SLAWSON
exploration company, inc.

RECEIVED
FEB 13 2014

February 13, 2014

US Environmental Protection Agency
Ground Water Program, 8P-W-GW
1595 Wynkoop Street
Denver, Colorado 80202-1129

Mr. Douglas Minter
Ms. Tricia Pfeiffer

Hand Delivered

Big Bend 1-5 SWD Aquifer Exemption Request
UIC Permit Number ND22184-08837
Sec 5 T151N R92W
Mountrail County, North Dakota

Dear Mr. Minter and Ms. Pfeiffer,

Enclosed please find the Aquifer Exemption request for the Big Bend 1-5 SWD well located in Mountrail County, North Dakota. The request is for a 1900' radius aquifer exemption in the Inyan Kaya formation.

The Big Bend 1-5 SWD (SENW S5 T151N R92W) was drilled, cased with new pipe, and swab tested Inyan Kara formation water in December 2013.

Thank you for your timely response in this matter. If you have any questions, please contact the undersigned at dsmith@slawsoncompanies.com or phone.

Sincerely,

Don Smith, PE
Special Projects Engineer

720.457.2815 O
303.550.4549 C

Rocky Mountain Division

1675 Broadway, Suite 1600
Denver, Colorado 80202
(303) 592-8880 - FAX (303) 592-8881

SLAWSON
exploration company, inc.

EPA Permit Number ND22184-08837
Big Bend 1-5 SWD
2500' FNL & 2400' FWL
SENW Sec 5-T151N-R92W
Mountrail County, ND

Aquifer Exemption Request

Slawson Exploration Company, Inc. is the holder of UIC Permit Number ND22184-08837, a class II permit for the injection of oilfield brine into the Inyan Kara formation of the Dakota Group (Lower Cretaceous). The Big Bend 1-5 SWD (SENW S5 T151N R92W) was drilled, cased with new pipe, and swab tested Inyan Kara formation water in December 2013.

Exemption Description

The Big Bend SWD 1-5 well will dispose of produced Bakken and Three Forks formation waters from the New Town peninsula area which is located south of New Town, ND. The majority of the water will be pipelined to the SWD, with the remaining water trucked. This SWD is necessary to remove as many trucks as possible from the roads to prevent pollution and simultaneously increase road safety. Slawson's goal is to pipe as much water as possible to the Big Bend 1-5 SWD well, minimizing water trucks and hauling traffic. Presently, as shown on Figure 1, the closet SWD to the Big Bend SWD is approximately 12 miles northeast, necessitating truck hauling traffic to travel through the east side of New Town, ND.

The requested aquifer exemption is for the Inyan Kara formation at a depth of 4,871-5,274'. The Inyan Kara is commonly utilized in North Dakota as an injection interval for Class II fluids. All SWD wells shown on Figure 1 inject into the Inyan Kara formation.

In December 2013, the deepest porosity interval in the Inyan Kara of the Big Bend well was perforated (5,247-5,274') and swab tested. The attached Astro-Chem Lab analyses show the Inyan Kara formation water to be between 6,510-9,170 PPM TDS. Since these results are less than the regulatory limit of 10,000 PPM, an aquifer exemption is required to inject into the Inyan Kara formation.

As part of the technical review for the application, Slawson calculated the radius of influence of the proposed injection and determined an aquifer exemption with a 1900' radius is necessary to allow for the proposed injection activity. Therefore, Slawson is requesting EPA approval for a 1900' radius aquifer exemption in the Inyan Kara formation of the Dakota Group for their Big Bend 1-5 SWD to supplement the original granted permit.

Type of Exemption Requested

Slawson is requesting an aquifer exemption for the Inyan Kara formation (Dakota Group) in this area for the following reasons:

1. (**Y**/n) The exempted aquifer does not currently serve as a source of drinking water.

2. (**Y**/n) The exempted aquifer has a total dissolved solids content more than 3,000 and less than 10,000 milligrams per liter (PPM) total dissolved solids (TDS) and is not expected to supply a public water supply system, and

3. (**Y**/n) The exempted aquifer cannot now, and will not in the future, serve as a source of drinking water for any of the following reasons:
   ( ) It produces hydrocarbons;
   (**X**) It is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical: or
   ( ) It is so contaminated that it would be economically or technologically impractical to render the water fit for human consumption.

General Application Information

1. The attached map labeled Figure 2 shows the surface location of all wells within the ½ mile area of review (AOR). There are 6 oil wells and no water wells within the ½ mile AOR, with one oil well just outside the AOR. Figure 3 shows the Big Bend SWD proximity to the New Town & Sanish Aquifers, Lake Sakakawea, and the oil and water wells.

   Oil wells: Coyote 1-32H, Coyote 2-32H, Coyote 3-32H, Jericho 1-5H Jericho 2-5H TF, Jericho 3-5H, and Jericho 4-5H. Note- the Jericho 1-5H is outside the ½ mile AOR, but has been included.

   Water wells-none, with the closest water well approximately 4,550+ feet SE and at a depth of 79 feet. All water wells shown on figure 3 are shallow, with depths ranging between 79-292 feet deep.

2. A written description of the following:

   a. Name of the aquifer to be exempted;
      Inyan Kara formation (also referred to as the Dakota or Dakota Sandstone)

   b. Subsurface depth or elevation of the injection zone;
      Open hole logs indicate the Inyan Kara is found between 4,871-5,274' feet. MD. The top of the Dakota Group in the proposed injection well is 4503'. (Big Bend 1-5 SWD open hole logs dated Nov 30, 2013 included).

c. Confining layers separating the injection zone from other underground sources of drinking water (USDWs);

See attached well bore diagram (WBD) Figure 4, a schematic of the construction of the current and proposed well with geology noted.
There are two major USDWs (Hell Creek & Fox Hills) and several minor shallow USDWs above the Pierre Shale. All of the USDWs are separated from the injection zone by several shale formations of aggregate thickness 3,166'.

Immediately above the injection zone and within the Dakota Group are the Skull Creek Shale and Mowry Shale for a total thickness of 368'.

Above the Dakota Group is the Colorado Group which is 899' thick, consisting of the Belle Fourche Shale (211'), Greenhorn Shale (188'), Carlile Shale (234'), and Niobrara Shale (266').

Also, above the Colorado Group is the Montana Group consisting of the Pierre Shale, which is 1899' thick in the Big Bend 1-5 SWD well. Any USDW in the Big Bend wellbore above the injection zone is protected by approximately 3,166' of impermeable shale as listed above.

Below the injection zone, any potential USDWs are protected by the Jurassic Swift formation, which is approximately 444' thick. (Reference Jericho 2-5H-TF on cross sections A-A' and B-B' attached. Cross Section key is noted as Figure 5). The Jericho 2-5H TF is approximately 2430+ feet NE of the Big Bend SWD.

d. Thickness of the proposed exempted aquifer;

The thickness of the proposed exempted aquifer, based on open hole logs is 403'. However, the proposed injection well will be selectively perforated from 4,898- 5,274', resulting in 177 net feet of injection interval.

e. Method and calculations used to delineate the exempted aquifer and the area of the exemption;

Slawson used a conservative approach to calculate the radius of influence based on forecasted produced water volumes. (See Figure 6). Based on this method, the calculated area of influence is 241.8 acres contained within a radius of 1,831.0' based on injection of 71,650,000 barrels water injected.

Based on the calculated radius of influence, Slawson is requesting a slightly larger aquifer exemption of 1,900 feet to allow a buffer to ensure the exemption is large enough to cover the entire radius of influence.

f. Water quality analysis from the aquifer to be exempted.

Attached is a copy of the Astro-Chem Lab water analysis (Figure 7a-7c) conducted in December 2013 on the Big Bend 1-5 SWD from Inyan Kara perforations 5,247-5,274'. Below is a summary of the results.

Swab Volume (BBLS)	Conductivity (mS/cm3)	TDS (mg/L)
300	9,300	6,510
400	13,100	9,170
500	12,560	8,790
600	13,390	8,676
715	12,250	7,769

The primary ions include sodium, chloride, and bicarbonate with traces of sulfate. As shown in the data table above, the TDS levels in the Inyan Kara in the Big Bend 1-5 SWD well are within 3,000-10,000 mg/L, requiring an aquifer exemption.

Presently the Inyan Kara formation of the Dakota Group is utilized as an injector in North Dakota (See attached NDIC approved blanket lands Order # 3062). Also, within the ½ mile AOR, there are no USDWs located within the Inyan Kara formation .

g. Water quality analysis from the proposed injection water.

Both the Bakken and Three Forks formation waters contain high concentrations of chlorides, sodium and some calcium, making the physical characteristics of the two waters very similar with total dissolved solids (TDS) up to 344,000 PPM as published in the Catalog of North Dakota Water Chemistries. Below are grab sample analyses of each formation and the results are well within the range of the Catalog. These waters have no secondary use and therefore are disposed of in Class II wells.

Source	Location	Formation	Sample Date	TDS (mg/L)
Sniper Fed 2-6-7H	S6-151-92	Bakken	3/08/13	266,664.4
Sniper Fed 5-6-7TFH	S6-151-92	Three Forks	3/08/13	284,800.7

(Note: See figures 8a & 8b)

h. Information on wells within the exempted area (including 1/2 mile buffer) including construction information and well schematics (WBD).

There are six Slawson operated oil wells within the ½ mile AOR which are located in the northern half of Sec 5 T151 R 92W and are listed below.

Coyote 1-32H, Coyote 2-32H, Coyote 3-32H, Jericho 1-5H[*1], Jericho 2-5H-TF, Jericho 3-5H, and Jericho 4-5H.

([*1] Jericho 1-5H is outside the AOR, however, WBD is included).

All Slawson wells within the New Town peninsula are constructed with the same design criteria. 9 5/8" 36# J55 surface pipe set into the Pierre Shale (1600+') and cement circulated to surface. Intermediate 7" P110 is run from surface and set below the kick off point (KOP 9,650-9,750') into the Bakken (or Three Forks) formation at 90 degrees horizontal) with top of cement designed above the Dakota formation. A 4 1/2" P110 liner with multiple frac packers is run to TD with liner overlap to the KOP. The 7" casing and liner hanger equipment are pressure tested to 7800 PSIG prior to fracture stimulation. (See attached WBDs with specific casing set points for each individual well, figures 9a-9g).

Specific Application Information

The purpose of this information is to support Slawson's determination that the proposed exempted aquifer is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical.

