013 [d]	—	—	—
	9/21/2013 [e]	335	2.9	1,407,005
	9/30/2015 [f]	1,074	68 [f]	7,313,515
	12/17/2015	1,152	44	12,266,210
	3/22/2016	1,248	32	16,657,635
	6/08/2016	1,326	9.0	17,661,576
	9/13/2016	1,423	5.7	18,453,822

[a] Pump went down in RW-1 on approximately November 15, 2013.

[b] Meter appears to not be functioning correctly, but the pumping well is functioning.

[c] Pump in RW-2 went down on December 14, 2012 due to a blown inner shaft motor seal.

[d] New pump installed in RW-2 and started on June 25, 2013.

[e] Meter and pump were removed from RW-2 on approximately September 21, 2013 by facility manager to install a new, larger-capacity pump.

[f] Meter reinstalled and pumping increased after the June 30 and July 1, 2015 monitoring event; flowrate assumes 60 days of operation (August 1 through September 30, 2015) based on personal communication with Jim Sayre (PAB).

gpm = Gallons per minute

Appendix A

Laboratory Analytical Report

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

October 12, 2016

John Ayarbe

Daniel B. Stephens & Assoc.
6020 Academy NE Suite 100
Albuquerque, NM 87109
TEL: (505) 822-9400
FAX (505) 822-8877

RE: Salty Dog OrderNo.: 1609828

Dear John Ayarbe:

Hall Environmental Analysis Laboratory received 13 sample(s) on 9/15/2016 for the analyses presented in the following report.

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

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

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

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1609828**
Date Reported: **10/12/2016**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: DBS-1R
Project: Salty Dog
Collection Date: 9/14/2016 3:30:00 PM
Lab ID: 1609828-001 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	360	50	*	mg/L	100	9/20/2016 8:45:19 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: DBS-2
Project: Salty Dog
Collection Date: 9/14/2016 2:00:00 PM
Lab ID: 1609828-002
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	41	5.0		mg/L	10	9/20/2016 8:57:44 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** DBS-3
Project: Salty Dog **Collection Date:** 9/14/2016 3:05:00 PM
Lab ID: 1609828-003 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	37	5.0		mg/L	10	9/20/2016 9:22:33 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: DBS-4
Project: Salty Dog
Collection Date: 9/14/2016 12:30:00 PM
Lab ID: 1609828-004
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	37	5.0		mg/L	10	9/20/2016 9:47:23 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** DBS-5
Project: Salty Dog **Collection Date:** 9/14/2016 2:30:00 PM
Lab ID: 1609828-005 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	170	5.0		mg/L	10	9/20/2016 10:37:02 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** DBS-6
Project: Salty Dog **Collection Date:** 9/14/2016 11:45:00 AM
Lab ID: 1609828-006 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	290	50	*	mg/L	100	9/20/2016 11:14:17 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: DBS-8
Project: Salty Dog
Collection Date: 9/14/2016 9:05:00 AM
Lab ID: 1609828-007
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	34	5.0		mg/L	10	9/20/2016 11:26:42 PM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** DBS-9
Project: Salty Dog **Collection Date:** 9/14/2016 8:25:00 AM
Lab ID: 1609828-008 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	190	50		mg/L	100	9/21/2016 12:03:56 AM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** MW-3
Project: Salty Dog **Collection Date:** 9/14/2016 11:10:00 AM
Lab ID: 1609828-009 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	9100	500	*	mg/L	1E	9/21/2016 12:28:45 AM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: MW-5
Project: Salty Dog
Collection Date: 9/14/2016 10:10:00 AM
Lab ID: 1609828-010
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	1000	50	*	mg/L	100	9/21/2016 1:18:24 AM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: PMW-1
Project: Salty Dog
Collection Date: 9/14/2016 4:05:00 PM
Lab ID: 1609828-011
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	9300	500	*	mg/L	1E	9/21/2016 1:43:14 AM	R37349

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc.
Client Sample ID: Injection
Project: Salty Dog
Collection Date: 9/14/2016 3:45:00 PM
Lab ID: 1609828-012
Matrix: AQUEOUS
Received Date: 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
SPECIFIC GRAVITY						Analyst: **LGT**	
Specific Gravity	0.9915	0			1	9/21/2016 3:49:00 PM	R37370
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	240	50		mg/L	100	9/21/2016 2:08:04 AM	R37349
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**	
Total Dissolved Solids	725	20.0	*	mg/L	1	9/23/2016 1:36:00 PM	27634
SM4500-H+B: PH						Analyst: **JRR**	
pH	8.11	1.68	H	pH units	1	9/19/2016 9:35:15 PM	R37296

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

Qualifiers:

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

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Daniel B. Stephens & Assoc. **Client Sample ID:** Brine
Project: Salty Dog **Collection Date:** 9/14/2016 4:07:00 PM
Lab ID: 1609828-013 **Matrix:** AQUEOUS **Received Date:** 9/15/2016 10:30:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
SPECIFIC GRAVITY						Analyst: **LGT**	
Specific Gravity	1.148	0			1	9/21/2016 3:49:00 PM	R37370
EPA METHOD 300.0: ANIONS						Analyst: **LGT**	
Chloride	160000	5000	*	mg/L	1E	9/21/2016 2:20:29 AM	R37349
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**	
Total Dissolved Solids	241000	2000	*D	mg/L	1	9/23/2016 1:36:00 PM	27634
SM4500-H+B: PH						Analyst: **JRR**	
pH	7.32	1.68	H	pH units	1	9/19/2016 9:39:11 PM	R37296
EPA METHOD 200.7: METALS						Analyst: **ELS**	
Sodium	140	2.0		mg/L	1	9/30/2016 8:22:30 PM	27612

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

Qualifiers:

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

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1609828**

12-Oct-16

Client: Daniel B. Stephens & Assoc.

Project: Salty Dog

Sample ID	**MB-27612**	SampType:	**MBLK**	TestCode:	**EPA Method 200.7: Metals**					
Client ID:	**PBW**	Batch ID:	**27612**	RunNo:	**37369**					
Prep Date:	**9/20/2016**	Analysis Date:	**9/21/2016**	SeqNo:	**1160993**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0								

Sample ID	**LCS-27612**	SampType:	**LCS**	TestCode:	**EPA Method 200.7: Metals**					
Client ID:	**LCSW**	Batch ID:	**27612**	RunNo:	**37369**					
Prep Date:	**9/20/2016**	Analysis Date:	**9/21/2016**	SeqNo:	**1160994**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	49	1.0	50.00	0	98.1	85	115			

Sample ID	**LLLCS-27612**	SampType:	**LCSLL**	TestCode:	**EPA Method 200.7: Metals**					
Client ID:	**BatchQC**	Batch ID:	**27612**	RunNo:	**37369**					
Prep Date:	**9/20/2016**	Analysis Date:	**9/21/2016**	SeqNo:	**1161051**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0	0.5000	0	105	50	150			

Qualifiers:

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

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1609828**

12-Oct-16

Client: Daniel B. Stephens & Assoc.

Project: Salty Dog

Sample ID	**MB**	SampType:	**MBLK**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**PBW**	Batch ID:	**R37349**	RunNo:	**37349**					
Prep Date:		Analysis Date:	**9/20/2016**	SeqNo:	**1160322**	Units:	**mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								

Sample ID	**LCS**	SampType:	**LCS**	TestCode:	**EPA Method 300.0: Anions**					
Client ID:	**LCSW**	Batch ID:	**R37349**	RunNo:	**37349**					
Prep Date:		Analysis Date:	**9/20/2016**	SeqNo:	**1160323**	Units:	**mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.8	0.50	5.000	0	95.4	90	110			

Qualifiers:

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

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1609828**

12-Oct-16

Client: Daniel B. Stephens & Assoc.

Project: Salty Dog

Sample ID	**1609828-012ADUP**	SampType:	**DUP**	TestCode:	**Specific Gravity**					
Client ID:	**Injection**	Batch ID:	**R37370**	RunNo:	**37370**					
Prep Date:		Analysis Date:	**9/21/2016**	SeqNo:	**1161076**	Units:				

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Specific Gravity	0.9934	0						0.191	20	

Qualifiers:

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

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1609828**

12-Oct-16

Client: Daniel B. Stephens & Assoc.

Project: Salty Dog

Sample ID	**MB-27634**	SampType:	**MBLK**	TestCode:	**SM2540C MOD: Total Dissolved Solids**					
Client ID:	**PBW**	Batch ID:	**27634**	RunNo:	**37439**					
Prep Date:	**9/21/2016**	Analysis Date:	**9/23/2016**	SeqNo:	**1163956**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	**LCS-27634**	SampType:	**LCS**	TestCode:	**SM2540C MOD: Total Dissolved Solids**					
Client ID:	**LCSW**	Batch ID:	**27634**	RunNo:	**37439**					
Prep Date:	**9/21/2016**	Analysis Date:	**9/23/2016**	SeqNo:	**1163957**	Units:	**mg/L**			

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1030	20.0	1000	0	103	80	120			

Qualifiers:

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

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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

Sample Log-In Check List

Client Name: DBS | Work Order Number: 1609828 | RcptNo: 1

Received by/date: AF 09/15/16

Logged By: **Lindsay Mangin** 9/15/2016 10:30:00 AM

Completed By: **Lindsay Mangin** 9/15/2016 2:01:34 PM

Reviewed By: IO 9/16/16

Chain of Custody

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

Log In

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

# of preserved bottles checked for pH: 1 (<2 or >12 unless noted)

Adjusted? No

Checked by: JC

Special Handling (if applicable)

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

Person Notified: _____ Date _____

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

Regarding: _____

Client Instructions: _____

17. Additional remarks:

18. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	8.7	Good	Not Present			

Chain-of-Custody Record

ent: DBS&A

ailing Address: 6020 Academy RD NE #100

Albuquerque NM 87109

ione #: 505-822-9400

nail or Fax#: JAYARBE@DBStephens.com

VQC Package:

☒ Standard ☐ Level 4 (Full Validation)

creditation

☐ NELAP ☐ Other _____

EDD (Type) _____

Turn-Around Time:

☒ Standard ☐ Rush _____

Project Name: SALTY DOG

Project #: ES08.0118.06

Project Manager: J. AYARBE

Sampler: M. Ebrozek

On Ice: ☒ Yes ☐ No

Sample Temperature: 8.7°C

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

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

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1609828	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	Chloride	pH, TDS, Spec Grav	Na		Air Bubbles (Y or N)
.16	1530	GW	DBS-1R	1 poly	none	-001												✓				
	1400		DBS-2			-002												✓				
	1505		DBS-3			-003												✓				
	1230		DBS-4			-004												✓				
	1430		DBS-5			-005												✓				
	1145		DBS-6			-006												✓				
	0905		DBS-8			-007												✓				
	0825		DBS-9			-008												✓				
	1110		MW-3			-009												✓				
	1010		MW-5			-010												✓				
	1605		PMW-1			-011												✓				
	1545		INJECTION	2 poly	2 none	-012												✓	✓	✓		
	1607		BRINE	3 poly	2 none, 1 HNO_3	-013												✓	✓	✓		

te:	Time:	Relinquished by:	Received by:	Date	Time
5/16	1032			9/15/16	10:30
te:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

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

Appendix B

Field Notes

3/23

9.13.16 M. Zbrozek

1440 M. Zbrozek onsite for quarterly Ground water monitoring

1950 Drive around site for recon Weather warm sunny clear ~87° Rig observed over RW-2 - Tires flat does not appear to be in service. See photos.

1515 Begin Gauging Wells. Depth recorded on field sheet

1545 RW-2 Totalizer - Pump On 405876.6 bbl sound

1610 MW-2 Totalizer 0.2 bbl

1730 M. Zbrozek offsite - returning 9.14.16 for sampling

MZ 9.13.2016

M. Zbrozek 9.14.16

0735 M. Zbrozek onsite for ground water Monitoring

0745 set up at DBS-9 Calibrate YSI

pH 4.0 | 24.02°C
10 | 24.40°C
7 | 24.32°C

SpC 1413 24.06°C
1510

ORP 220 / 200.7 23.95°C

DO% 767.1 mmHg 78.3 DO% 100.9 DO%

0805 Begin Sampling @ DBS-9 Sample @ 0825

0845 Set up at DBS-8 Sample @ 0905

0920 Setup at MW-5 Sample @ 1010

1025 Setup at MW-3 Sample @ 1110

1043 RW-2 Totalizer pump off 405 930.3 bbl no sound

1128 SETUP @ DBS-6 Sample @ 1145

1205 SETUP @ DBS-4 Sample @ 1230

9.14.16 M. Zbrozek

1241 Setup AT DBS-2
Sample @ 1400
Pump will not pump to top of casing consistently - Trouble Shoot often attributed to pump housing unable to repair. used poly Bailer
1420 Attempted pump, still does not pump to top of casing use of Bailer for remaining wells. - Pump is working
DBS-5 sampled at 1430
1445 SETup and DBS-3
Sample @ 1505
1515 Setup at DBS-1R
Sample @ 1530
1541 Sample at Injection
@ 1545
FWS-1 Totalizer
80438.8 bbl
Pump on ~ 3156 BPD
1550 SETUP AT PMW1
Sample @ 1605
1607 SAMPLE at Brine Tanks
Na, pH, TDS, Spec grav, Cl @ 1607
1610 Jim Sapp onsite, Jim mentioned that the totalizers near RW-2 -

M. Zbrozek 9.14.16

1610 - May not be recording properly and that we may want to check his sale Numbers to verify pumping output which has increased due to recent growth in oil drilling.
1645 M Zbrozek offsite
All samples preserved on Ice for transport to Hall Environmental

9.14.16

Daniel B. Stephens & Associates, Inc.