1. Distance from the proposed exempted aquifer to public water supplies;

The proposed aquifer exemption is approximately 3.5 miles south of the nearest public water supply for the city of New Town, ND and approximately 2 miles from Lake Sakakawea's closest shore, a source for the Fort Berthold Indian Reservation farther downstream. The New Town city water supply consists of three (3) ground water wells penetrating the New Town Aquifer. The table below provides additional information about New Town's groundwater sources:

Well ID	Aquifer	Depth
152-092-19AA	New Town	175'
152-092-19AAA	New Town	173'
152-092-20BBb	New Town	184'

2. Current sources of water supply for the potential users of the proposed exempted aquifer;

The principal USDWs in the area of the proposed aquifer exemption are the New Town Aquifer, Sanish Aquifer, and Missouri River/Lake Sakakawea. The list below shows the approximate depth and TDS of other common water sources that are available.

Name	Depth *1	TDS mg/L *2
Coleharbor Formation	0'	
Bullion Creek Formation	23'	2,110
Cannonball Formation	558'	
Hell Creek Formation	1,043'	1,530
Fox Hills Formation	1,413'	1,530

*1 Source: Clayton, Lee, 1972. "Geology of Mountrail County, North Dakota", North Dakota Geological Survey Bulletin 55-IV.

Bluemle, John P., Sidney B. Anderson, John A. Andrew, David W. Fischer and Julie A. LeFever, 1986. "North Dakota Stratigraphic Column", North Dakota ?Geological Survey Miscellaneous Series 66.

*2 Source: USGS Water Resources of North Dakota/Water Resources of the Fort Berthold Indian Reservation, West Central North Dakota, Report 98-4098 p1.

The Fox Hills formation in this area is approximately 290' thick with the top at 1,413'. Note the Hell Creek and Fox Hills formations are connected hydrologically and are therefore considered to be a single aquifer. This combined aquifer underlies the entire Reservation and ranges from 100 to 350 feet in thickness. USGS 98-4098 p10.

3. Availability and quality of alternative water sources;

Water resources of the New Town peninsula & Fort Berthold Indian Reservation occur as ground water in bedrock and buried-valley aquifers which are readily available and as surface water in Lake Sakakawea. The below table shows the water resource water allocation for the peninsula.

Resource	Mean TDS (mg/L)	Approximate peninsula (Volume Ac-Ft)
Sentinel Butte formation	1,300	1,250,500
Tongue River formation	2,110	1,925,500
Fox Hills/Hell Creek formation	1,530	4,091,600
New Town Aquifer	1,390	127,500
Sanish Aquifer	1,350	240,000

Total New Town peninsula water available (Ac-Ft) 7,635,100
(Reference USGS Report 98-4098 pgs. 1, 10, 18, 23, 37, 39).

Note: Lake Sakakawea is not included in the above total, however, the lake holds a permanent pool of 4,980,000 Ac-Ft with a top range of 23,821,000 Ac-Ft with a useable volume up to 18,841,000 Ac-ft. (US Corp of Engineers, Mr. Todd Lindquist phone conversation Jan. 2014).

4. Estimated costs to develop the proposed exempted aquifer as a water supply source including any treatment costs and costs to develop alternative water supplies. Include costs for well construction, transportation, and water treatment for each source;

The primary factor controlling the cost of developing the proposed exempted aquifer as a water supply source is depth and water quality. As shown above, the Inyan Kara is found at approximately 4,898' below land surface, with a total depth of 5,444'. In contrast, the better quality Fox Hills/ Hell Creek formation, is available at approximately 1,413' below land surface and an approximate TD of 1,710', with several other acceptable formations at shallower depths.

Slawson recently drilled, cased, and partially perforated the Big Bend 1-5 SWD for a cost of $1,085,900. A phone conversation with Rex at Backman Drilling (701.734.6667) located in Wilton, ND provided verbal information for 5" cased domestic wells of $31.00/foot. Agri Industries Inc. (Williston, ND) provided verbal information for 100-200 gallon per minute industrial wells for 200' 10" casing of approximately $40,000, a 900' Ft. Union well around $60,000 and a 1600' Fox Hills well approximately $150,000. Dennis Water Well Service located in New Town, ND (701.627.2390) provided a verbal quote of $280,000 to drill a Fox Hills well. These costs represented do not include location construction or surface equipment, as it is assumed that these additional costs would be the same for each formation.

Aquifer	Depth (TD)	Estimated TD well cost
Unnamed	200'	$ 6,200[1]
New Town	200'	$ 40,000
Ft. Union	900'	$ 60,000
Fox Hills	1,805'	$280,000
Inyan Kara	5,444'	$1,085,900

As can be observed above, drilling cost varies by depth, size of hole, and contractor. The estimated total depth drilling cost to drill an Inyan Kara water supply well exceeds the cost of drilling a Fox Hills water supply well by an estimated $805,900, with additional savings and shallower depths. Therefore, based on cost, the quantity, and quality of the water available in the Fox Hills/Hell Creek aquifers and other supplies located at

shallower depths, it is Slawson's opinion the proposed exempted aquifer is situated at a depth which makes recovery for USDW purposes economically impractical.

[1] Domestic well only, other wells are commercial with larger casing sizes for larger production volumes. Conversations held February 2014.

5. Current sources of public water supply in the area;

As stated above, the principal USDWs in the Peninsula area are the New Town Aquifer and Lake Sakakawea.

6. Are population projections and adequacy of the current water supply to meet future needs;

The table below shows historic population statistics for Mountrail County and the peninsula block population as recorded by the US Census. Also shown are the estimated population for 2014-2020 by county and block. Exhibit 10 defines the block boundary for the peninsula.

Year	Population County	Block Population Peninsula
1910	8491	
1920	12140	
1930	13544	
1940	10482	
1950	9418	
1960	10077	
1970	8437	
1980	7679	
1990	7021	1951
2000	6631	2159
2010	7673	2479
2012	8734	2821 (Est)
2014	9941 (Est)	3210 (Est)
2016	11316 (Est)	3653 (Est)
2018	12881 (Est)	4158 (Est)
2020	14662 (Est)	4731 (Est)

Based on the information above, the population of Mountrail county decreased by approximately 23.9% between 1960 and 2010.

However, even though the data indicates the population of Mountrail County is generally trending downward, the latest Census Bureau's data shows an increase of 1061 or 13.8% for 2012. Using this percent increase, the projected county population through 2020 is estimated to be 14,662 . Similarly, the Block peninsula population could increase to 4731 by 2020.

As previously discussed, it is estimated that the Fox Hills/Hell Creek and other formations as well as the local aquifers have 7,635,100 Ac-Ft of recoverable water (USGS 98-4098). Therefore using the projected 2020 population, there would be 520 Ac-Ft of recoverable water per person in Mountrail County in 2020 and approximately 1613 Ac-Ft of recoverable water per person for the peninsula area alone. (Note: calculation does not include Lake Sakakawea water).

In contrast, EPA website (http://www.epa.gov/watersense/our_water/water_use_today.html) states the average American family uses approximately 300 gallons of water per day. Assuming four people per family, an individual American uses approximately 75 gallons of water per day or 27,375 gallons per year. This amount is equal to 0.084 Ac-Ft per year.

Based on this information, Slawson believes there is sufficient quantity of water available from current supplies to serve current and future population of Mountrail County (and the peninsula area) without the development of the proposed exempted portion of the injection zone.

Conclusion

Slawson requests the EPA approve a 1900' radius aquifer exemption in the Inyan Kara Group for Salt Water Disposal into the Big Bend 1-5 SWD well based on the following:

1. Slawson is the holder of EPA permit number ND22184-08837.

2. The Big Bend 1-5 SWD has been constructed to prevent contamination of fresh water resources by the proposed injection activity.

3. Using a conservative, analytical method, Slawson calculated the radius of influence of the proposed injection to be 1831'. This is slightly smaller than the requested 1900' radius aquifer exemption.

4. The TDS levels in the Inyan Kara formation of the Big Bend 1-5 SWD well are between 6,510-9,170 mg/L which is within the EPA guidelines of 3000-10,000 mg/L.

5. The proposed aquifer is 2 miles from the shore of Lake Sakakawea and 3 miles from the New Town, ND water supply and does not penetrate the New Town or Sanish Aquifers.

6. The New Town Aquifer and Lake Sakakawea are the principal sources of drinking water near the area of the proposed aquifer exemption. The New Town Aquifer is estimated to have 127,500 Ac-Ft of recoverable water and Lake Sakakawea has up to 18,841,000 Ac-Ft of recoverable water.

7. The estimated cost of drilling an Inyan Kara water well is approximately $806,000 more than drilling a Fox Hills water well in the peninsula. The drilling to shallower water formations would represent an even greater savings.

8. Based on the Mountrail County (and peninsula) population trends and the amount of available water in the Sentinel Butte, Tongue River, Fox Hills/Hell Creek formations and New Town and Sanish Aquifers, there is sufficient quantity of water in these resources to serve the current and future population of Mountrail County and the peninsula without the development of the exempted portion of the Inyan Kara formation.