GROUNDWATER ELEVATION DATA SHEET

Project Name: Salty Dog Sampler: M. Zbrozek

Project #: ES08.0118.06 Sample Date: 09/13/16

Project Manager: John Ayarbe Sheet # 1 of 1

Well ID	Depth to NAPL	Depth to Water	Total Depth	Comments: (well dia., sampled, condition)
DBS-1R	–	67.43	74.39	
DBS-2	–	69.76	75.38	
DBS-3	–	64.56	74.73	
DBS-4	–	70.35	78.83	
DBS-5	–	66.64	75.84	
DBS-6	–	65.51	76.03	
DBS-7	–	64.34	75.77	WL only
DBS-8	–	63.83	69.92	
DBS-9	–	56.81	67.59	
MW-3	–	66.33	147.05	
MW-4	–	66.31	147.49	WL only
MW-5	–	63.66	128.79	
MW-6	–	65.11	119.15	WL only
PMW-1		71.08	77.82	
NW-1				WL only

Comments:

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1530

Well #: DBS-1R

Well Diameter: 2" (inches) Height of Water Column: 6.96 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.11 (gal)
Depth to Water: 67.43 (feet btoc) Purge Volume: 3.33 (gal)
Total Depth of Well: 74.39 (feet) Purge Method: ~~Grab~~ pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.67	21.73	1356	102.2	11.38	Hazy clear
1	7.51	19.75	1375	106.6	10.67	
1.5	7.40	19.57	1403	112.5	10.44	
2	7.18	19.50	1457	123.9	10.30	Hazy Tan clear
2.5	6.95	19.44	1500	133.1	10.23	
3	6.69	19.42	1567	145.3	10.12	Hazy clear
3.5						
4						
4.5						
5						

Sample Description: _____

Physical Observations: _____

Analytical Method(s): ~~Sodium~~, Chloride, ~~TDS~~, Spec Gravity, ~~pH~~

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Project #: ES08.0118.06
Project Manager: John Ayarbe

Sampler: M. Zbrozek
Sample Date: 09/14/2016
Sample Time: 1400

Well #: DBS-2
Well Diameter: 2" (inches)
Depth to NAPL: --- (feet btoc)
Depth to Water: 69.76 (feet btoc)
Total Depth of Well: 75.38 (feet)

Height of Water Column: 5.62 (feet)
Casing Vol: 0.89 (gal)
Purge Volume: 2.70 (gal)
Purge Method: ~~Grab~~ pump Fail used Bailer

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.62	25.12	532	111.4	8.28	Hazy Tan Clear
1	7.35	22.19	530	132.4	8.32	
1.5						
2	7.60	22.61	534	107.9	8.03	
2.5						
3						
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations: Pump not Functioning used Pole Bailer

Analytical Method(s): ~~Sodium~~, Chloride, ~~TDS~~, ~~Spec Gravity~~, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1505

Well #: DBS-3

Well Diameter: 2" (inches) Height of Water Column: 10.17 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.62 (gal)
Depth to Water: 64.56 (feet btoc) Purge Volume: 4.88 (gal)
Total Depth of Well: 74.73 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.73	20.00	522	112.7	11.08	Hazy Turbid Brown
1	7.61	19.91	521	116.2	10.60	Hazy clear
1.5	7.30	19.72	520	130.4	10.03	
2	7.09	19.71	520	141.1	9.99	
2.5	6.83	19.67	519	152.0	9.96	
3	6.75	19.66	519	156.3	9.95	
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, ~~TDS~~, ~~Spec Gravity~~, ~~pH~~

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1230

Well #: DBS-4

Well Diameter: 2" (inches) Height of Water Column: 8.48 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.36 (gal)
Depth to Water: 70.35 (feet btoc) Purge Volume: 4.07 (gal)
Total Depth of Well: 78.83 (feet) Purge Method: pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.71	23.32	482	128.7	8.67	Hazy Brown Turb.d
1	7.58	20.87	505	123.9	9.42	
1.5	7.41	20.47	505	126.6	9.52	Hazy Brown
2	7.41	20.38	504	127.4	9.51	
2.5	7.37	20.01	505	129.8	9.64	
3	7.34	19.98	504	131.7	9.58	Hazy Clear
3.5						
4						
4.5						
5						

Sample Description: 1 Poly

Physical Observations:

Analytical Method(s): ~~Sodium~~, Chloride, ~~TDS~~, ~~Spec Gravity~~, ~~pH~~

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1430

Well #: DBS-5

Well Diameter: 2" (inches) Height of Water Column: 9.2 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.47 (gal)
Depth to Water: 66.64 (feet btoc) Purge Volume: 4.42 (gal)
Total Depth of Well: 75.84 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.20	20.31	1148	120.3	9.32	
1	7.15	20.10	1143	121.5	9.07	
1.5	7.07	20.04	1140	124.4	8.86	
2	6.77	20.03	1131	133.3	8.63	
2.5	6.57	20.03	1128	141.0	8.55	
3	6.39	19.99	1123	147.5	8.49	
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1145

Well #: DBS-6

Well Diameter: 2" (inches) Height of Water Column: 10.52 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.68 (gal)
Depth to Water: 65.51 (feet btoc) Purge Volume: 5.05 (gal)
Total Depth of Well: 76.03 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.22	23.58	1544	91.3	8.06	Tan Hazy Mod Turbid
1	7.06	20.07	1471	107.5	8.02	
1.5	7.00	19.81	1467	111.5	8.20	Hazy Tan
2	6.95	19.64	1455	114.1	8.21	
2.5	6.92	19.62	1445	115.0	8.11	
3	6.91	19.64	1439	114.7	8.04	
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 0905

Well #: DBS-8

Well Diameter: 2" (inches) Height of Water Column: 6.09 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 0.97 (gal)
Depth to Water: 63.83 (feet btoc) Purge Volume: 2.92 (gal)
Total Depth of Well: 69.92 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.23	20.03	614	149.2	8.34	Hazy clear
1	7.05	20.11	618	129.8	8.30	
1.5	7.02	20.12	620	129.0	8.40	
2	6.99	19.91	619	128.8	8.40	
2.5	6.97	19.85	613	128.8	8.29	
3	6.97	19.83	611	128.8	8.25	
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 0825

Well #: DBS-9

Well Diameter: 2" (inches) Height of Water Column: 10.78 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.72 (gal)
Depth to Water: 56.81 (feet btoc) Purge Volume: 5.17 (gal)
Total Depth of Well: 67.59 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	6.94	19.83	1584	141.7	104.5 %	Slight Tan Hazy
1	6.92	18.91	1217	128.7	9.36 mg/L	Hazy clear
1.5	6.91	18.84	1148	129.8	9.28	
2	6.89	18.80	1150	129.6	9.29	
2.5	6.87	18.78	1119	129.6	9.29	
3	6.81	19.09	1195	132.0	9.31	
3.5	6.83	19.14	1105	130.5	9.31	
4						
4.5						
5						

Sample Description: _____

Physical Observations: _____

Analytical Method(s): ~~Sodium~~, Chloride, ~~TDS~~, ~~Spec Gravity~~, ~~pH~~

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1110

Well #: MW-3
Well Diameter: 2" (inches) Height of Water Column: 80.72 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 12.91 (gal)
Depth to Water: 66.33 (feet btoc) Purge Volume: 38.74 (gal)
Total Depth of Well: 147.05 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	6.97	20.17	81	130.9	5.03	clear
1	6.89	19.61	11582	124.3	5.64	clear
1.5	6.73	19.54	12999	129.8	~~6.~~ 4.96	
2	6.53	19.49	15932	126.9	4.34	
2.5	6.51	19.76	19076	121.0	4.28	clear
3	6.53	19.56	20552	117.7	4.24	
3.5	6.54	19.56	21237	117.6	4.21	clear
4	6.55	19.56	21039	117.1	4.19	
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1010

Well #: MW-5
Well Diameter: 2" (inches) Height of Water Column: 65.13 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 10.42 (gal)
Depth to Water: 63.66 (feet btoc) Purge Volume: 31.26 (gal)
Total Depth of Well: 128.79 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	6.52	20.09	159	161.1	10.93	clear
1	6.43	19.55	3188	132.9	4.54	
1.5	6.51	19.66	3106	130.3	4.59	
2	6.52	19.67	3070	130.0	4.60	
2.5	6.54	19.71	3021	129.1	4.61	clear
3	6.54	1968	2995	128.5	4.64	clear
3.5						
4						
4.5						
5						

Sample Description: 1 poly

Physical Observations: clear.

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Daniel B. Stephens & Associates, Inc.

GROUNDWATER MONITORING DATA SHEET

Project Name: Salty Dog
Sampler: M. Zbrozek
Project #: ES08.0118.06
Sample Date: 09/14/2016
Project Manager: John Ayarbe
Sample Time: 1605

Well #: PMW-1

Well Diameter: 2" (inches) Height of Water Column: 6.74 (feet)
Depth to NAPL: --- (feet btoc) Casing Volume: 1.07 (gal)
Depth to Water: 71.08 (feet btoc) Purge Volume: 3.32 (gal)
Total Depth of Well: 77.82 (feet) Purge Method: Pump

Note:
One casing volume (SCH 40 PVC): 2.0" ID casing = 0.16 gal/ft; 4.0" = 0.65 gal/ft; 6.0" = 1.47 gal/ft

Groundwater Parameters:

Casing Volume	pH	Temp (°F)	Conductivity (µS/cm)	ORP (mv)	D.O. (mg/L)	Turbidity (NTU)
Initial	7.13	21.17	35477	114.7	9.56	Milky White
1	7.16	20.26	23120	102.8	9.19	Hazy
1.5	7.13	20.23	22420	103.3	9.15	Hazy clear
2	7.10	20.10	22067	103.7	9.16	
2.5	7.09	20.06	22064	104.3	9.13	
3	7.09	20.04	21877	104.9	9.10	Hazy clear
3.5						
4						
4.5						
5						

Sample Description:

Physical Observations:

Analytical Method(s): Sodium, Chloride, TDS, Spec Gravity, pH

Chain-of-Custody Record

Client: DFS & A

Mailing Address: 6020 Academy RD NE #100 Albuquerque NM 87109

Phone #: 505-822-9400

email or Fax#: JAYARBE@DBSHouston.com

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

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☐ Standard ☐ Rush _____

Project Name: SALTY DOG

Project #: ES08.0118.06

Project Manager: J. AYARBE

Sampler: M. Ebrozek

On Ice: ☒ Yes ☐ No

Sample Temperature: 3.7 C

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

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

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No.
9.14.16	1530	GW	DFS-1R	1 poly	none	
	1400		DFS-2			
	1505		DBS-3			
	1230		DBS-4			
	1430		DBS-5			
	1145		DBS-6			
	0905		DBS-8			
	0825		DBS-9			
	1110		MW-3			
	1010		MW-5			
	1605		PMW-1			
	1645 1607		INJECTION BRINE	2 poly 3 poly	2 none 3 none	

BTEX + MTBE + TMB's (8021)
BTEX + MTBE + TPH (Gas only)
TPH 8015B (GRO / DRO / MRO)
TPH (Method 418.1)
EDB (Method 504.1)
PAH's (8310 or 8270 SIMS)
RCRA 8 Metals
Anions ($F, Cl, NO_3, NO_2, PO_4, SO_4$)
8081 Pesticides / 8082 PCB's
8260B (VOA)
8270 (Semi-VOA)
Chloride
Alk, TDS, Spec Grav, Na
Air Bubbles (Y or N)

Date:	Time:	Relinquished by:	Received by:	Date	Time
9/15/16	1032			9/15/16	1032
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

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

September 17, 2014

Mr. Jim Griswold
New Mexico Oil Conservation Division
Environmental Bureau
1220 South St. Francis Drive
Santa Fe, NM 87505-4225

Re: Work Plan for Surface Subsidence Monitoring and Solution Cavern Characterization
Salty Dog Brine Station

Dear Mr. Griswold:

On behalf of PAB Services, Inc., Daniel B. Stephens & Associates, Inc. (DBS&A) is pleased to submit the enclosed work plan for surface subsidence monitoring and solution cavern characterization at the Salty Dog Brine Station in Lea County, New Mexico. The work plan was prepared in accordance with the requirements of Conditions 2.B.1 and 2.B. 2 of discharge permit (DP) BW-8.