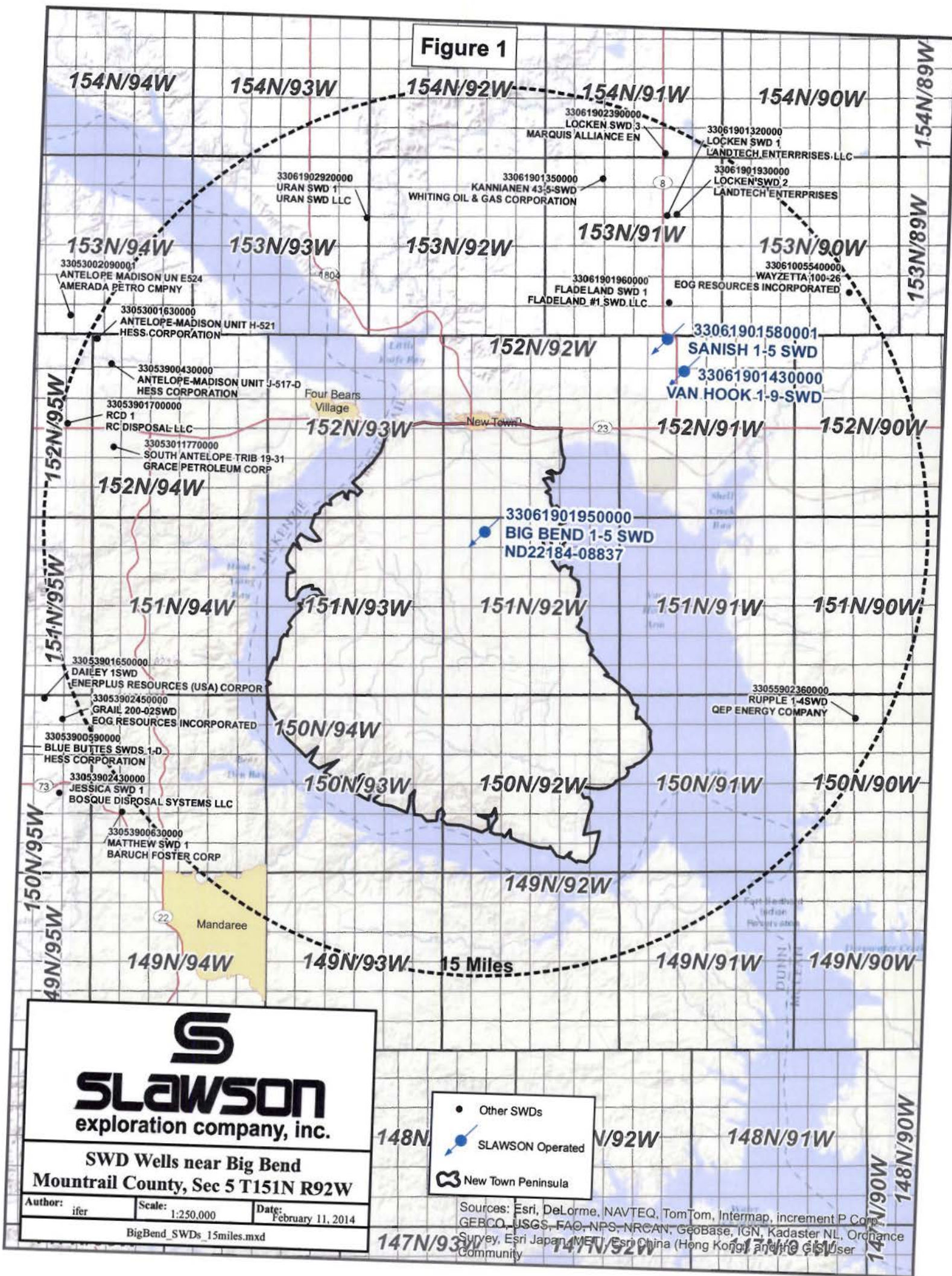
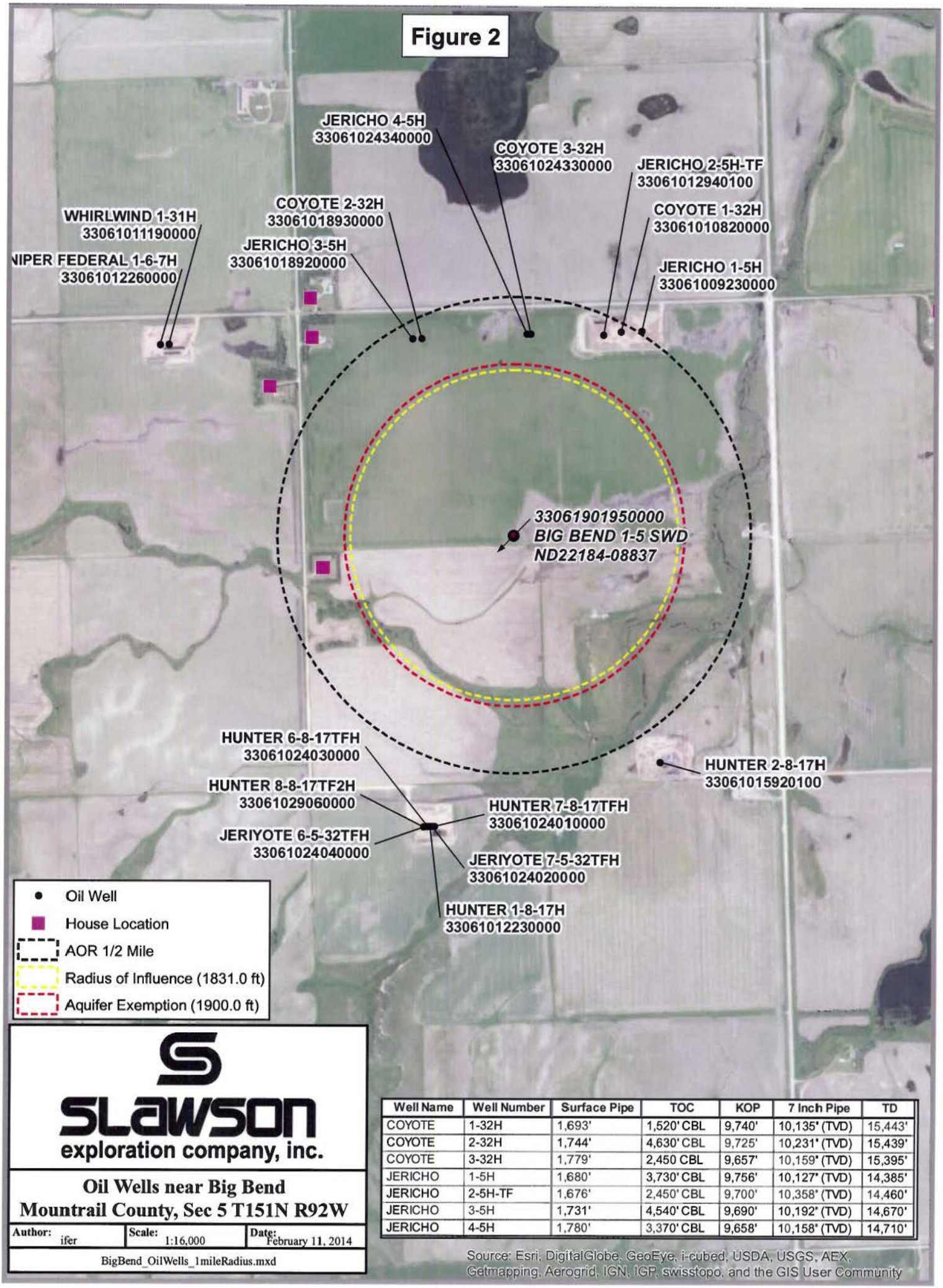


Figure 1
154N/94W
154N/93W
154N/92W
154N/91W
154N/90W
154N/89W
33061902390000
LOCKEN SWD 3
MARQUIS ALLIANCE EN
33061901320000
LOCKEN SWD 1
LANDTECH ENTERRRISES LLC
33061902920000
URAN SWD 1
URAN SWD LLC
33061901350000
KANNIANEN 43-5-SWD
WHITING OIL & GAS CORPORATION
33061901930000
LOCKEN SWD 2
LANDTECH ENTERPRISES
153N/94W
153N/93W
153N/92W
153N/91W
153N/90W
153N/89W
33053002090001
ANTELOPE MADISON UN E524
AMERADA PETRO CMPNY
33061901960000
FLADELAND SWD 1
FLADELAND #1 SWD LLC
33061005540000
WAYZETTA 100-26
EOG RESOURCES INCORPORATED
33053001630000
ANTELOPE-MADISON UNIT H-521
HESS CORPORATION
152N/92W
33061901580001
SANISH 1-5 SWD
33061901430000
VAN HOOK 1-9-SWD
33053900430000
ANTELOPE-MADISON UNIT J-517-D
HESS CORPORATION
Four Bears Village
33053901700000
RCD 1
RC DISPOSAL LLC
152N/93W
New Town
152N/91W
152N/90W
152N/95W
33053011770000
SOUTH ANTELOPE TRIB 19-31
GRACE PETROLEUM CORP
152N/94W
33061901950000
BIG BEND 1-5 SWD
ND22184-08837
151N/94W
151N/93W
151N/92W
151N/91W
151N/90W
151N/95W
33053901650000
DAILEY 1SWD
ENERPLUS RESOURCES (USA) CORPOR
33053902450000
GRAIL 200-02SWD
EOG RESOURCES INCORPORATED
33055902360000
RUPPLE 1-4SWD
QEP ENERGY COMPANY
150N/94W
33053900590000
BLUE BUTTES SWDS 1-D
HESS CORPORATION
33053902430000
JESSICA SWD 1
BOSQUE DISPOSAL SYSTEMS LLC
150N/93W
150N/92W
150N/91W
150N/90W
150N/95W
33053900630000
MATTHEW SWD 1
BARUCH FOSTER CORP
149N/92W
Mandaree
149N/94W
149N/93W
15 Miles
149N/91W
149N/90W
149N/95W
148N/92W
148N/91W
148N/90W
147N/93W
147N/92W
147N/90W
SLAWSON
exploration company, inc.
SWD Wells near Big Bend
Mountrail County, Sec 5 T151N R92W
Author: ifer
Scale: 1:250,000
Date: February 11, 2014
BigBend_SWDs_15miles.mxd
Other SWDs
SLAWSON Operated
New Town Peninsula
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

Figure 2



SLAWSON
exploration company, inc.

Oil Wells near Big Bend
Mountrail County, Sec 5 T151N R92W

Author:	Scale:	Date:
ifer	1:16,000	February 11, 2014

BigBend_OilWells_1mileRadius.mxd

Well Name	Well Number	Surface Pipe	TOC	KOP	7 Inch Pipe	TD
COYOTE	1-32H	1,693'	1,520' CBL	9,740'	10,135' (TVD)	15,443'
COYOTE	2-32H	1,744'	4,630' CBL	9,725'	10,231' (TVD)	15,439'
COYOTE	3-32H	1,779'	2,450 CBL	9,657'	10,159' (TVD)	15,395'
JERICHO	1-5H	1,680'	3,730' CBL	9,756'	10,127' (TVD)	14,385'
JERICHO	2-5H-TF	1,676'	2,450' CBL	9,700'	10,358' (TVD)	14,460'
JERICHO	3-5H	1,731'	4,540' CBL	9,690'	10,192' (TVD)	14,670'
JERICHO	4-5H	1,780'	3,370' CBL	9,658'	10,158' (TVD)	14,710'

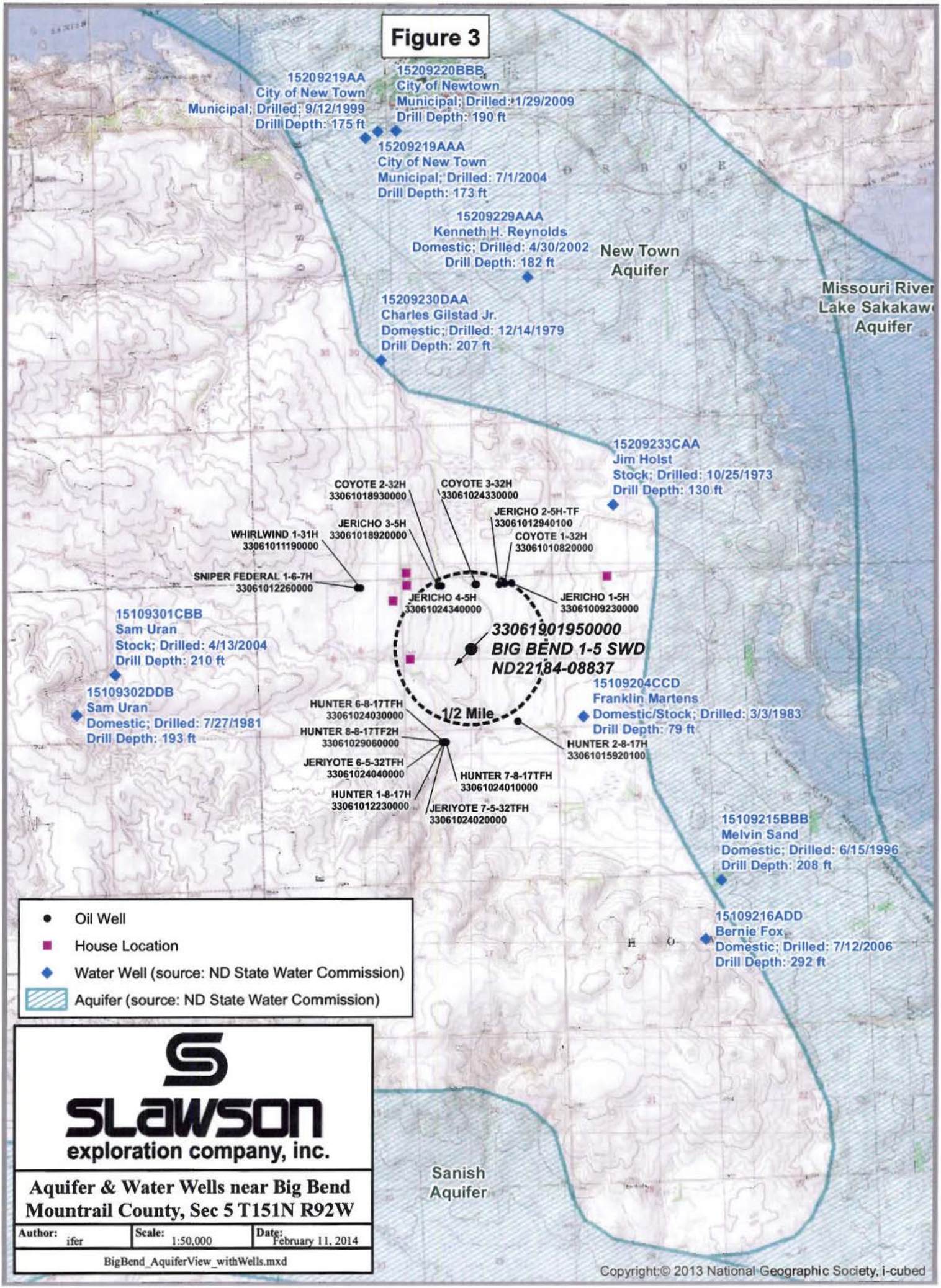


Figure 3
15209219AA
City of New Town
Municipal; Drilled: 9/12/1999
Drill Depth: 175 ft
15209220BBB
City of Newtown
Municipal; Drilled: 1/29/2009
Drill Depth: 190 ft
15209219AAA
City of New Town
Municipal; Drilled: 7/1/2004
Drill Depth: 173 ft
15209229AAA
Kenneth H. Reynolds
Domestic; Drilled: 4/30/2002
Drill Depth: 182 ft
New Town Aquifer
Missouri River
Lake Sakakawe
Aquifer
15209230DAA
Charles Gilstad Jr.
Domestic; Drilled: 12/14/1979
Drill Depth: 207 ft
15209233CAA
Jim Holst
Stock; Drilled: 10/25/1973
Drill Depth: 130 ft
COYOTE 2-32H
33061018930000
COYOTE 3-32H
33061024330000
JERICHO 2-5H-TF
33061012940100
JERICHO 3-5H
33061018920000
COYOTE 1-32H
33061010820000
WHIRLWIND 1-31H
33061011190000
SNIPER FEDERAL 1-6-7H
33061012260000
JERICHO 4-5H
33061024340000
JERICHO 1-5H
33061009230000
33061901950000
BIG BEND 1-5 SWD
ND22184-08837
1/2 Mile
15109301CBB
Sam Uran
Stock; Drilled: 4/13/2004
Drill Depth: 210 ft
15109302DDB
Sam Uran
Domestic; Drilled: 7/27/1981
Drill Depth: 193 ft
15109204CCD
Franklin Martens
Domestic/Stock; Drilled: 3/3/1983
Drill Depth: 79 ft
HUNTER 6-8-17TFH
33061024030000
HUNTER 8-8-17TF2H
33061029060000
HUNTER 2-8-17H
33061015920100
JERIYOTE 6-5-32TFH
33061024040000
HUNTER 7-8-17TFH
33061024010000
HUNTER 1-8-17H
33061012230000
JERIYOTE 7-5-32TFH
33061024020000
15109215BBB
Melvin Sand
Domestic; Drilled: 6/15/1996
Drill Depth: 208 ft
15109216ADD
Bernie Fox
Domestic; Drilled: 7/12/2006
Drill Depth: 292 ft
Oil Well
House Location
Water Well (source: ND State Water Commission)
Aquifer (source: ND State Water Commission)
SLAWSON
exploration company, inc.
Aquifer & Water Wells near Big Bend
Mountrail County, Sec 5 T151N R92W
Author: ifer
Scale: 1:50,000
Date: February 11, 2014
BigBend_AquiferView_withWells.mxd
Sanish Aquifer
Copyright:© 2013 National Geographic Society, i-cubed

Figure 4

SLAWSON exploration company, inc.

WELLBORE DIAGRAM
BIG BEND 1-5 SWD

SE NW SEC 5 T151 R92
2500' FNL and 2400' FWL
Mountrail County, North Dakota

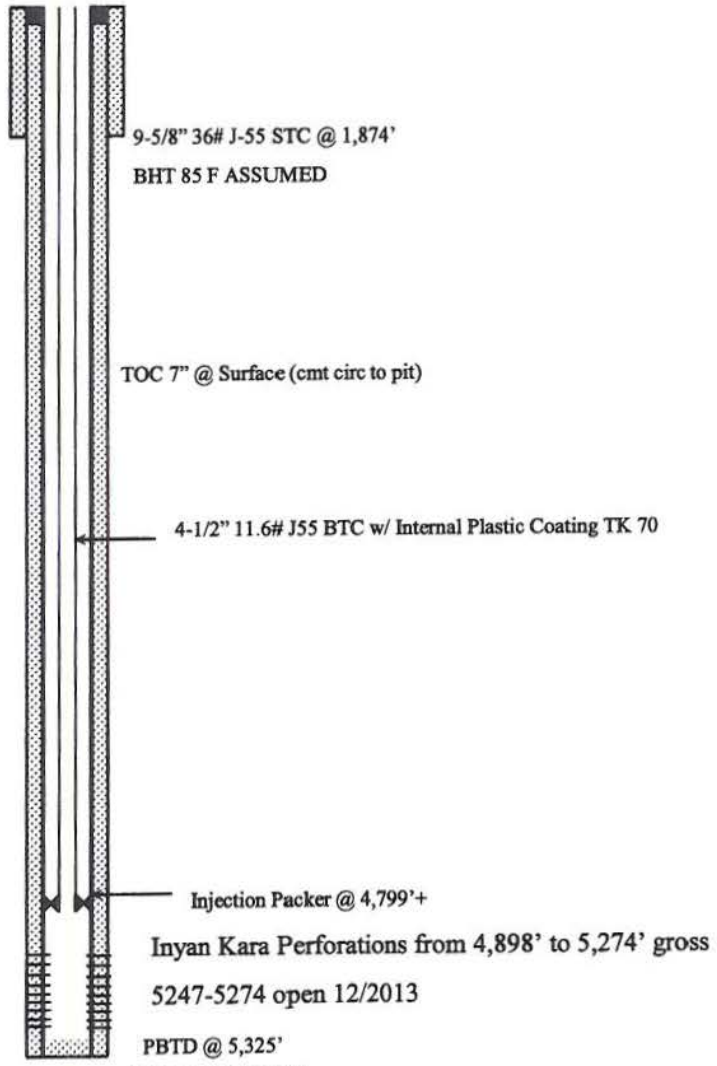
GL ELEVATION = 1898'
KB ELEVATION = 1902'
API#33-061-90195

USDW Surface-1705' < 10,000 TDS
Coleharbor-Fox Hills

Formation	TVD KB
Coleharbor Group	0-23'
Bullion Creek	23'
Cannon Ball	558'
Hell Creek	1,043'
Fox Hills	1,413'
Pierre	1,705'
Niobrara	3,604'
Carlile	3,870'
Greenhorn	4,104'
Belle Fourche	4,292'
Mowry	4,503'
Inyan Kara (Dakota)	4,871'
Swift	5,274'
TD	5,444'

Mowry Upper confining zone 4,503'

Swift Lower confining zone 5,274'



NOTE: NOT TO SCALE

9 5/8" - 360 SXS 11.5 PPG & 135 SXS 13.0 PPG
7" 365 SXS 11.8 PPG & 170 SXS 15.8 PPG 87 BBLS to pit


Figure 5
BARTLESON 11-32H
A
153N/92W
153N/91W
SORENSON 11-3H
B'
BARTLESON 44-1H
PATHFINDER 1-9H
MEERKAT 1-12H
152N/92W
152N/93W
DAKOTA-3 PENNINGTON 16-15H
152N/91W
GENESIS 1-13H
MINX 1-29H
RIPPER 1-22H
ATLANTIS FEDERAL 1-34-35H
JERICHO-2-5H-TF
BIG BEND 1-5 SWD
WOLF 1-4H
HUNTER 1-8-17H
NEPTUNE 1-15H
PEARL 41-13TFH
A'
ARMADA FEDERAL 1-14-13H
151N/93W
151N/92W
151N/91W
B
AH 34-23H
150N/92W
150N/91W
Big Bend 1-5 SWD
Cross Section Line
SLAWSON
exploration company, inc.
Cross-Section Index Map
Author: ifer
Scale: 1:90,000
Date: February 11, 2014
BigBend_CrossSectionIndex.mxd
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

FIGURE 6

BIG BEND 1-5 SWD RADIUS OF INFLUENCE CALCULATIONS

Total anticipated injection w/ 5% Safety Factor	PV	71,650,000	BW
Porosity (OH log dated Nov 30, 2013)	PHI	21.58	%
Thickness 4871-5274' (perfs)	H	177.0	FEET

Assume radial flow (injection)
Formula (BBLS) PV=7758*PHI*AREA*H

AREA=PV/7758/PHI/H	241.8	Acres

AREA=PI*R^2

Radius of Influence= r=(Area/PI)^.5	1831.0	Feet
Aquifer exemption	1900.0	Feet
AOR 1/2 mile	2640.0	Feet

Figure 7a

ASTRO-CHEM LAB, INC.
P.O. BOX 972 - WILLISTON, ND 58802-0972
TELEPHONE
701-572-7355

December 24, 2013

Slawson Exploration Co., Inc.
1675 Broadway
Suite 1600
Denver, CO 80202

Dear Sir:

Waters from the Big Bend 1-5 SWD were submitted on December 23, 2013 for TDS analysis. A conductivity analysis was performed and an approximate TDS was calculated.