Please do not hesitate to call us at (505) 822-9400 if you have any questions or require additional information.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John Ayarbe, P.G.
Senior Hydrogeologist

Michael D. McVey, C.P.G., P.G.
Senior Hydrogeologist

JA/rpf
Enclosures
cc: Pieter Bergstein, PAB Services, Inc.
Brenda Patterson, Aqueous Operating
Terry Wallace, Salty Dog, Inc.

Work Plan for
Surface Subsidence Monitoring and
Solution Cavern Characterization
Salty Dog Brine Station

Prepared for **New Mexico Energy, Minerals and Natural Resources Department**
Oil Conservation Division

September 17, 2014

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

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Work Plan for
Surface Subsidence Monitoring and
Solution Cavern Characterization
Salty Dog Brine Station

1. Introduction

Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this work plan on behalf of PAB Services, Inc. (PAB) to satisfy Conditions 2.B.1 and 2.B. 2 of recently renewed discharge permit BW-8 (DP BW-8). The Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department (NMEMNRD) renewed DP BW-8 on November 8, 2013, permitting continued operation of the Salty Dog Brine Station (Salty Dog) and the associated Underground Injection Control (UIC) Class III well (Brine Supply Well #1 [API No. 30-025-26307]) (NMEMNRD, 2013). The facility is located in Lea County, New Mexico, approximately 11 miles west of Hobbs, New Mexico along Highway 180 (Figure 1).

This work plan describes the proposed technical approach to be used to satisfy Conditions 2.B.1 and 2.B.2 of DP BW-8, including (1) the design of survey monuments and establishment of a program to monitor for potential surface subsidence, and (2) investigation activities to characterize the size and shape of the solution cavern created by brine production. Section 2 provides pertinent background information, such as the history of the facility, site geology, and brine well construction. Sections 3 and 4 present the proposed plans for surface subsidence monitoring and solution cavern characterization, respectively. Reporting is discussed in Section 5. Section 6 presents a schedule for the proposed work.

2. Background

Salty Dog is a brine water production and loading station, consisting of a fresh water supply well, a brine production well, and a concrete truck loading pad with two brine filling stations. Fresh water is stored in two 1,000-barrel (bbl) fresh water aboveground storage tanks (ASTs). Brine is stored at a bermed tank battery consisting of six 750-bbl ASTs. Figure 1 shows the

locations of the Salty Dog facilities. The brine well is located approximately 0.5 mile southwest of the brine station. Figure 2 presents a 2014 aerial photograph of the brine station showing the layout of the current facility infrastructure.

Brine is produced from the in situ extraction of salt at the UIC Class III well (Brine Supply Well #1 [API No. 30-025-26307]). The physical location of the brine well is 1,980 feet from south line (FSL) and 1,980 feet from east line (FEL) (NW/4 SE/4, Unit Letter J) in Section 5, Township 19 South, Range 36 East, New Mexico Principal Meridian (NMPM) (Figure 1). The brine well was installed in June 1979. The original discharge permit for the brine well (GWB-2) appears to have been issued on December 18, 1982 (OCD, 1994). The discharge permit was last renewed on November 8, 2013 (NMEMNRD, 2013).

Figure 3 shows a generalized schematic of the brine well illustrating its construction, tubing depths, and the penetrated geologic units. The brine well was drilled to a total depth of 2,958 feet below ground surface (bgs). Surface casing (8⅝-inch) extends from land surface to a depth of 1,877 feet bgs and is cemented in place. The well is completed open hole from 1,877 to 2,958 feet bgs. The well was originally completed with open-ended 2⅞-inch tubing, hung to a depth of 2,887 feet bgs and perforated from 2,872 to 2,887 feet bgs (NRE, 1982). In August 1999, holes in the surface casing were repaired, and a 5½-inch casing liner was installed and cemented to 1,829 feet bgs; open-ended 2⅞-inch tubing was hung to a depth of 2,534 feet bgs (Salty Dog, 1999). The tubing is currently set at 2,665 feet bgs.

The Salty Dog brine well is configured for reverse circulation brine recovery, where fresh water is circulated down the casing annulus into the Salado Formation—a Permian Age sedimentary rock unit composed of halite (salt) and other evaporative beds. Fresh water dissolves the salt, and the brine is extracted through the center tubing of the well (Figure 3). The total dissolved solids (TDS) concentrations of the fresh water and produced brine are approximately 600 milligrams per liter (mg/L) and 320,000 to 350,000 mg/L, respectively (Martin, 1982; Unichem, 1987).

Figure 3 shows the geologic stratigraphy at the brine well. The Ogallala Formation is the uppermost geologic unit, extending from land surface to a depth of approximately 150 feet bgs. At the Salty Dog site, the Ogallala Formation consists primarily of sand, with the upper 40 feet

containing appreciable amounts of caliche. Regional groundwater is present within the formation under a water-table condition and is considered part of the Ogallala Aquifer. This groundwater is used as the fresh water supply for the brine station, and is pumped from an on-site well (Figure 2). Depth to groundwater is approximately 60 feet bgs (DBS&A, 2009a). The Rustler Formation underlies the Ogallala Formation and consists of redbed and anhydrite sequences from approximately 150 to 1,800 feet bgs and 1,800 to 2,000 feet bgs, respectively. The Salado Formation is present from approximately 2,000 to 2,900 feet bgs.

In addition to the fresh water pumped from the supply well, chloride-impacted groundwater recovered at two on-site groundwater extraction wells is used as injection water at the brine well. Figure 4 shows the locations of the two extraction wells (RW-1 and RW-2).

3. Surface Subsidence Monitoring Plan

Condition 2.B.1 of DP BW-8 requires surface subsidence monitoring at the Salty Dog Brine Station. DBS&A proposes to install four survey monuments near the brine well to be surveyed semiannually by a licensed professional surveyor to satisfy this condition.

Figure 5 shows the proposed locations of the survey monuments. One survey monument would be placed about 50 feet from the brine well; the other three monuments would be placed about 200 feet from the brine well. A 2009 sonar survey identified a maximum radius of a solution cavern along an azimuth of 200 degrees (Section 4.1). Two of the proposed survey monuments are positioned along this direction (SMP-1 and SMP-2).

Figure 6 provides a design schematic for the survey monuments prepared by Engineering Analytics, Inc., a geotechnical engineering firm based in Fort Collins, Colorado. Each monument will be constructed from stainless steel rod sleeved within 1-inch-diameter SCH 80 polyvinyl chloride (PVC) pipe, with the top of the rod serving as the surface subsidence monitoring point. The stainless steel rod will be anchored in 2 feet of concrete at a depth of approximately 25 to 30 feet bgs. Final depths will be determined in the field and selected such that the stainless steel rods are anchored in hard and well-indurated sand that often appears as stone due to the presence of appreciable amounts of caliche. Several monitor and recovery wells have been completed within the Ogallala Aquifer at the site. Lithologic data collected at

these wells show the presence of sandstone or well-indurated sand units at depths of up to approximately 40 feet bgs (DBS&A, 2009a and 2009b). At RW-2, the closest existing well to the brine well, hard and well-indurated sand exists between 20 and 35 feet bgs (DBS&A, 2009b).

The space between the PVC pipe and stainless steel rod will be filled with grease to allow the rod to move independent of the PVC pipe and surface completion (Figure 6). The survey monuments have been designed to detect ground movement at depth, which would more likely be associated with a cavern collapse than near-surface disturbances that are not associated with cavern subsidence (e.g., shrinking and swell of surface soil). Each monument will be constructed in an approximately 8¾-inch-diameter borehole, advanced using the air-rotary drilling method or other comparable drilling technology.

After installation, the location and elevation of each survey monument will be established relative to the nearest U.S. Geological Survey (USGS) benchmark. A licensed New Mexico land surveyor will survey the elevation of each monument semiannually to at least the nearest 0.01 foot. Survey results will be submitted to OCD within 15 days of the survey and included in the Annual Class III Well Reports.

In accordance with DP BW-8, if subsidence is measured at or greater than 0.1 foot, Salty Dog will suspend operations at the brine well and conduct an analysis to determine the cause of the movement and integrity of the cavern.

4. Solution Cavern Characterization Program

Condition 2.B.2 of DP BW-8 requires a characterization program to delineate the size and shape of the solution cavern using a geophysical method. The following sections summarize a previous characterization effort and the proposed geophysical approach to satisfy Condition 2.B.2.

4.1 Previous Characterization Survey

In 2009, SOCON Sonar Well Services, Inc. of Conroe, Texas conducted a sonar survey at the Salty Dog brine well in an attempt to determine the extent of the solution cavern (SOCON,

2009). The sonar survey was performed to satisfy an OCD requirement (NMEMNRD, 2008), and was run from a depth of 1,871 to 1,903 feet bgs, a vertical distance of 32 feet. Available lithologic information shows that the top of the Salado Formation is at a depth of approximately 2,000 feet bgs, indicating that the section surveyed was the anhydrite sequence of the Rustler Formation (Figure 3). Survey results show a cavern volume of 720 bbls, with a maximum radius of 41 feet at a depth of 1,882 feet bgs along an azimuth of 200 degrees.

OCD has estimated a volume of 1,022,196 bbls for the Salty Dog solution cavern based on brine production records (NMEMNRD, 2012). The volume determined from the sonar survey (720 bbls) accounts for less than 1 percent of this estimated volume.

4.2 Proposed Geophysical Approach

DBS&A proposes to use the digital high-resolution magnetotellurics (HRMT) method to determine the size and shape of the Salty Dog solution cavern. The selection of this approach is based on the general success of the method at the former I&W brine facility in Carlsbad, New Mexico. OCD has conducted extensive testing of several geophysical methods to delineate the solution cavern at the I&W site, including two-dimensional (2D) seismic reflection (August 2009), sonar logging (September 2010), electrical resistivity (April 2011), and digital HRMT (March 2011 and April 2013) (NMEMNRD, 2012). Because the geologic environment at the I&W site is similar to that at the Salty Dog Brine Station, DBS&A relied heavily on available information regarding the geophysical surveys conducted at the I&W site when selecting an appropriate cavern characterization approach.

Each of the four geophysical methods used at the I&W site identified one or more subsurface anomalies, as shown in Figure 7. The following is a brief summary of the findings from the I&W site:

- Sonic logging reportedly identified the upper part of a cavity approximately 150 feet in diameter and 25 feet high, but was unable to delineate the cavern at depth, possibly due to the presence of insoluble residues or broken rubble (NMEMNRD, 2012).

- Seismic data interpretation indicated a pear-shaped anomaly measuring about 610 feet north to south and up to 420 feet across; evidence of the most extensive dissolution was around the brine extraction well (RESPEC, 2009).

- Electrical resistivity data interpretation indicated a J-shaped low-resistivity anomaly approximately 900 feet north to south and approximately 85 feet wide that was coincident with the sonar anomaly (Figure 7). The survey also identified four smaller anomalies that were interpreted to represent brine-saturated areas of the Rustler Formation that were either highly fractured or brecciated, rather than open void space (Land and Veni, 2011).

- HRMT data indicated a roughly oval-shaped anomaly approximately 1,660 feet north to south and 790 feet wide (DMT, 2011 and 2013).

Only the HRMT approach identified a large anomaly at the I&W site that might approach the volume indicated by historical production data (Figure 7). OCD has estimated a cavern volume of 1,050,386 bbls based on brine production at the former I&W facility (NMEMNRD, 2012).

HRMT is a passive electromagnetic (EM) system commonly used for oil and gas exploration. It relies on natural EM waves (telluric currents) generated by the interaction of the earth's magnetic field with solar wind. A large-amplitude, very-low-frequency EM signal enters the earth perpendicular to the land surface, propagating into the subsurface. The amplitude and phase of individual frequencies intersect conductive formations, are modified, and are reflected back to the land surface. The air-ground interface marks a large impedance mismatch to the reflected EM waves, generating a series of higher-frequency EM waves: telluric (electric field) and geomagnetic (magnetic field). These electric and magnetic fields are recorded, and their frequency, amplitude, and phase responses are analyzed to map subsurface conditions.

DBS&A proposes to contract with DMT Technologies, LLC (DMT) in Broken Arrow, Oklahoma to perform the HRMT survey. This is the same company that conducted the HRMT survey at the I&W site. The HRMT survey will be performed using a rectangular grid of survey stations. DMT (or other contractor, if necessary), will establish the grid based on professional judgment and initial field findings at the time of the survey. Station density will be sufficient to obtain an

accurate cavern volume. Each station will be surveyed, either by a licensed New Mexico land surveyor or using a global positioning system (GPS) unit accurate to within 0.01 foot.

A best effort will be made to accurately determine the volume of the Salty Dog brine cavern; however, the results of an HRMT survey, or any geophysical survey, are interpretive. While best judgments are used in developing data interpretations, the accuracy of the HRMT survey cannot be guaranteed.

5. Reporting

After the completion of field activities and receipt of the final geophysical survey report, DBS&A will prepare a Subsidence Monitoring and Solution Cavern Characterization Report. This report will document the construction of the survey monuments and present results of the cavern characterization, including estimates of its volume and lateral extent. The final report will be submitted to the OCD, and will provide the following:

- As-built diagrams of the survey monuments, including surveyed locations and elevations
- A figure showing the locations of the survey monuments
- The report prepared by the geophysical survey contractor and associated data
- Calculation of the solution cavern volume based on brine production records and a comparison of this volume to results of the geophysical survey
- Figures illustrating the extent and depth of the cavern based on the geophysical survey
- Conclusions and recommendations

6. Schedule

Upon OCD approval of this work plan, DBS&A will work with PAB to (1) contract a driller for the installation of the survey monuments, (2) contract DMT to perform the geophysical survey, (3) contract a licensed land surveyor to perform the surveying, and (4) obtain any necessary access agreements from adjacent landowners.

DBS&A anticipates that the installation of the subsidence survey monuments and geophysical survey can begin within approximately 30 days of receiving signed access agreements and that the geophysical survey and data processing can be completed within approximately 45 days.

DBS&A will prepare a draft report for initial review within 30 days of receipt of the geophysical survey report.

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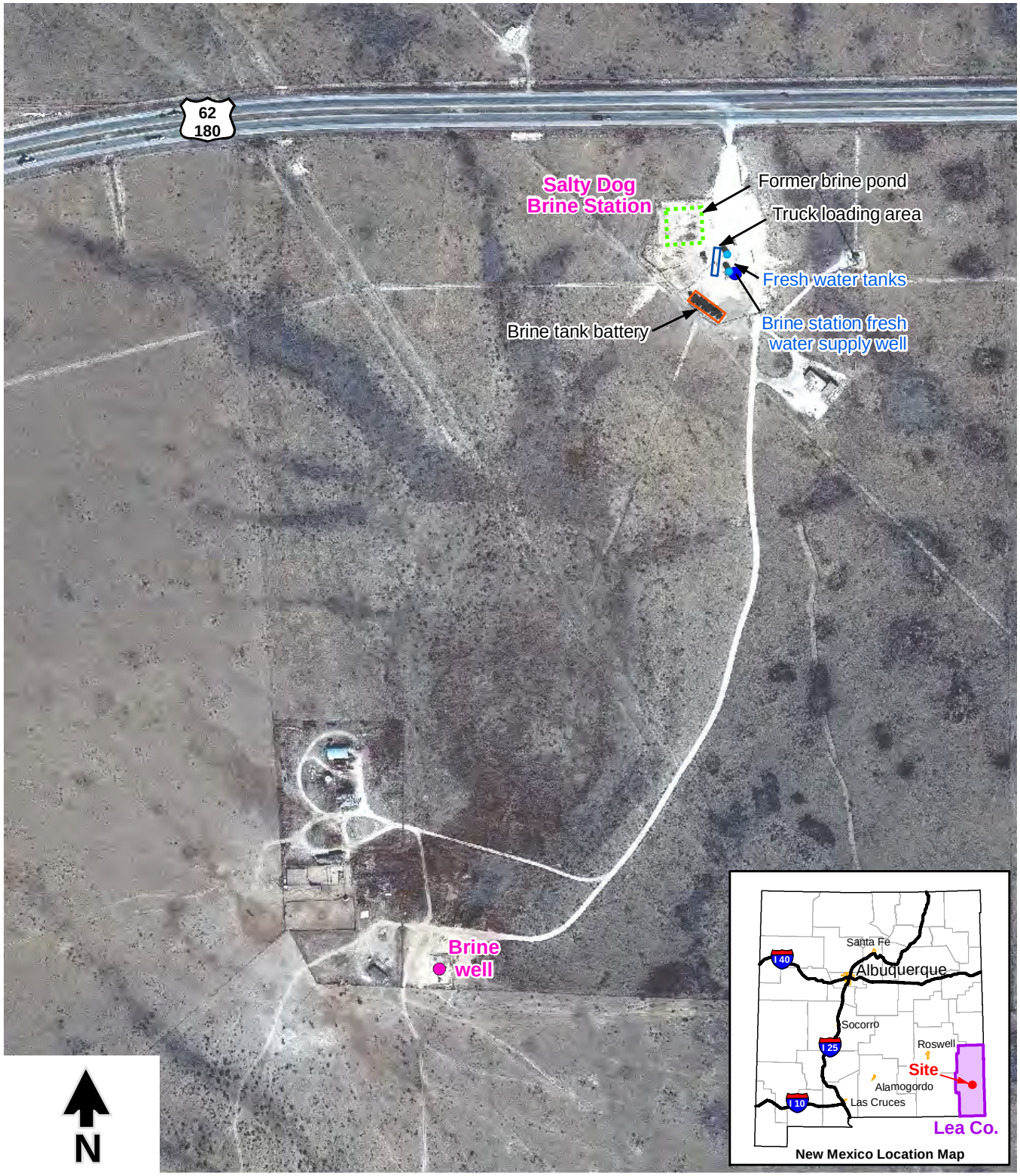
Figures



Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

Explanation

- Water supply well
- Brine well
- Fresh water tank

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG01_SITE_LOCATION_AND_FACILITIES.MXD

Daniel B. Stephens & Associates, Inc.
9/10/2014
JN ES08.0118.05

SALTY DOG BRINE STATION
Site Location and Facilities

Figure 1

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG02_SITE_2014_AERIAL_PHOTO.MXD

Source: USDA Farm Service Agency, DigitalGlobe, NMRGIS, February 14, 2014

Figure 2

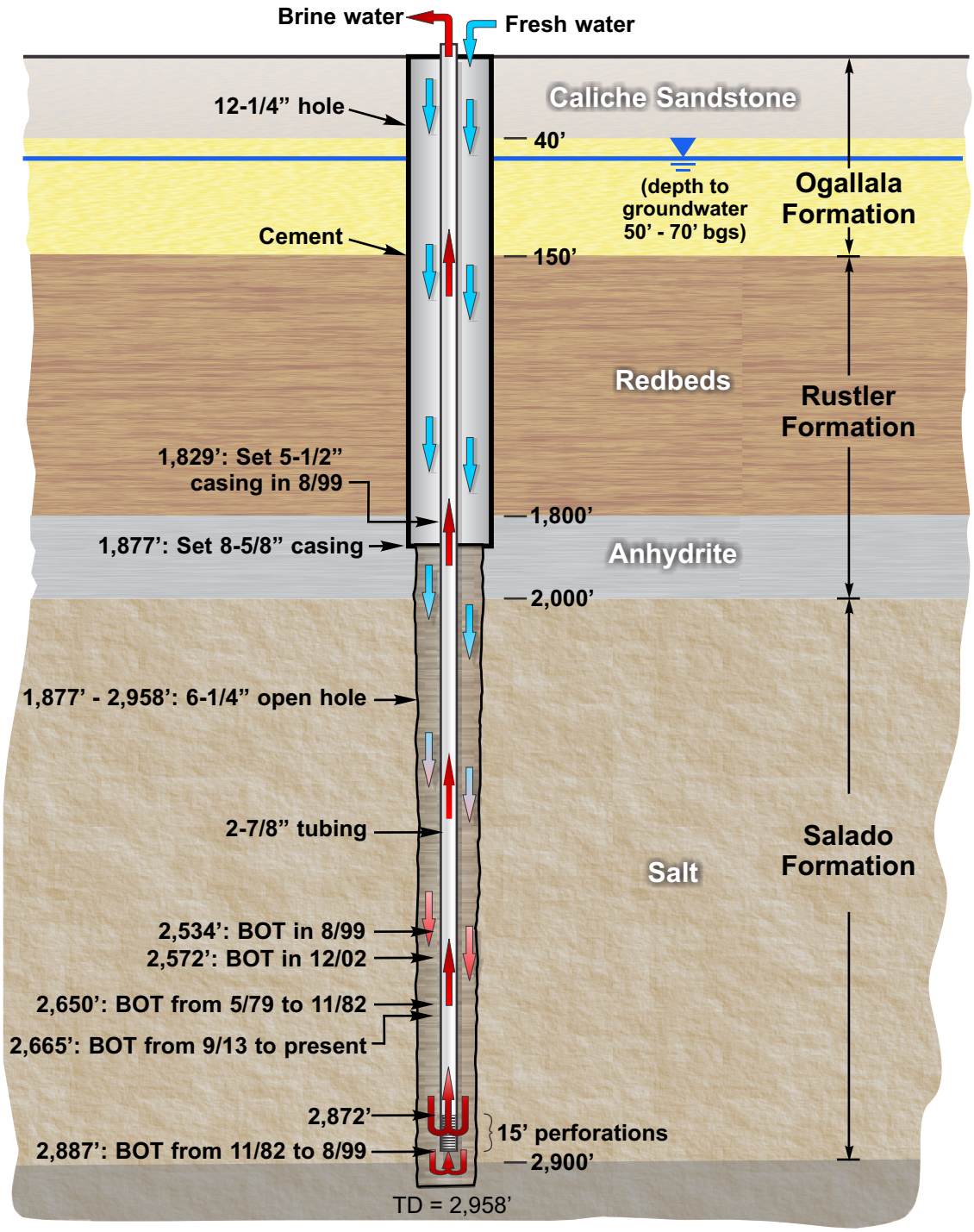
SALTY DOG BRINE STATION

2014 Aerial Photograph of Salty Dog Brine Station

Daniel B. Stephens & Associates, Inc.

9/10/2014 JN ES08.0118.05

Salty Dog Brine Well



Notes:

1. BOT = Bottom of tubing
2. Figure not to scale

Sources:

1. Completion data based on OCD well reports
2. Lithology from Salty Dog (1988)

SALTY DOG BRINE STATION

Generalized Brine Well Schematic

Daniel B. Stephens & Associates, Inc.

9-17-14

JN ES08.0118.05

Figure 3

S:\PROJECTS\ES08.0118.05 SALTY DOG DP BW-8\VR DRAWINGS\FIG03 GENERALIZED BRINE WELL SCHEMATIC.CDR

Explanation

- Monitor well
- Recovery well
- Water supply well
- Brine well
- Brine tank battery
- Truck loading area
- Former brine pond
- Fresh water tank

Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG04_SITE_MONITOR_AND_EXTRACTION_WELL_LOCS.MXD

Daniel B. Stephens & Associates, Inc.
9/17/2014
JN ES08.0118.05

SALTY DOG BRINE STATION
Monitor and Extraction Well Locations

Figure 4

Source: USDA Farm Service Agency
DigitalGlobe, NMRGIS
February 14, 2014

Explanation

- Proposed subsidence monitoring point
- Recovery well
- Brine well

SALTY DOG BRINE STATION

Proposed Subsidence Monitoring Station Locations

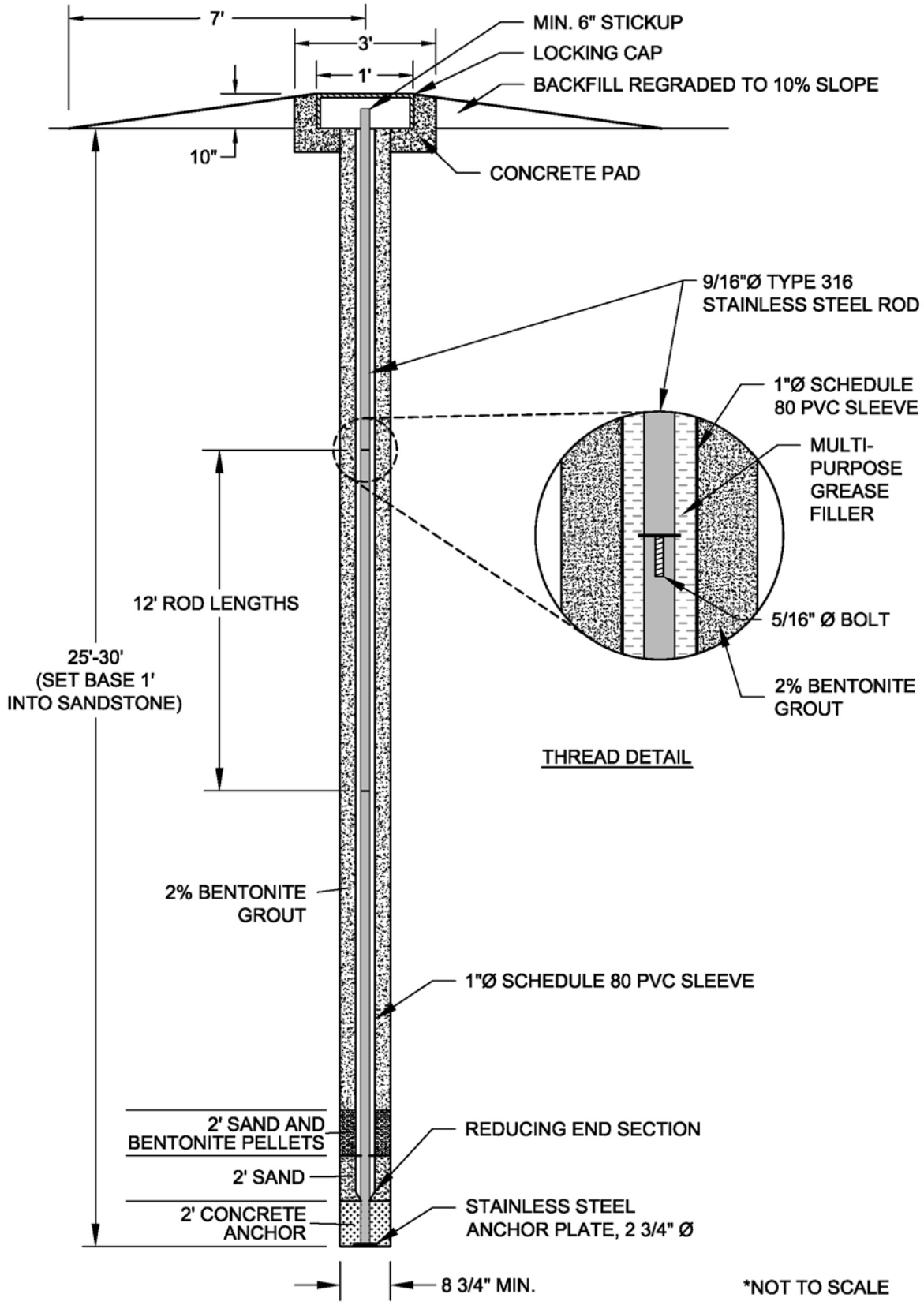
Daniel B. Stephens & Associates, Inc.

9/17/2014

JN ES08.0118.05

Figure 5

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\GIS\MXD\FIG05_PROP_SUBSIDENCE_MONITORING_STATIONS.MXD



Source:

Prepared by Engineering Analytics, Inc. (2014)

SALTY DOG BRINE STATION

Subsidence Survey Monument Design

Daniel B. Stephens & Associates, Inc.

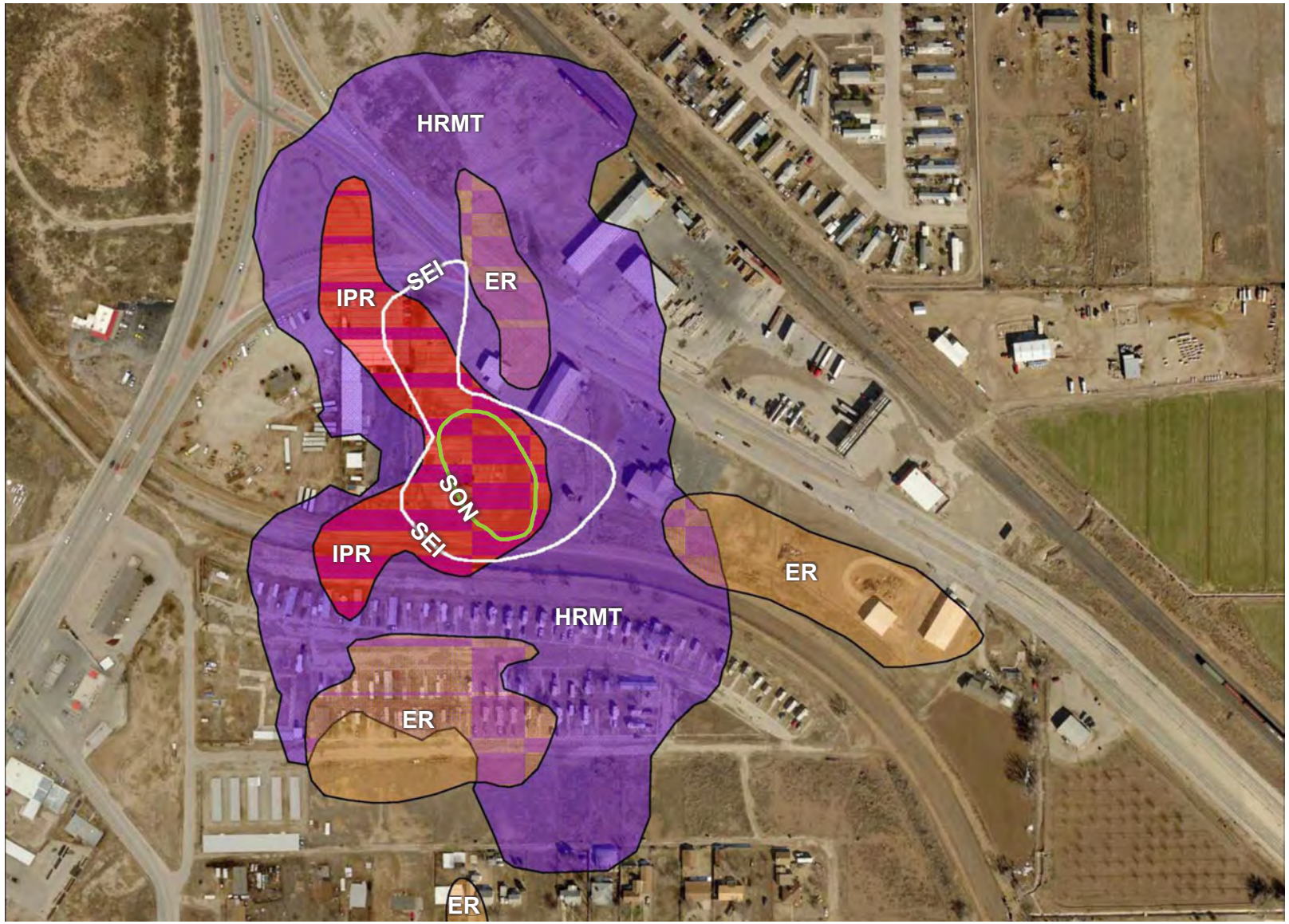
8-22-14

JN ES08.0118.05

Figure 6

S:\PROJECTS\ES08.0118.05 SALTY DOG DP BW-8\VR DRAWINGS\FIG06 SUBSIDENCE SURVEY MONUMENT DESIGN.CDR

S:\PROJECTS\ES08.0118.05_SALTY_DOG_DP_BW-8\VR_DRAWINGS\FIG07_SEISMIC_SONIC_MAGNETOTELLURICS_IP-RESISTIVITY.CDR



Explanation

HRMT = High-resolution magnetotellurics
ER = Electrical resistivity
IPR = Induced polarization resistivity
SEI = Seismic
SON = Sonic

Source:
New Mexico Energy, Minerals &
Natural Resources Department (2012)

SALTY DOG BRINE STATION

Subsurface Anomalies Identified by Geophysical Methods at the I&W Site

Figure 7

Daniel B. Stephens & Associates, Inc.
9-17-14
JN ES08.0118.05

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD

Sent: Friday, November 14, 2008 4:38 PM

To: 'ziatransports@gmail.com'; 'jrmillett@gmail.com'; 'rharrisnm@aim.com'; 'gandy2@leaco.net'; 'seay04@leaco.net'; 'iwcarlsbad@plateautel.net'; 'Patterson, Bob'; 'Dimas Herrera'; 'gil@mull.us'; 'David Pyeatt'; 'Wayne E Roberts'; Dennis L Shearer; 'garymschubert@aol.com'; 'dgibson@keyenergy.com'; 'Clay Wilson'; 'Prather, Steve'; Ronnie D Devore

Cc: Hill, Larry, EMNRD; Gum, Tim, EMNRD; Price, Wayne, EMNRD

Subject: Brine Well Moratorium Press Release Today

Attachments: PR-OCD Brine Well Moratorium.pdf

FYI, please see the attached NM OCD Press Release issued today. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3491
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Porter, Jodi, EMNRD
Sent: Friday, November 14, 2008 2:35 PM
Subject: PR-Energy, Minerals and Natural Resources Cabinet Secretary Prukop Orders a Six Month Moratorium on New Brine Wells
Attachments: PR-OCD.Brine.Well.Moratorium.pdf; image001.jpg; image015.jpg

New Mexico Energy, Minerals and Natural Resources Department

November 14, 2008

NEWS RELEASE

Contact: Jodi McGinnis Porter,
Public Information Officer 505.476.3226

Energy, Minerals and Natural Resources Cabinet Secretary Prukop Orders a Six Month Moratorium on New Brine Wells

Oil Conservation Division to Investigate Brine Well Collapses and Provide Recommendations

SANTA FE, NM – Secretary Joanna Prukop today ordered the Oil Conservation Division to place a six month moratorium on any new brine well applications located in geologically sensitive areas. Secretary Prukop's action comes following the second brine well collapse in less than four months in southeastern New Mexico. The Secretary has also directed the Oil Conservation Division to work with the Environmental Protection Agency, other states, technical experts and oil and gas industry representatives to examine the causes of recent collapses, and provide a report with recommendations to the Oil Conservation Commission for a safe path forward. The report should be completed by May 1, 2009.

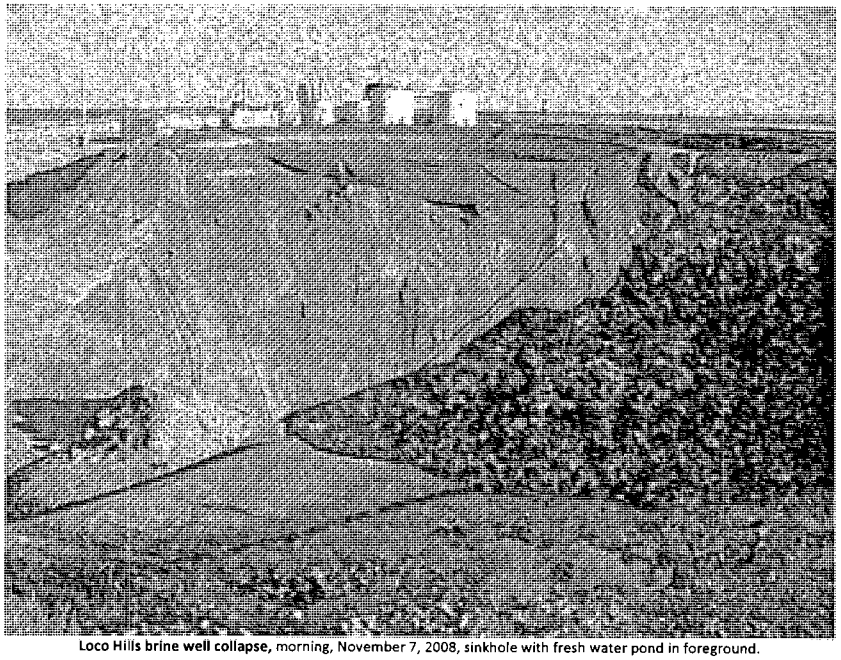
"I am deeply concerned by these two serious incidents and we are taking action to ensure the safety of our citizens and to protect the environment," stated Secretary Prukop.

Brine wells are an essential part of the oil and gas drilling industry, particularly in the southeastern part of the state. Oil and gas operators use brine water in the drilling process. Brine is saturated salt water which can be more salty than sea water. Brine is created by injecting fresh water into salt formations, allowing the water to absorb the salt and then pumping it out of the well. This method creates an underground cavity.