Sample Description	Conductivity (µS/cm)	Approximate TDS (mg/l)	Analyst
300 Swabbed	9,300	6,510	B. Kyllo
400 Swabbed	13,100	9,170	B. Kyllo
500 Swabbed	12,560	8,790	B. Kyllo

If you have any questions or need further information, please do not hesitate to call me at 701-572-7355. Thank you for allowing Astro-Chem to be of service.

Sincerely,

Bruce Kyllo
Astro-Chem Lab, Inc.

BK:vm

M-13-9355-9357

Figure 7b

ASTRO-CHEM LAB, INC.
P O BOX 972 • WILLISTON, ND 58802-0972
TELEPHONE
701-572-7355

December 27, 2013

Slawson Exploration Co., Inc.
1675 Broadway
Suite 1600
Denver, CO 80202

Dear Sir:

Water from the Big Bend 1-5 SWD was submitted on December 23, 2013 for TDS analysis. A conductivity analysis was performed and an approximate TDS was calculated.

Sample Description	Conductivity (µS/cm)	Approximate TDS (mg/l)	Analyst
600 Swabbed	12,390	8,676	C. Jungels

If you have any questions or need further information, please do not hesitate to call me at 701-572-7355. Thank you for allowing Astro-Chem to be of service.

Sincerely,

Christina Jungels
Astro-Chem Lab, Inc.

/cj

M-13-9401

Figure 7c

ASTRO-CHEM LAB, INC.

4102 2nd Ave. W. Williston, ND 58802-0972 P.O. Box 972 Phone: (701) 572-7355

WATER ANALYSIS REPORT

SAMPLE NUMBER W-13-9400 DATE OF ANALYSIS 12-24-13

COMPANY Slawson Exploration

CITY Denver STATE CO

WELL NAME AND/OR NUMBER Big Bend 1-5 SWD

DATE RECEIVED 12-23-13 DST NUMBER

SAMPLE SOURCE 715 BBLS Total Swab DAKOTA 5247 - 74'

LOCATION OF SEC. TWN. RANGE COUNTY

FORMATION DEPTH

DISTRIBUTION Jim Burtyk

RESISTIVITY @ 77°F = 0.816 Ohm-Meters pH = 8.29

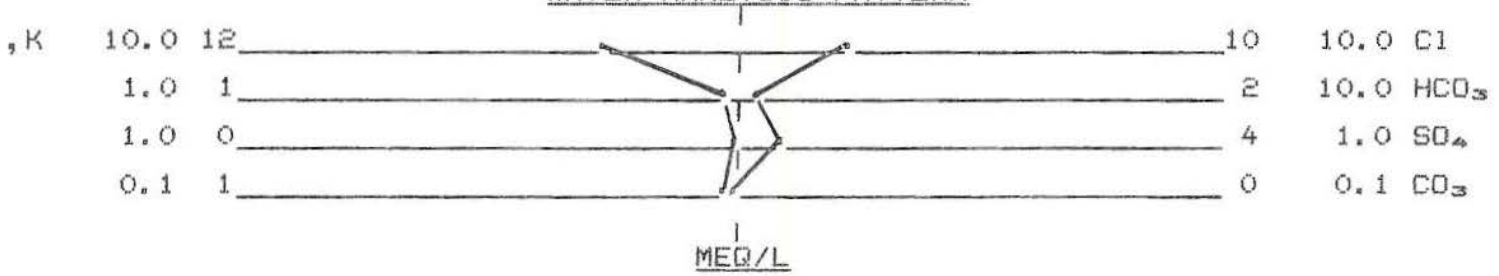
SPECIFIC GRAVITY @ 77°F = 1.000 H_2S = Negative

TOTAL DISSOLVED SOLIDS (CALCULATED) = 7769 mg/L (7769 ppm)

SODIUM CHLORIDE (CALCULATED) = 5605 mg/L (5605 ppm)

CATION	MEQ/L	mg/L	ANION	MEQ/L	mg/L
CALCIUM	0.8	16	CHLORIDE	95.9	3399
MAGNESIUM	0.2	2	CARBONATE	0.0	0
SODIUM	118.3	2720	BICARBONATE	23.6	1440
IRON	0.1	2.3	SULFATE	3.7	178
CHROMIUM	0.0	0.0	NITRATE	0.0	0
BARIUM	0.0	0.0			
POTASSIUM	0.3	13			

WATER ANALYSIS PATTERN



REMARKS Conductivity = 12250 µmhos/cm

2 DAYS 715 BBL

ANALYZED BY: C. Jungels

Figure 8a

Water Analysis Report

Attention: **Cason Schenfisch**

Customer: **Slawson Exploration Co Inc (1500280)**

Location Code: **31505**
Sample ID: **AA09646**
Batch ID: **2013-03-14-016-45-SW**
Collection Date: **03/08/2013**
Receive Date: **03/14/2013**
Report Date: **03/25/2013**

Region: **Van Hook Field**
Location: **New Town, ND**
System: **Production System**
Equipment: **Sniper Federal 2-6-7H**
Lab ID: **ABU-0045**
Sample Point: **Treater**

Analyses	Result	Unit
Dissolved CO2	2376	mg/L
Dissolved H2S	0	mg/L
pH	6.8	
Pressure	20	psi
Temperature	40	° F

Analyses	Result	Unit
Ionic Strength	5.06	
Resistivity	0.024	ohms - m
Total Dissolved Solids	266664.4	mg/L
Conductivity	416302	µS - cm3
Specfic Gravity	1.184	
Bicarbonate	183	mg/L
Carbonate	0	mg/L

Cations	Result	Unit
Iron	222.5	mg/L
Manganese	8.592	mg/L
Barium	13.04	mg/L
Strontium	1076	mg/L
Calcium	15620	mg/L
Magnesium	1223	mg/L
Sodium	84875.24	mg/L

Anions	Result	Unit
Chloride	163100	mg/L
Sulfate	343	mg/L

Scale Type	SI	PTB
Calcite (CaCO3)	0.12	13.10
Barite (BaSO4)	1.76	7.60
Gypsum (CaSO4)	-0.22	0.00
Hemihydrate (CaSO4)	-0.25	0.00
Anhydrite (CaSO4)	-0.22	0.00
Celestite (SrSO4)	0.75	156.10
Saturation Index Calculation (Tomson-Oddo Model)		

Comments:

Fisure 8b

Champion Technologies

Water Analysis Report

Attention: **Cason Schenfisch**

Customer: **Slawson Exploration Co Inc (1500280)**

Location Code: **31507**
Sample ID: **AA09648**
Batch ID: **2013-03-14-016-45-SW**
Collection Date: **03/08/2013**
Receive Date: **03/14/2013**
Report Date: **03/25/2013**

Region: **Van Hook Field**
Location: **New Town, ND**
System: **Production System**
Equipment: **Sniper Federal 5-6-7 TFH**
Lab ID: **ABU-0045**
Sample Point: **Treater**

Analyses	Result	Unit
Dissolved CO2	1782	mg/L
Dissolved H2S	0	mg/L
pH	7.0	
Pressure	60	psi
Temperature	100	° F

Analyses	Result	Unit
Ionic Strength	5.63	
Resistivity	0.022	ohms - m
Total Dissolved Solids	284800.7	mg/L
Conductivity	444548	µS - cm3
Specfic Gravity	1.194	
Bicarbonate	110	mg/L
Carbonate	0	mg/L

Cations	Result	Unit
Iron	279.3	mg/L
Manganese	10.62	mg/L
Barium	15.37	mg/L
Strontium	1656	mg/L
Calcium	23670	mg/L
Magnesium	1879	mg/L
Sodium	81762.36	mg/L

Anions	Result	Unit
Chloride	175100	mg/L
Sulfate	318	mg/L

Scale Type	SI	PTB
Calcite (CaCO3)	1.03	43.90
Barite (BaSO4)	1.44	8.80
Gypsum (CaSO4)	-0.22	0.00
Hemihydrate (CaSO4)	-0.19	0.00
Anhydrite (CaSO4)	0.14	34.60
Celestite (SrSO4)	0.90	142.50
Saturation Index Calculation (Tomson-Oddo Model)		

Comments:

Updated 8-1-2013
Jer Potthoff

FIGURE 9A

SLAWSON exploration company, inc.