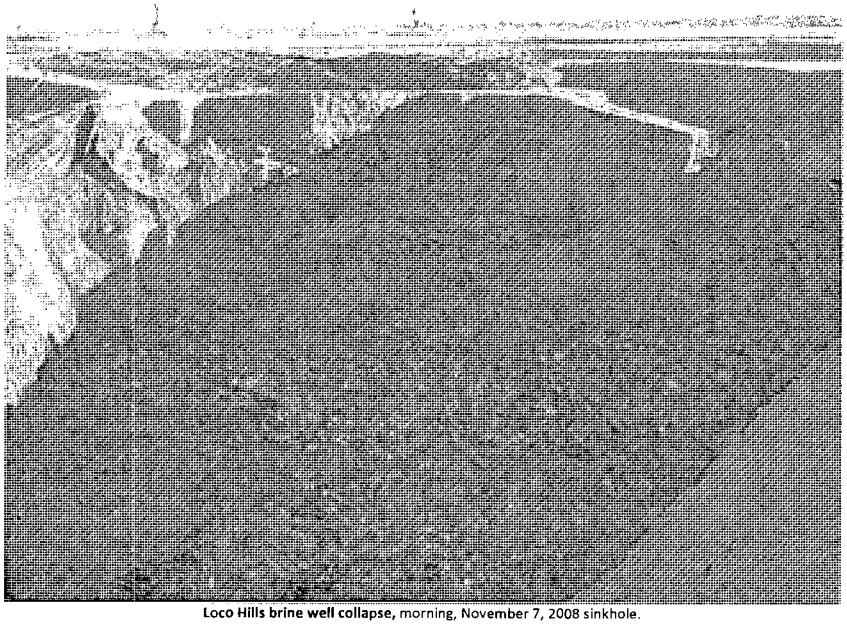
"The moratorium will provide time to properly evaluate the causes of the recent collapses and to discuss the development of new rules or guidelines to ensure the safety and stability of brine well systems," added Secretary Prukop.

The moratorium will only affect new wells and will not impact existing wells and facilities.

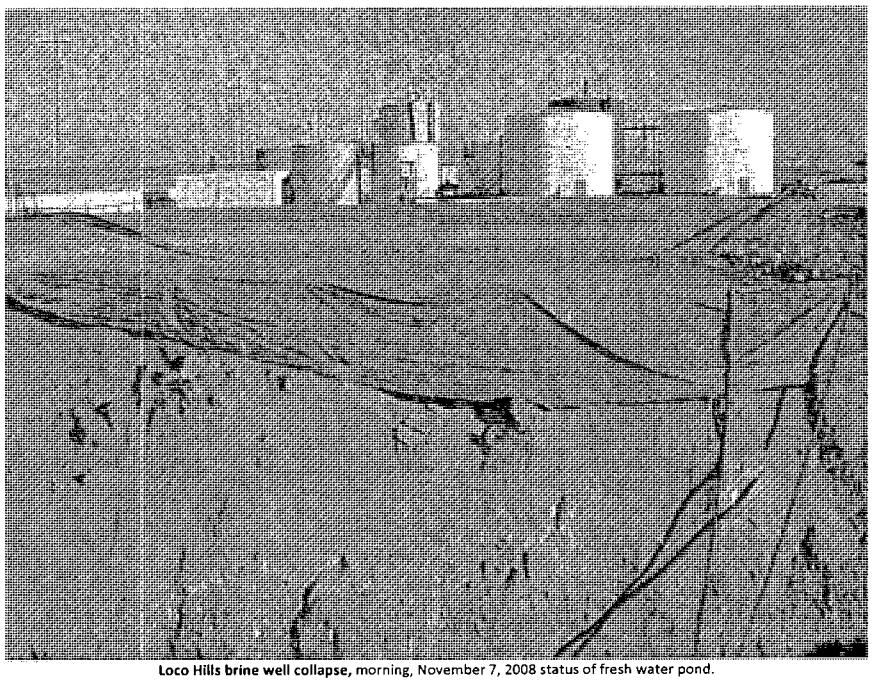
Below are photographs of the two recent collapses:



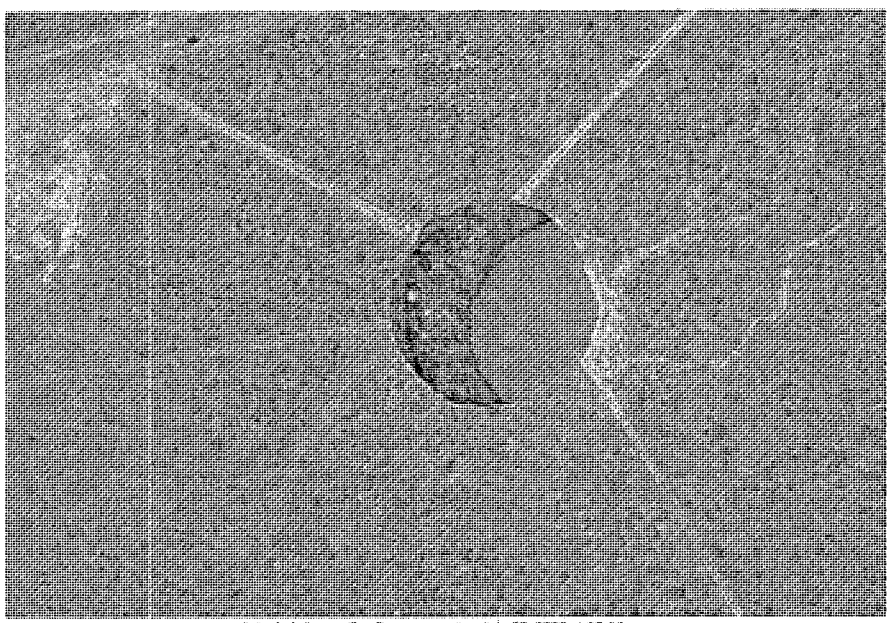
Loco Hills brine well collapse, morning, November 7, 2008, sinkhole with fresh water pond in foreground.
Photo courtesy of Oil Conservation Division



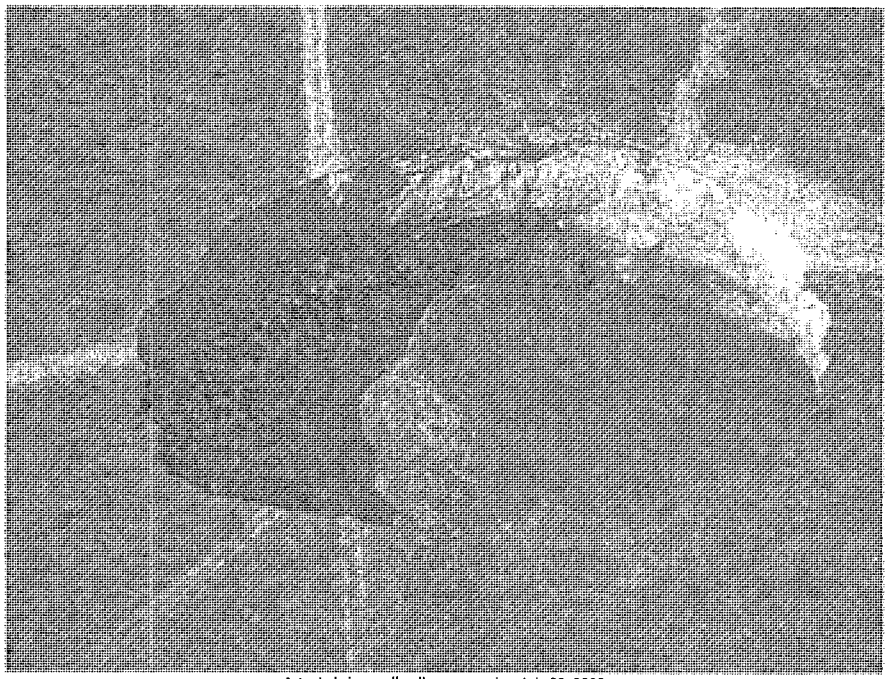
Loco Hills brine well collapse, morning, November 7, 2008 sinkhole.
Photo courtesy of Oil Conservation Division



Loco Hills brine well collapse, morning, November 7, 2008 status of fresh water pond.
Photo courtesy of Oil Conservation Division



Artesia brine well collapse, morning, July 20, 2008 at 10:44 am.
Photo courtesy of National Cave and Karst Research Institute



Artesia brine well collapse morning, July 22, 2008
Photo courtesy of National Cave and Karst Research Institute

#30#

The Energy, Minerals and Natural Resources Department provides resource protection and renewable energy resource development services to the public and other state agencies.

Oil Conservation Division
1220 South St. Francis Drive • Santa Fe, New Mexico 87505
Phone (505) 476-3440 • Fax (505) 476-3462 • www.emnrd.state.nm.us/OCD

Jodi

Jodi McGinnis Porter
Public Information Officer
Energy, Minerals and Natural Resources Department (EMNRD)
1220 South St. Francis Drive
Santa Fe, NM 87505
Phone: (505) 476-3226
Fax: (505) 476-3220
Cell: (505) 690-1689
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Website: www.emnrd.state.nm.us

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD

Sent: Wednesday, November 12, 2008 11:50 AM

To: 'ziatransports@gmail.com'; 'jrmillett@gmail.com'; 'Patterson, Bob'; Philliber, Mark; 'rharrisnm@aim.com'; 'gandy2@leaco.net'; 'David Pyeatt'; 'garymschubert@aol.com'

Cc: Price, Wayne, EMNRD; Sanchez, Daniel J., EMNRD; Hill, Larry, EMNRD; Gum, Tim, EMNRD

Subject: Brine Well Sonar Testing Requirement with this season's upcoming MIT Schedule 2009

Gentlemen:

Re: MITs and OCD Sonar Test Requirement

Good morning. It is that time of season when the OCD requests your proposed MIT schedule. The OCD is requiring a sonar test in addition to the MIT this season. The OCD objective is to complete the MITs on or before July 31, 2009. If circumstances require it, the deadline for MITs may be extended to on or before October 31, 2009. Please contact me within 30 days to schedule your MIT and sonar test with date and time that you prefer. Note that brine well operators scheduled for the annual OCD 4-hr. formation MIT may conduct the EPA 5-Yr. 30 minute MIT (+/- 10% to pass) at 300 – 500 psig on casing in lieu of the OCD annual formation MIT this season.

After reviewing the site files and your responses to the recent OCD questionnaire following the Jims Water Service (BW-5) brine well collapse SE of Artesia in Eddy County on 7/16/2008, and the more recent collapse at Loco Hills (BW-21) in Eddy County on 11/3/2008, the OCD is requiring Sonar Testing along with your MIT this season to assess the configuration of your brine well cavern and any threats to public health and safety in your areas. The OCD is focused on the maturity of brine wells and the "Calculation" from the recent questionnaire attempts to assess brine well maturity by comparing the total brine production relative to the depth of the brine well casing shoe. This is one of the reasons why fresh water and brine well production record reporting to the OCD is so critical. Any operators that are planning to plug and abandon their brine wells are required by the OCD to conduct a sonar test of the well in advance of plugging and abandonment. Also, the OCD requires that the brine cavern be filled with brine fluid as this adds structural stability to the cavern and well. This will be required in a C-103 approved with conditions by the OCD. Currently, 3 brine well operators have been required by the OCD to conduct sonar testing within 30 days due to the maturity issue mentioned above. The OCD is continuing to assess its EPA Class III Brine Well program and will keep you updated on improvements and/or changes as needed.

If you feel that your brine well is too new to require sonar testing or a sonar was recently completed at your brine well, please provide the basis for requesting an exemption to this OCD sonar test requirement ASAP for OCD approval.

Please contact me if you have questions. Thanks in advance for your cooperation in this matter.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3491
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

New Mexico Energy, Minerals and Natural Resources Department

RECEIVED
2008 OCT 31 PM 1 01

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

OIL CONSERVATION DIVISION
BRINE WELL INFORMATION REQUEST

GENERAL INFORMATION:

Operator Name Salty Dog Well Name(s) Salty Dog #1
API Number 30-025-26307 Brine Well Permit # BW-008
Date Permit Expires? April 18, 2009

Location: Section 5 Ts 19 Rg 36
FNL _____ FSL 1980 FEL 1980 FWL _____
GPS of well(s): Lat: Long:

Have you reviewed and understand all of your permit conditions? Yes ☑ No ☐
Are you presently deficient of any condition in your permit? Yes ☐ No ☑ Don't know ☐ we are working on this
Do you operate below grade tanks or pits at the site? Yes ☐ No ☑
Do all tanks, including fresh water tanks, have secondary containment? Yes ☐ No ☑
Do you think you have the expertise, knowledge and general understanding of what causes a brine well to collapse? Yes ☑ No ☐
Do you think OCD should provide guidelines on subsidence and collapse issues? Yes ☑ No ☐

SITING INFORMATION: ***Please provide the following information and depict on 7.5 minute (1": 2000') USGS Quad Map. Limit search to one mile radius.***

Is the brine well located within a municipality or city limits? Yes ☐ No ☑

Distance and direction to nearest permanent structure, house, school, *etc. if less than one mile:*
1/2 mile a barn

Distance and direction to nearest water well *if less than one mile:*
1/4 of a mile

Distance to nearest watercourse(s), floodplain, playa lake(s), or man-made canal(s) or pond(s) *if less than one mile:* 1/4 mile

Distance and direction to nearest known karst features or mines *if less than one mile:*

Distance and direction to nearest producing oil or gas well(s) *if less than one mile:* Provide API Number: N/A
Distance and direction to nearest tank battery(ies) *if less than one mile:* N/A
Distance and direction to nearest pipeline(s), including fresh water pipelines *if less than one mile:* N/A
Distance and direction to nearest paved or maintained road or railroad *if less than one mile:* 1 mile
Depth to ground water found above the Salado (salt section), regardless of yield:
Name of aquifer(s):
WELL CONSTRUCTION: ***Please provide the following information and attach a diagram depicting the brine well. Check box if attached:*** *Copy of a current well diagram:* *Attached* ☐ *Copy of formation record with tops:* *Attached* ☐ *Copy of geophysical well logs if available:* *Attached* ☐ *If not, well logs within one mile* ☐
Depth of the top of the salt below ground surface (feet): 1600ft
Depth to the bottom of the salt below ground surface (feet): Not Sure
Depth(s) to and thickness(es) of any anhydrite section(s) (located above the salt): 300ft at least
Depth of casing(s) shoe below ground surface (feet): 1900 ft Is the casing shoe set in the anhydrite or other layer above the salt? Yes ☑ No ☐ Is the casing shoe set into the salt? Yes☐ No☐ If yes, how far into the salt?
Depth of tubing(s): 2400 ft
Do you suspect that your cavern has partially caved in? Yes☐ No☐ Don't know☑
OPERATIONS: *Please provide the following information.*
Start date of brine well operation: 3-6-1980
Total volume of fresh water injected into the brine well to date (bbls) and how determined: UNSURE

Total volume of brine water produced (bbls) to date and how determined:
Have you ever lost casing or tubing? If yes, please provide details. Yes in the 90's Document attached ☐
Do you maintain a surface pressure on your well during idle times? Yes☑ No☐
Have you noticed large amounts of air built up during cavity pressurization? Yes☐ No☑
Have you ever noticed fluids or air/gas bubbling up around the casing during testing or normal operations? Yes☐ No☑
MONITORING: ***Please provide the following information.***
Are you currently monitoring ground water contamination from your brine well or system? Yes ☑ No☐
Have you ever run a sonar log? Yes☐ No☑ *If yes,* please provide last date:_____
Provide cavern configuration (dimensions and volume) and method(s) used to estimate: If sonar report please attach ☐ *If other, please specify and provide a sketch of cavern:* ☐
Do you have a subsidence monitoring program in place? Yes ☐ No☑
Do you have any geophysical monitoring devices, such as a seismic device positioned near your brine well? Yes ☐ No☑
Have you submitted all of your monthly, quarterly, or annual reports to the OCD? Yes ☐ No☑ We are now but previously some had been missed
Have you failed a brine well mechanical integrity test (MIT)? If yes, please attach details and results. Attached ☐ NO
Have you ever had a casing leak? Yes ☑ No☐ Have you ever had a cavern leak? Yes ☐ No☑ Don't know ☐ Have you ever exceeded the cavern fracture pressure? Yes ☐ No☑ Don't know ☐ Do you know how to calculate your maximum pressure? Yes ☐ No☐ Don't know ☑
Have you routinely looked for cracks or fissures in the ground surface around your brine well? Yes ☑ No☐
Do you have any minor or major cracks, fissures, tank settlement, line breakage from settlement or any minor subsidence. Yes ☐ No☑
During operations have you experienced any ground vibration, ground movement, or well movement after opening or shunting valves, pump start-up, shut-down, etc.? Yes☐ No☑

Have you ever experienced unexpected pressure gain or loss in the cavern? Yes☐ No☑
If Yes, was there a difference in your normal flow rate? Yes☐ No☑

Anytime during the past 5 years, have you experienced a noticeable difference between fresh water volume pumped into the well verses brine water produced? Yes ☐ No☑

Are you concerned about pulling the tubing due to the fact it may be difficult to re-enter the hole? Yes☑ No☐

Are you concerned about running a sonar tool in fear of losing tool because of debris in hole? Yes☑ No☐

Have you ever conducted a fly over of your well site? No☐ *Yes☑ if yes, please provide photo.*
☐ *Photo(s) attached* No Photos taken

Calculation: Please divide your estimated total volume of produced brine by 180,000 and multiply by 50. ***Example:*** If you have produced a total of 18,000,000 bbls of brine in the life time of the well then your calculation would be 18,000,000/180,000 = 100 x 50 = 5000.

1. Provide the calculated number above here:_____.
2. Now provide the depth (ft) from the surface to your casing shoe:_____ .

Is the calculated number found in #1 above greater than #2? Yes☐ No☐

Comments or recommendations for OCD:

While we have not previously been there to submit all reports we are now striving to do ~~anything~~ everything

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

Salty Dog
Company Name~~-print~~ name above

James Millett
Company Representative- print name

Company Representative- Signature

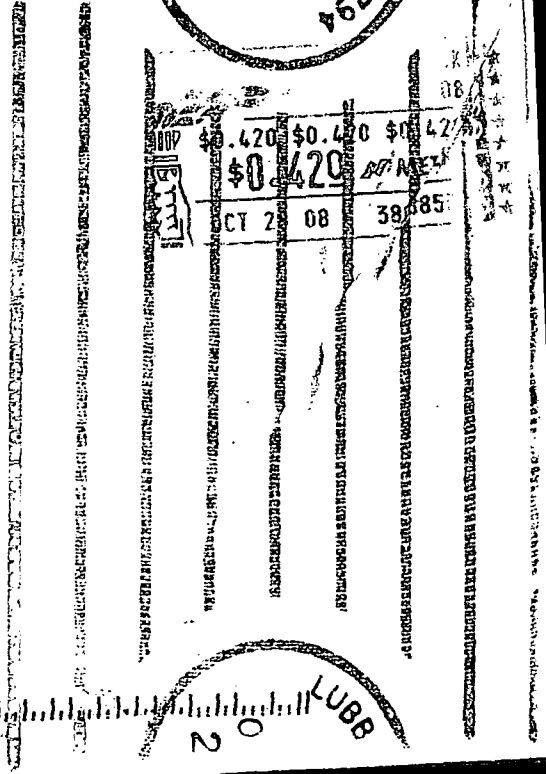
Title Manager

Date: 10-14-2008

ity Dog
2724
bbock, TX
79408

Wayne Price
OCD
1220 S St. Francis Dr
Santa Fe, NM 87505

87505$4225 C011



New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

Certified Receipt/Return Requested:

August 01, 2008

Attention Brine Well Operator(s):

One of the permitted brine wells has experienced a total collapse and created an enormous sinkhole. The well was located approximately 17 miles SE of Artesia, NM. on State Trust Land. The operator was Jim's Water Service and the brine well permit is BW-005. OCD has enclosed a press release with photos of the event.

The magnitude of this event warrants an immediate investigation of all brine wells in the state. Therefore, please find enclosed a "BRINE WELL INFORMATION REQUEST" form to be filled out and returned to this office no later than September 05, 2008. Failure to properly fill out and return the form in a timely manner may result in OCD requesting you shut down your operations until further notice. If you have any questions please do not hesitate to call me at 505-476-3490 or E-mail wayne.price@state.nm.us.

Sincerely,

Wayne Price
Environmental Bureau Chief
Oil Conservation Division

Attachments: (2)

Cc: EMNRD Cabinet Secretary-Joanna Prukop
OCD Director-Mark Fesmire
NMSLO- Brian Henington SF, Jim Carr-Carlsbad
BLM-Carlsbad Office- Dave Herrell
Eddy Co. Emergency Management-Joel Arnwine
NM State Police –Roswell Sgt. Les Clements
National Cave and Karst Research Institute- Dr. George Veni
NMOSE-John Stewart
Solution Mining Research Institute-John Voigt

Price, Wayne, EMNRD

From: Porter, Jodi, EMNRD
Sent: Wednesday, July 23, 2008 5:00 PM
Subject: PR-Secretary Prukop Proposes Stricter Conditions on Brine Wells State-wide
Attachments: PR-OCD.Brine.Wells07.23.08.pdf

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

July 23, 2008

NEWS RELEASE

Contact: Jodi McGinnis Porter,
Public Information Officer 505.476.3226

Energy, Minerals and Natural Resources Cabinet Secretary Joanna Prukop Proposes Stricter Conditions on Brine Wells State-wide

Artesia brine well collapse prompts statewide review

SANTA FE, NM – Secretary Joanna Prukop has directed the Oil Conservation Division (OCD) to conduct a complete evaluation of the rules and regulations concerning brine wells, a method of creating saturated salt water used in oil and gas production. The OCD evaluation will include an internal audit and inspection of all existing brine wells in New Mexico. Secretary Prukop is considering strengthening oversight of brine wells to protect against well failures such as the recent collapse in Artesia that created a huge sinkhole and forced the closure of an Eddy County road.

"There are several brine wells in New Mexico and we must ensure that they are all properly monitored to ensure safety and stability," stated Cabinet Secretary Joanna Prukop. "We have now seen that these wells can collapse and the extensive damage such a collapse can generate."

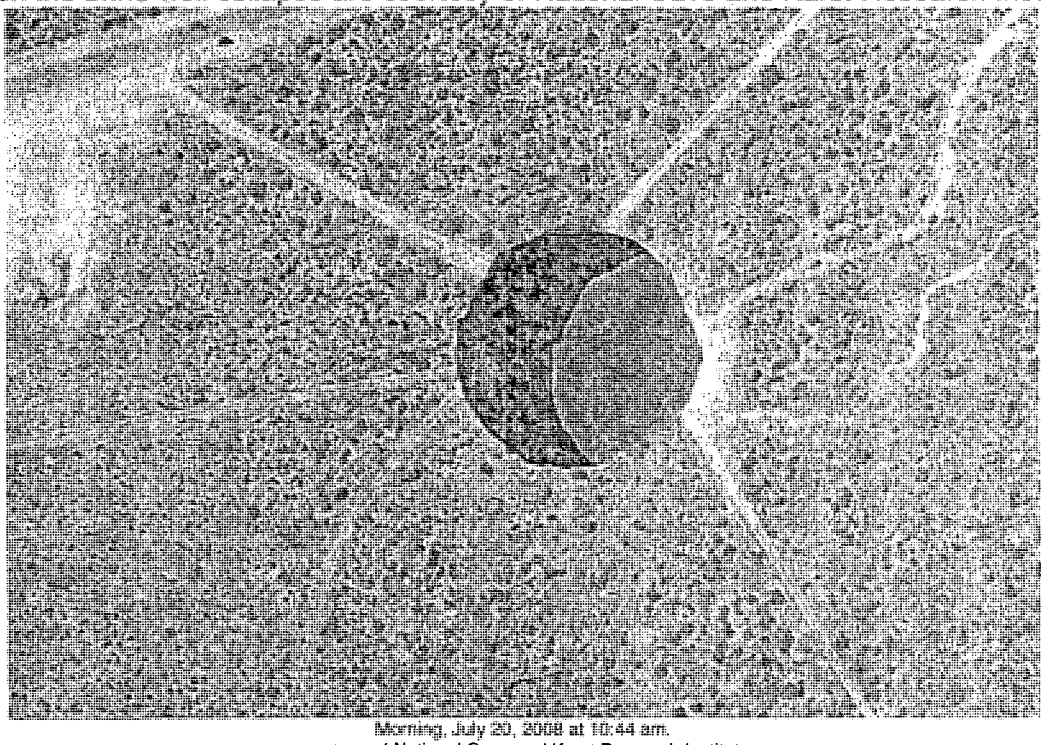
The Oil Conservation Division is continuing to monitor and investigate the collapse of the brine well, located on state trust land 17.3 miles southeast of Artesia, which is still active. The well is owned by Jim's Water Service. County Road 217 remains closed as a safety precaution, and a command center is on site. Division engineers estimate that the well is approximately 300 to 400 feet in diameter, 70 feet to the water level, and the actual depth to the bottom is unknown.

Scientists from the Oil Conservation Division, the Bureau of Land Management, State Land Office, the New Mexico

Bureau of Geology and Mineral Resources, and the National Cave & Karst Research Institute are all working together to assess horizontal and vertical movements to project any future subsidence. Work on a protective fence and keep-out signage began yesterday with completion expected on Friday.

In a related issue, the Oil Conservation Division has also been closely monitoring a brine well operated by I & W, Inc located in Carlsbad, NM. Yesterday, following ongoing inquiries from OCD the operator decided voluntarily to stop operation of the well The division will work with I & W, Inc. to ensure that the well is properly plugged, permanently abandoned, and monitored for the long term.