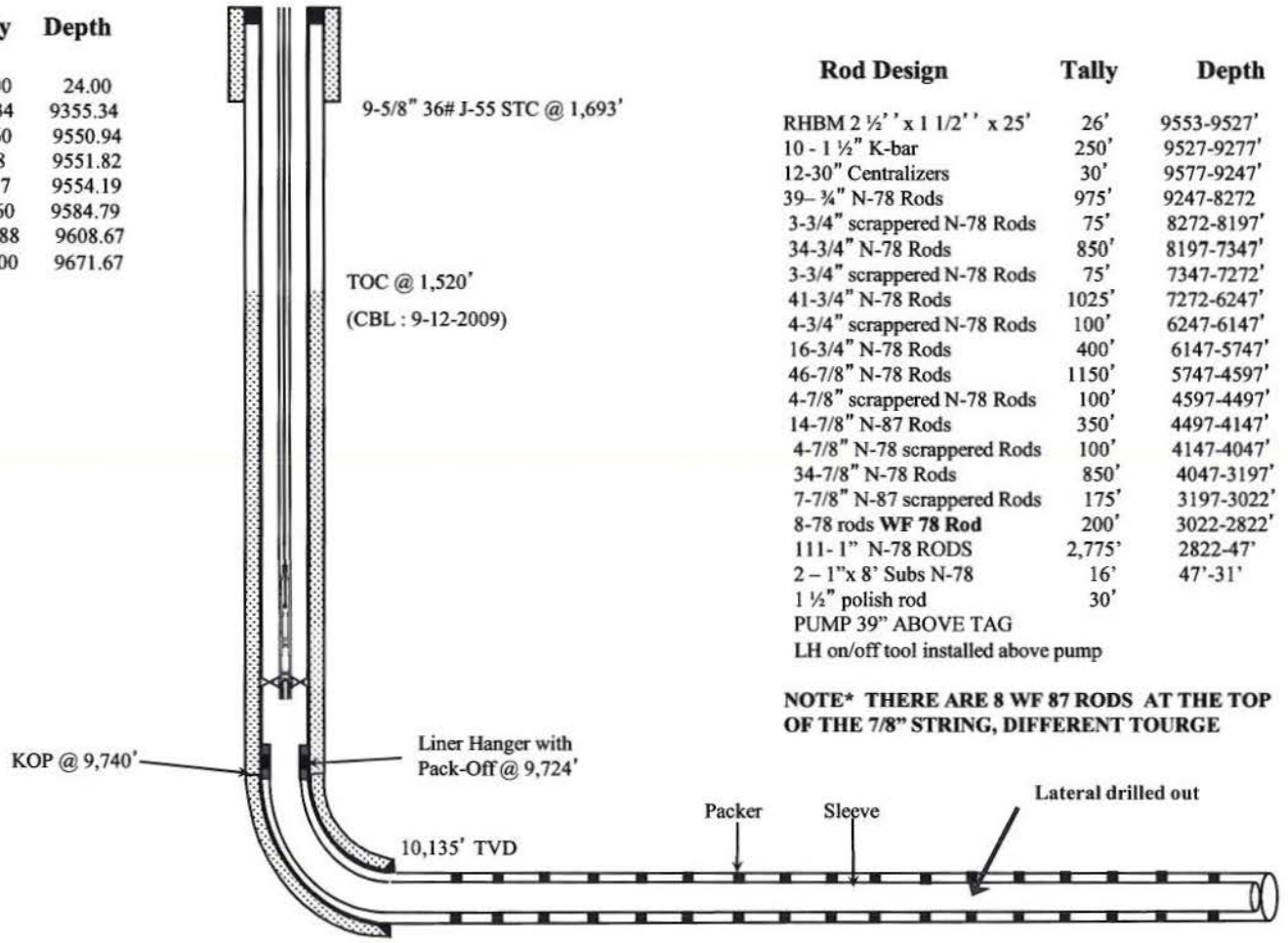
WELLBORE DIAGRAM
Coyote #1-32H

Location: 280' FNL and 1,630' FEL
NWNE Sec 32, T152N-R92W
Mountrail County, North Dakota

GL ELEVATION = 1,894'.'
KB ELEVATION = 1,918'
API#: 33-061-01082
NDIC#: 18220

Tubing Profile	Tally	Depth
KB	24.00	24.00
300 JTS 2 7/8 6.5# L-80 EUE	9331.34	9355.34
6 JTS 2 7/8" Dura seal	195.60	9550.94
MHDSN	.88	9551.82
Quinn 7"Carbide TAC	2.37	9554.19
1 JT 2 7/8"	30.60	9584.79
1- 2 7/8" Sand Screen	23.88	9608.67
2 JTS 2 7/8" w/bull plug	63.00	9671.67

Formation	TVD
Pierre/base Foxhills	1,593'
Dakota (marine)	5,022'
Dunham Salt	6,384'
Base Dunham Salt	6,402'
Pine Salt	6,655'
Base Pine Salt	6,689'
Opeche	6,714'
Base Opeche	6,943'
Kibbey Lime	7,760'
Charles	7,982'
base last Charles salt	8,512'
Mission Canyon	8,682'
Lodgepole	9,284'
Upper Bakken shale	10,104'
Top of Target	10,130'
Target	10,135'
Base of Target	10,140'



Rod Design	Tally	Depth
RHBM 2 ½'' x 1 1/2'' x 25'	26'	9553-9527'
10 - 1 ½" K-bar	250'	9527-9277'
12-30" Centralizers	30'	9577-9247'
39– ¾" N-78 Rods	975'	9247-8272
3-3/4" scrappered N-78 Rods	75'	8272-8197'
34-3/4" N-78 Rods	850'	8197-7347'
3-3/4" scrappered N-78 Rods	75'	7347-7272'
41-3/4" N-78 Rods	1025'	7272-6247'
4-3/4" scrappered N-78 Rods	100'	6247-6147'
16-3/4" N-78 Rods	400'	6147-5747'
46-7/8" N-78 Rods	1150'	5747-4597'
4-7/8" scrappered N-78 Rods	100'	4597-4497'
14-7/8" N-87 Rods	350'	4497-4147'
4-7/8" N-78 scrappered Rods	100'	4147-4047'
34-7/8" N-78 Rods	850'	4047-3197'
7-7/8" N-87 scrappered Rods	175'	3197-3022'
8-78 rods **WF 78 Rod**	200'	3022-2822'
111- 1" N-78 RODS	2,775'	2822-47'
2 – 1"x 8' Subs N-78	16'	47'-31'
1 ½" polish rod	30'	
PUMP 39" ABOVE TAG		
LH on/off tool installed above pump		

NOTE* THERE ARE 8 WF 87 RODS AT THE TOP OF THE 7/8" STRING, DIFFERENT TOURGE

7" 26# HCP-110 from Surface to 6,213' 7" 32# P-110 from 6,213' to 7,063' 7" 26# HCP-110 from 7,063' to 7,799' 7" 32# P-110 from 7,799' to 8,628' 7" 26# HCP-110 from 8,628' to 10,769'

5,689' of 4-1/2" 11.6# HCP-110 liner with 17 swell packers, 18 sleeves and a liner hanger with pack-off (499' of tools). Set Liner at 15,403'

Lateral TD @ 15,443' MD, 10,144' TVD
4,684' of Open Hole

Updated 6/20/2013
Jim Burtyk

FIGURE 9B

SLAWSON exploration company, inc.

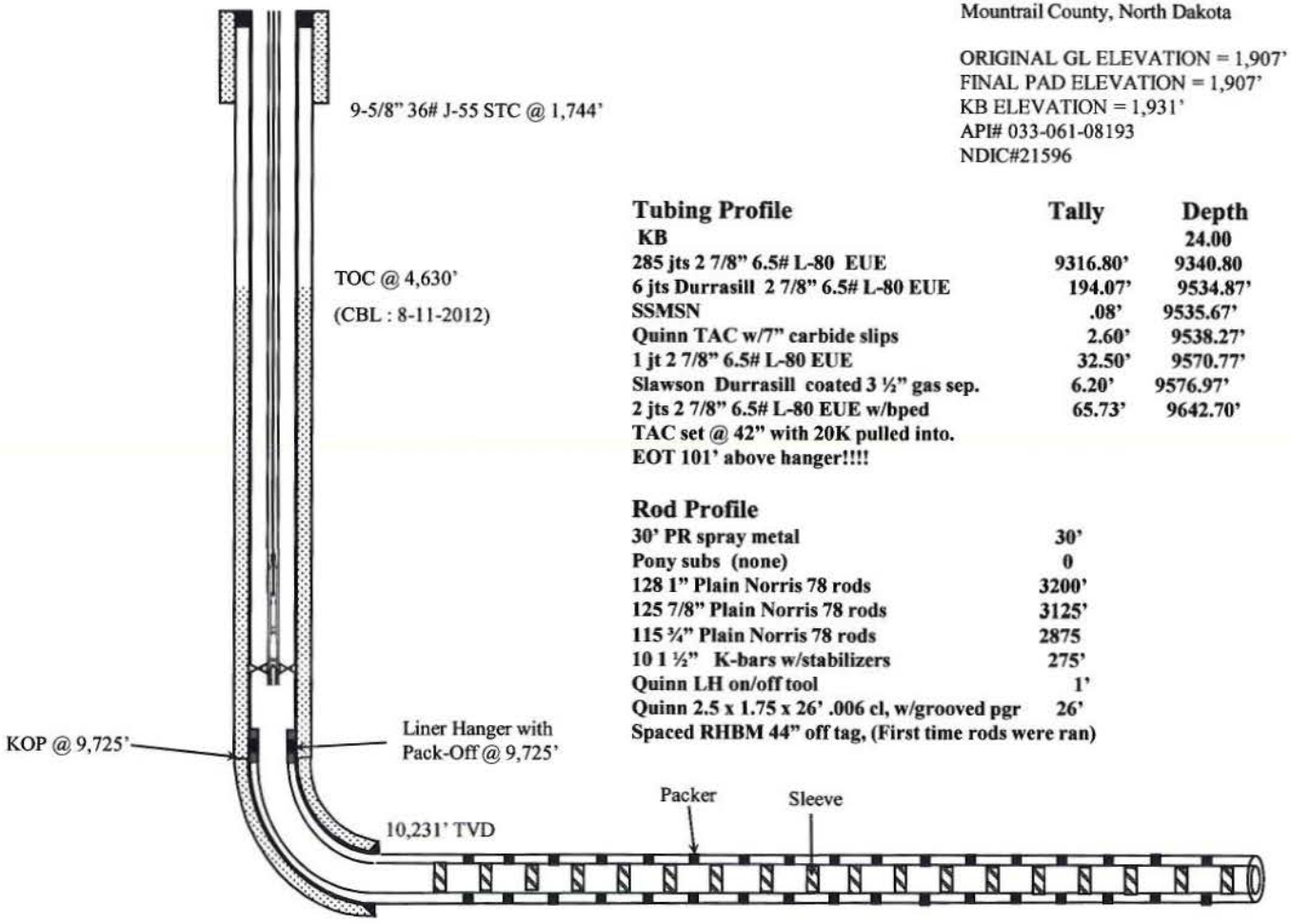
WELLBORE DIAGRAM
Coyote 2-32H

Location: 290' FNL and 1,430' FWL
NENW Sec 5, T151N-R92W
Mountrail County, North Dakota

ORIGINAL GL ELEVATION = 1,907'
FINAL PAD ELEVATION = 1,907'
KB ELEVATION = 1,931'
API# 033-061-08193
NDIC#21596

Formation	TVD
Pierre/base Foxhills	1,621'
Dakota (marine)	4,939'
Dunham Salt	6,301'
Base Dunham Salt	6,334'
Pine Salt	6,609'
Base Pine Salt	6,660'
Opeche	6,680'
Minnelussa	7,034'
Kibbey Lime	7,883'
Charles	8,038'
base last Charles salt	8,546'
Mission Canyon	8,712'
Lodgepole	9,372'
Upper Bakken shale	9,192'
Top of Target	10,221'
Target	10,231'
Base of Target	10,241'

Temporary rod design 6/20/2013
Quinn soft set tool
10 k-bars with stabilizers
115- ¾" rods, 125 7/8", 126 1" rods
4 work rods in hole that need to come out,
For a total of 130. 1" rods.
We backed off top rod and have a box looking up
Approx, 4' down. Installed 5K gate valve.