Images provided on the brine well collapse are courtesy of National Cave and Karst Research Institute:



Morning, July 20, 2008 at 10:44 am.
courtesy of National Cave and Karst Research Institute

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

OIL CONSERVATION DIVISION
BRINE WELL INFORMATION REQUEST

GENERAL INFORMATION:
Operator Name_____ Well Name(s)_____ API Number _____ Brine Well Permit # _____ Date Permit Expires? _____ Location: Section _____Ts _____ Rg _____ FNL_____FSL_____FEL_____FWL_____ GPS of well(s): Lat: Long:
Have you reviewed and understand all of your permit conditions? Yes ☐ No☐ Are you presently deficient of any condition in your permit? Yes ☐ No☐ Don't know☐ Do you operate below grade tanks or pits at the site? Yes☐ No☐ Do all tanks, including fresh water tanks, have secondary containment? Yes☐ No☐ Do you think you have the expertise, knowledge and general understanding of what causes a brine well to collapse? Yes☐ No☐ Do you think OCD should provide guidelines on subsidence and collapse issues? Yes☐ No☐
SITING INFORMATION: ***Please provide the following information and depict on 7.5 minute (1": 2000') USGS Quad Map. Limit search to one mile radius.***
Is the brine well located within a municipality or city limits? Yes☐ No☐
Distance and direction to nearest permanent structure, house, school, *etc. if less than one mile:*
Distance and direction to nearest water well *if less than one mile:*
Distance to nearest watercourse(s), floodplain, playa lake(s), or man-made canal(s) or pond(s) *if less than one mile:*
Distance and direction to nearest known karst features or mines *if less than one mile:*

Distance and direction to nearest producing oil or gas well(s) *if less than one mile:* Provide API Number:
Distance and direction to nearest tank battery(ies) *if less than one mile:*
Distance and direction to nearest pipeline(s), including fresh water pipelines *if less than one mile:*
Distance and direction to nearest paved or maintained road or railroad *if less than one mile:*
Depth to ground water found above the Salado (salt section), regardless of yield:
Name of aquifer(s):
WELL CONSTRUCTION: ***Please provide the following information and attach a diagram depicting the brine well. Check box if attached:*** *Copy of a current well diagram:* *Attached* ☐ *Copy of formation record with tops:* *Attached* ☐ *Copy of geophysical well logs if available:* *Attached* ☐ *If not, well logs within one mile* ☐
Depth of the top of the salt below ground surface (feet):
Depth to the bottom of the salt below ground surface (feet):
Depth(s) to and thickness(es) of any anhydrite section(s) (located above the salt):
Depth of casing(s) shoe below ground surface (feet):_____ Is the casing shoe set in the anhydrite or other layer above the salt? Yes ☐ No ☐ Is the casing shoe set into the salt? Yes☐ No☐ If yes, how far into the salt?_____
Depth of tubing(s):
Do you suspect that your cavern has partially caved in? Yes☐ No☐ Don't know☐
OPERATIONS: *Please provide the following information.*
Start date of brine well operation:
Total volume of fresh water injected into the brine well to date (bbls) and how determined:

Total volume of brine water produced (bbls) to date and how determined:
Have you ever lost casing or tubing? If yes, please provide details. Document attached ☐
Do you maintain a surface pressure on your well during idle times? Yes☐ No☐
Have you noticed large amounts of air built up during cavity pressurization? Yes☐ No☐
Have you ever noticed fluids or air/gas bubbling up around the casing during testing or normal operations? Yes☐ No☐
MONITORING: ***Please provide the following information.***
Are you currently monitoring ground water contamination from your brine well or system? Yes ☐ No☐
Have you ever run a sonar log? Yes☐ No☐ *If yes,* please provide last date:_____
Provide cavern configuration (dimensions and volume) and method(s) used to estimate: If sonar report please attach ☐ *If other, please specify and provide a sketch of cavern:* ☐
Do you have a subsidence monitoring program in place? Yes ☐ No☐
Do you have any geophysical monitoring devices, such as a seismic device positioned near your brine well? Yes ☐ No☐
Have you submitted all of your monthly, quarterly, or annual reports to the OCD? Yes ☐ No☐
Have you failed a brine well mechanical integrity test (MIT)? If yes, please attach details and results. Attached ☐
Have you ever had a casing leak? Yes ☐ No☐ Have you ever had a cavern leak? Yes ☐ No☐ Don't know ☐ Have you ever exceeded the cavern fracture pressure? Yes ☐ No☐ Don't know ☐ Do you know how to calculate your maximum pressure? Yes ☐ No☐ Don't know ☐
Have you routinely looked for cracks or fissures in the ground surface around your brine well? Yes ☐ No☐
Do you have any minor or major cracks, fissures, tank settlement, line breakage from settlement or any minor subsidence. Yes ☐ No☐
During operations have you experienced any ground vibration, ground movement, or well movement after opening or shunting valves, pump start-up, shut-down, etc.? Yes☐ No☐

Have you ever experienced unexpected pressure gain or loss in the cavern? Yes☐ No☐ If Yes, was there a difference in your normal flow rate? Yes☐ No☐
Anytime during the past 5 years, have you experienced a noticeable difference between fresh water volume pumped into the well verses brine water produced? Yes ☐ No☐
Are you concerned about pulling the tubing due to the fact it may be difficult to re-enter the hole? Yes☐ No☐
Are you concerned about running a sonar tool in fear of losing tool because of debris in hole? Yes☐ No☐
Have you ever conducted a fly over of your well site? No☐ *Yes☐ if yes, please provide photo.* ☐ *Photo(s) attached*
Calculation: Please divide your estimated total volume of produced brine by 180,000 and multiply by 50. ***Example:*** If you have produced a total of 18,000,000 bbls of brine in the life time of the well then your calculation would be 18,000,000/180,000 = 100 x 50 = 5000. 1. Provide the calculated number above here:_____. 2. Now provide the depth (ft) from the surface to your casing shoe:_____ . Is the calculated number found in #1 above greater than #2? Yes☐ No☐
Comments or recommendations for OCD:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

_____
Company Name-print name above

_____
Company Representative- print name

_____
Company Representative- Signature

Title_____

Date:_____

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, July 25, 2008 4:21 PM
To: Hansen, Edward J., EMNRD; Price, Wayne, EMNRD
Cc: Sanchez, Daniel J., EMNRD
Subject: RE: PR-Secretary Prukop Proposes Stricter Conditions on Brine Wells State-wide
Attachments: image001.jpg; image007.jpg

Ed, Wayne, et. al:

Based on my records and knowledge of current activities at NMOCD BWs, my tally is as follows:

There are a total of 15 active UIC Class III Brine Well Permits (excluding BW-5 JWS & BW-6 I&W)

There are currently 13 active UIC Class III Brine Wells in operation (BW-2; BW-4; BW-8; BW-9; BW-12; BW-13; BW-22; BW-25; BW-27 Wells 1 & 2; BW-28; BW-30; and BW-31)

There are currently 6 brine wells that have actually been PA'd including: BW-5 JWS Collapse w/ Site Closure; BW-6 Eugenie #2; BW-21 Loco Hills Well #1 recently PA'd; BW-26 Salado Brine Sales; BW-29 Marbob; & William Brininstool.

There are currently 3 pending PAs of BWs including: BW-6 Eugenie #1 w/ Site Closure; BW-18 Key w/ redrill; and BW-19 Key w/ redrill.

There are currently 5 inactive brine wells (BW-5 Collapse w/ Site Closure; BW-6 needs PA Eugenie #1 w/ Site Closure; BW-18 needs PA w/ redrill; BW-19 needs PA w/ redrill; and BW21 needs redrill)

Let me know how we need to straighten RBDMS out. Please contact me if you have questions. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3491
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/index.htm
(Pollution Prevention Guidance is under "Publications")

From: Hansen, Edward J., EMNRD
Sent: Wednesday, July 23, 2008 5:56 PM
To: Price, Wayne, EMNRD
Cc: Chavez, Carl J, EMNRD
Subject: FW: PR-Secretary Prukop Proposes Stricter Conditions on Brine Wells State-wide

Wayne,
Jane and I tallied these numbers off of RBDMS (you may want to double check).

From: Hansen, Edward J., EMNRD
Sent: Wednesday, July 23, 2008 5:54 PM
To: Porter, Jodi, EMNRD
Subject: RE: PR-Secretary Prukop Proposes Stricter Conditions on Brine Wells State-wide

Jodi,

We counted (from our database: RBDMS):

16 Active Brine Wells

11 Plugged and Abandoned Brine Wells

2 Inactive Brine Wells

From: Porter, Jodi, EMNRD
Sent: Wednesday, July 23, 2008 5:00 PM
Subject: PR-Secretary Prukop Proposes Stricter Conditions on Brine Wells State-wide

New Mexico Energy, Minerals and Natural Resources Department

July 23, 2008

NEWS RELEASE

Contact: Jodi McGinnis Porter,
Public Information Officer 505.476.3226

Energy, Minerals and Natural Resources Cabinet Secretary Joanna Prukop Proposes Stricter Conditions on Brine Wells State-wide

Artesia brine well collapse prompts statewide review

SANTA FE, NM – Secretary Joanna Prukop has directed the Oil Conservation Division (OCD) to conduct a complete evaluation of the rules and regulations concerning brine wells, a method of creating saturated salt water used in oil and gas production. The OCD evaluation will include an internal audit and inspection of all existing brine wells in New Mexico. Secretary Prukop is considering strengthening oversight of brine wells to protect against well failures such as the recent collapse in Artesia that created a huge sinkhole and forced the closure of an Eddy County road.

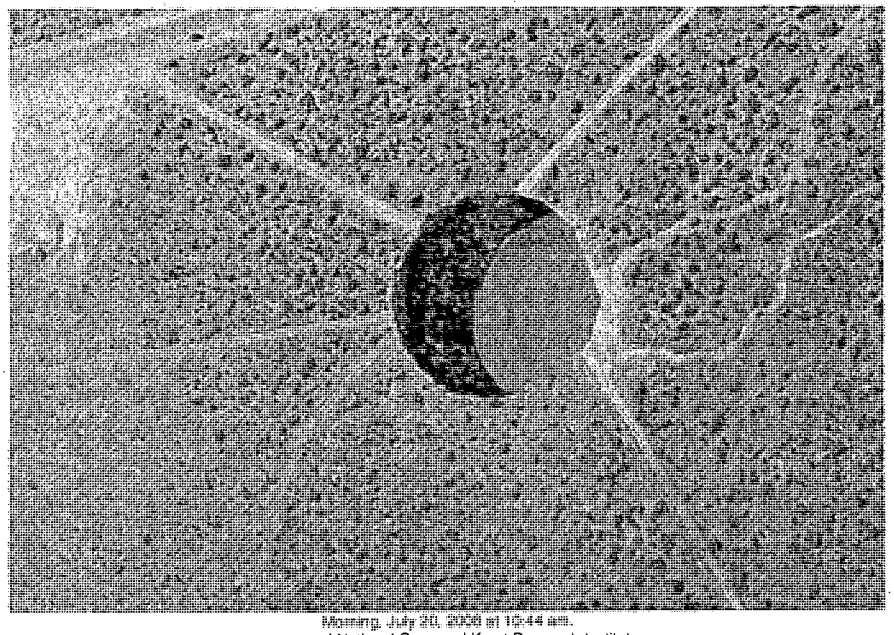
"There are several brine wells in New Mexico and we must ensure that they are all properly monitored to ensure safety and stability," stated Cabinet Secretary Joanna Prukop. "We have now seen that these wells can collapse and the extensive damage such a collapse can generate."

The Oil Conservation Division is continuing to monitor and investigate the collapse of the brine well, located on state trust land 17.3 miles southeast of Artesia, which is still active. The well is owned by Jim's Water Service. County Road 217 remains closed as a safety precaution, and a command center is on site. Division engineers estimate that the well is approximately 300 to 400 feet in diameter, 70 feet to the water level, and the actual depth to the bottom is unknown.

Scientists from the Oil Conservation Division, the Bureau of Land Management, State Land Office, the New Mexico Bureau of Geology and Mineral Resources, and the National Cave & Karst Research Institute are all working together to assess horizontal and vertical movements to project any future subsidence. Work on a protective fence and keep-out signage began yesterday with completion expected on Friday.

In a related issue, the Oil Conservation Division has also been closely monitoring a brine well operated by I & W, Inc located in Carlsbad, NM. Yesterday, following ongoing inquiries from OCD the operator decided voluntarily to stop operation of the well The division will work with I & W, Inc. to ensure that the well is properly plugged, permanently abandoned, and monitored for the long term.

Images provided on the brine well collapse are courtesy of National Cave and Karst Research Institute:



Morning, July 20, 2008 at 10:44 am.
courtesy of National Cave and Karst Research Institute

Morning, July 22, 2008
courtesy of National Cave and Karst Research Institute

#30#

The Energy, Minerals and Natural Resources Department provides resource protection and renewable energy resource development services to the public and other state agencies.

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Jodi

Jodi McGinnis Porter
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7/29/2008

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