Tubing Profile	Tally	Depth
KB		24.00
285 jts 2 7/8" 6.5# L-80 EUE	9316.80'	9340.80
6 jts Durrasill 2 7/8" 6.5# L-80 EUE	194.07'	9534.87'
SSMSN	.08'	9535.67'
Quinn TAC w/7" carbide slips	2.60'	9538.27'
1 jt 2 7/8" 6.5# L-80 EUE	32.50'	9570.77'
Slawson Durrasill coated 3 ½" gas sep.	6.20'	9576.97'
2 jts 2 7/8" 6.5# L-80 EUE w/bped	65.73'	9642.70'
TAC set @ 42" with 20K pulled into.		
EOT 101' above hanger!!!!		

Rod Profile	
30' PR spray metal	30'
Pony subs (none)	0
128 1" Plain Norris 78 rods	3200'
125 7/8" Plain Norris 78 rods	3125'
115 ¾" Plain Norris 78 rods	2875
10 1 ½" K-bars w/stabilizers	275'
Quinn LH on/off tool	1'
Quinn 2.5 x 1.75 x 26' .006 cl, w/grooved pgr	26'
Spaced RHBM 44" off tag, (First time rods were ran)	

7" 29# P-110 from	Surface	to	6,092'
7" 32# P-110 from	6,092'	to	8,722'
7" 29# P-110 from	8,722'	to	10,420'

5,146' of 4-1/2" 11.6# P-110 liner with 18 mech packers, 18 sleeves and a liner hanger with pack-off (500' of tools). Set Liner at 15,424'

Lateral TD @ 15,439' MD, 10,191' TVD
5,020' of Open Hole

Updated 8/13/2013
Jer Potthoff

FIGURE 9C

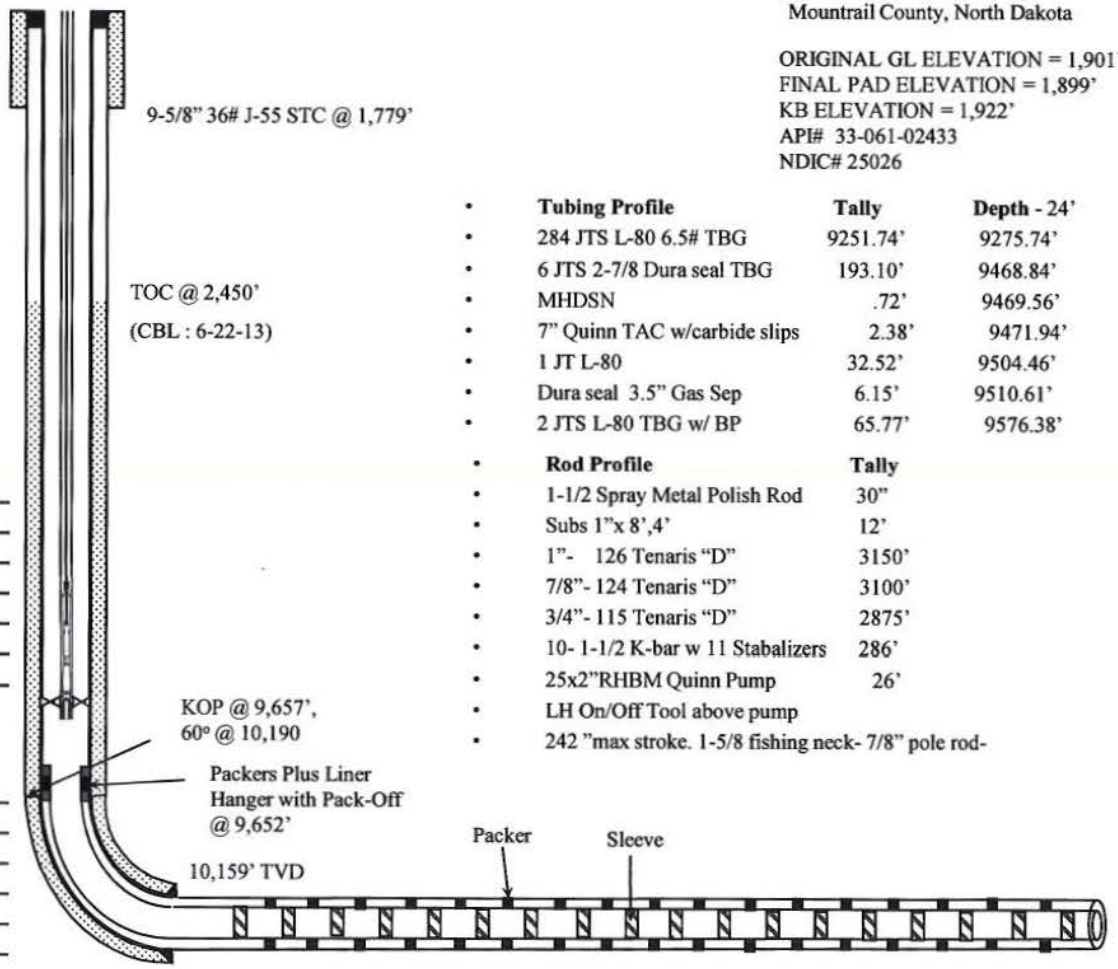
SLAWSON exploration company, inc.

WELLBORE DIAGRAM
Coyote 3-32H

Location: 275' FNL and 2,635' FEL
NWNE Sec 5, T151N-R92W
Mountrail County, North Dakota

ORIGINAL GL ELEVATION = 1,901'
FINAL PAD ELEVATION = 1,899'
KB ELEVATION = 1,922'
API# 33-061-02433
NDIC# 25026

Formation	TVD
Pierre/base Foxhills	1,673'
Dakota (marine)	4,889'
Dunham Salt	6,234'
Base Dunham Salt	6,271'
Pine Salt	6,527'
Base Pine Salt	6,561'
Opeche	6,562'
Minnelussa	6,974'
Kibbey Lime	7,823'
Charles	7,975'
Base last Charles salt	8,525'
Mission Canyon	8,699'
Lodgepole	9,319'
Upper Bakken shale	10,125'
Top of Middle Bakken Target	10,157'
Middle Bakken Target	10,165'
Base of Middle Bakken Target	10,172'



Tubing Profile	Tally	Depth - 24'
284 JTS L-80 6.5# TBG	9251.74'	9275.74'
6 JTS 2-7/8 Dura seal TBG	193.10'	9468.84'
MHDSN	.72'	9469.56'
7" Quinn TAC w/carbide slips	2.38'	9471.94'
1 JT L-80	32.52'	9504.46'
Dura seal 3.5" Gas Sep	6.15'	9510.61'
2 JTS L-80 TBG w/ BP	65.77'	9576.38'

Rod Profile	Tally
1-1/2 Spray Metal Polish Rod	30"
Subs 1"x 8',4'	12'
1"- 126 Tenaris "D"	3150'
7/8"- 124 Tenaris "D"	3100'
3/4"- 115 Tenaris "D"	2875'
10- 1-1/2 K-bar w 11 Stabalizers	286'
25x2"RHBM Quinn Pump	26'
LH On/Off Tool above pump	
242 "max stroke. 1-5/8 fishing neck- 7/8" pole rod-	

RockSeal Packers @

PKR 1	15,132'	PKR 11	12,436'
PKR 2	14,855'	PKR 12	12,200'
PKR 3	14,578'	PKR 13	11,921'
PKR 4	14,341'	PKR 14	11,644'
PKR 5	14,068'	PKR 15	11,366'
PKR 6	13,788'	PKR 16	11,129'
PKR 7	13,509'	PKR 17	10,849'
PKR 8	13,272'		
PKR 9	12,994'		
PKR 10	12,717'		

FracPorts @

DEH	15,270'	3.063	12,298'
2.438	14,995'	3.125	12,061'
2.500	14,718'	3.188	11,784'
2.563	14,438'	3.250	11,506'
2.625	14,206'	3.313	11,227'
2.688	13,929'	3.375	10,989'
2.750	13,651'	3.438	10,713'
2.813	13,370'		
2.875	13,135'		
2.938	12,856'		
3.000	12,578'		

7" 32# P-110 from	Surface	to	199'
7" 29# P-110 from	199'	to	6,146'
7" 32# P-110 from	6,146'	to	8,650'
7" 29# P-110 from	8,650'	to	10,549'

Packers Plus Completion System:

6,001' of 4-1/2" 13.5# P-110 BTC liner with 17 mech packers, 18 sleeves and a liner hanger with pack-off (500' of tools). Set Liner at 15,380'

Lateral TD @ 15,395' MD,
10,151' TVD
4,846' of Open Hole

UPDATED 8/9/2013
Jer Potthoff

FIGURE 9D

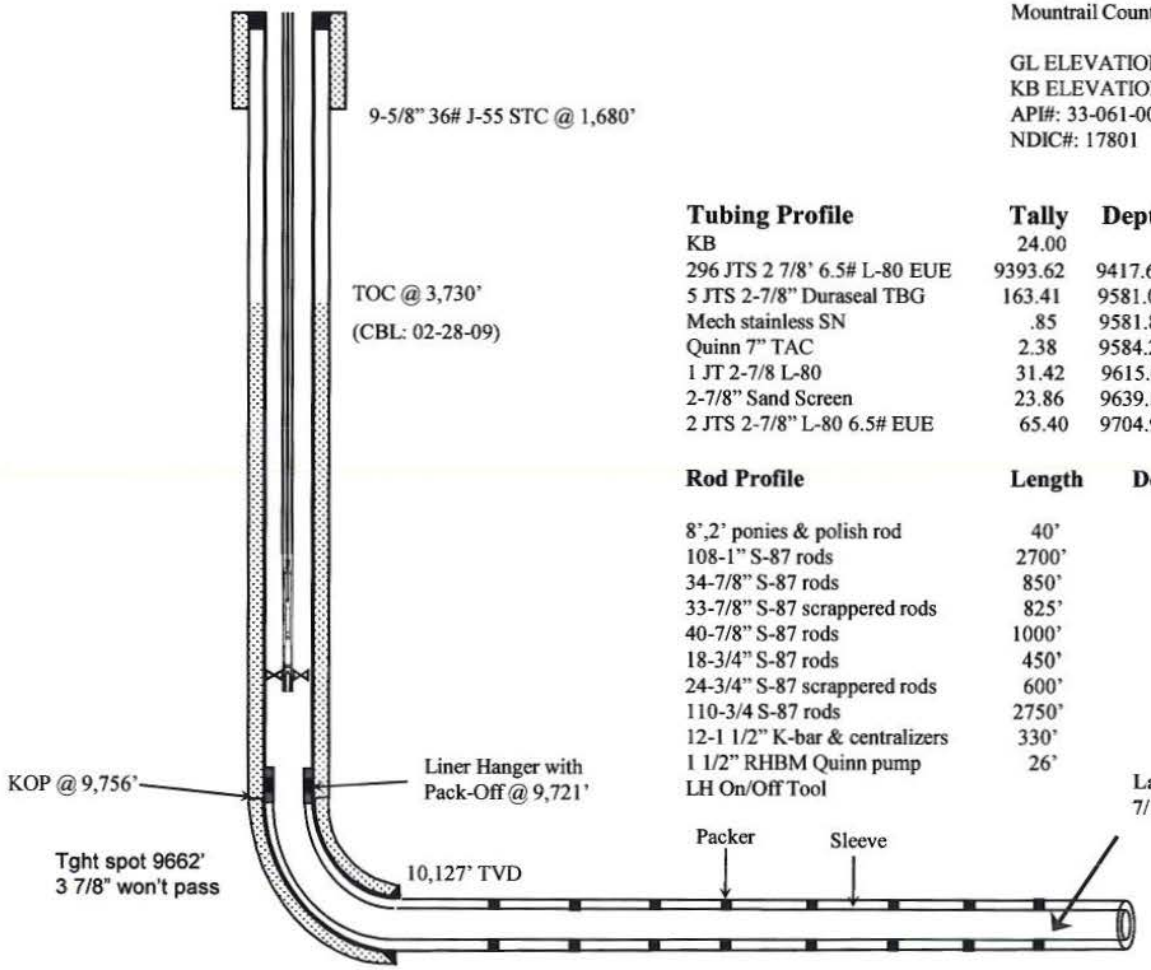
SLAWSON exploration company, inc.

WELLBORE DIAGRAM
Jericho #1-5H

Location: 280' FNL and 1,400' FEL
NWNE Sec 5, T151N-R92W
Mountrail County, North Dakota

GL ELEVATION = 1,890.'
KB ELEVATION = 1,914'
API#: 33-061-00923
NDIC#: 17801

Formation	TVD
Pierre/base Foxhills	1,604'
Dakota (marine)	4,892'
Dunham Salt	6,254'
Base Dunham Salt	6,287'
Pine Salt	6,526'
Base Opeche Salt	6,633'
Minnelusa-Amsden	6,987'
Kibbey Lime	7,836'
Charles	7,986'
base last Charles salt	8,499'
Mission Canyon	8,665'
Lodgepole	9,423'
Upper Bakken shale	10,145'
Top of Target	10,174'
Target	10,184'
Base of Target	10,194'



Tubing Profile	Tally	Depth
KB	24.00	
296 JTS 2 7/8' 6.5# L-80 EUE	9393.62	9417.62
5 JTS 2-7/8" Duraseal TBG	163.41	9581.03
Mech stainless SN	.85	9581.88
Quinn 7" TAC	2.38	9584.26
1 JT 2-7/8 L-80	31.42	9615.68
2-7/8" Sand Screen	23.86	9639.54
2 JTS 2-7/8" L-80 6.5# EUE	65.40	9704.94

Rod Profile	Length	Depth
8',2' ponies & polish rod	40'	
108-1" S-87 rods	2700'	
34-7/8" S-87 rods	850'	
33-7/8" S-87 scrappered rods	825'	
40-7/8" S-87 rods	1000'	
18-3/4" S-87 rods	450'	
24-3/4" S-87 scrappered rods	600'	
110-3/4 S-87 rods	2750'	
12-1 1/2" K-bar & centralizers	330'	
1 1/2" RHBM Quinn pump	26'	
LH On/Off Tool		

7" 26# HCP-110 from Surface to 6,113'
7" 32# P-110 from 6,113' to 7,010'
7" 26# HCP-110 from 7,010' to 7,757'
7" 32# P-110 from 7,757' to 8,685'
7" 29# L-80 from 8,685' to 10,369'

4,444' of 4-1/2" 11.6# P-110 liner with 8 swell packers, 9 sleeves and a liner hanger with pack-off (204'). Set Liner at 14,370'

Lateral TD @ 14,385' MD, 10,161' TVD
4,016' of Open Hole

Updated 2/4/2014
Jer Potthoff

FIGURE 9E

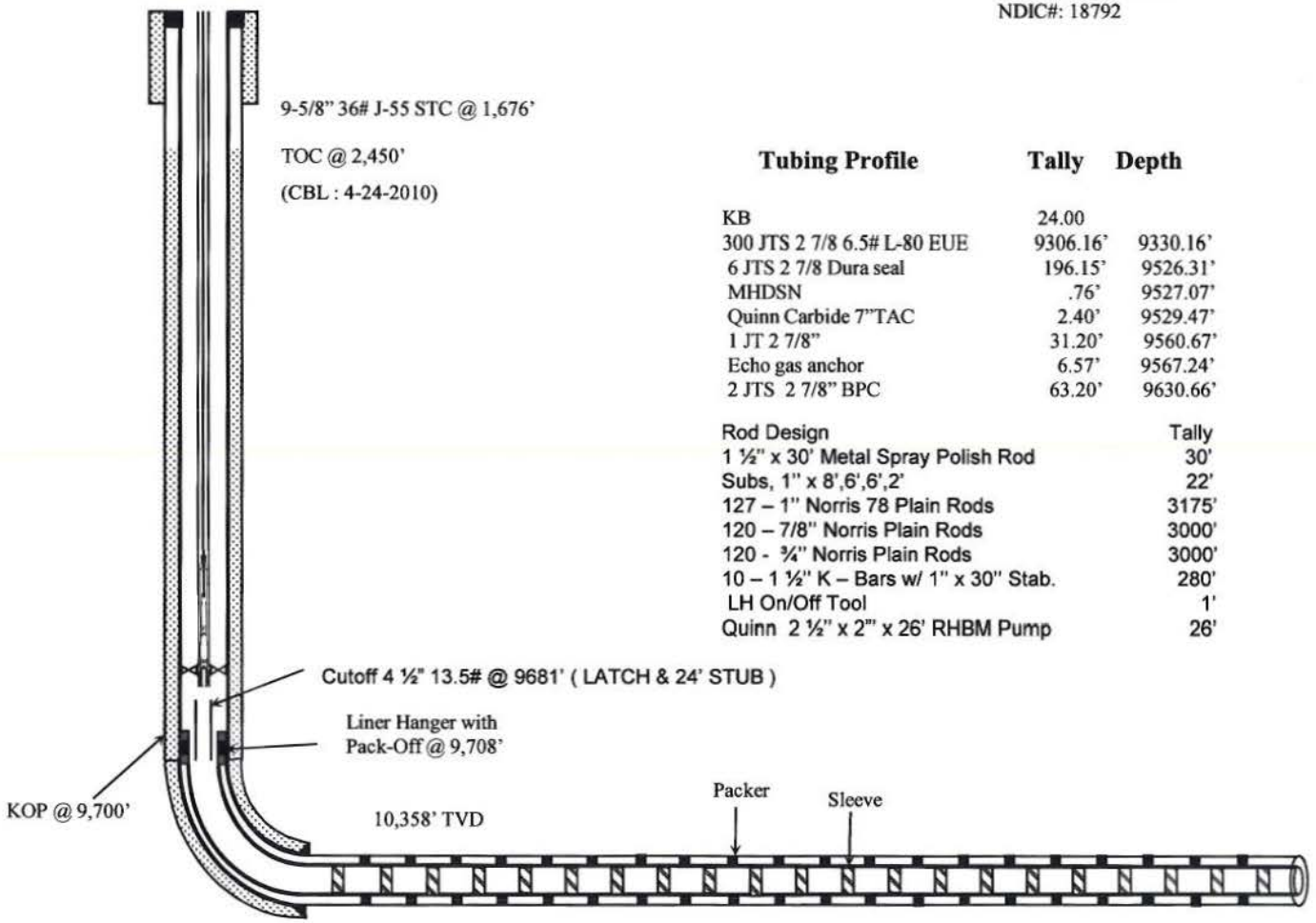
SLAWSON exploration company, inc.

WELLBORE DIAGRAM
Jericho #2-5H-TF

Location: 310' FNL and 1,830' FEL
NWNE Sec 5, T151N-R92W
Mountrail County, North Dakota

GL ELEVATION = 1,890'
KB ELEVATION = 1,914'
API#: 33-061-01294
NDIC#: 18792

Formation	TVD
Pierre/base Foxhills	1,589'
Dakota (marine)	5,018'
Dunham Salt	6,380'
Base Dunham Salt	6,398'
Pine Salt	6,651'
Base Pine Salt	6,685'
Opeche	6,710'
Base Opeche	6,939'
Kibbey Lime	7,756'
Charles	7,978'
base last Charles salt	8,508'
Mission Canyon	8,678'
Lodgepole	9,280'
Upper Bakken shale	10,100'
Lower Bakken Shale	10,155'
Three Forks	10,195'
Top of Target	10,348'
Target	10,358'
Base of Target	10,368'



Tubing Profile	Tally	Depth
KB	24.00	
300 JTS 2 7/8 6.5# L-80 EUE	9306.16'	9330.16'
6 JTS 2 7/8 Dura seal	196.15'	9526.31'
MHDSN	.76'	9527.07'
Quinn Carbide 7"TAC	2.40'	9529.47'
1 JT 2 7/8"	31.20'	9560.67'
Echo gas anchor	6.57'	9567.24'
2 JTS 2 7/8" BPC	63.20'	9630.66'

Rod Design	Tally
1 ½" x 30' Metal Spray Polish Rod	30'
Subs, 1" x 8',6',6',2'	22'
127 – 1" Norris 78 Plain Rods	3175'
120 – 7/8" Norris Plain Rods	3000'
120 - ¾" Norris Plain Rods	3000'
10 – 1 ½" K – Bars w/ 1" x 30" Stab.	280'
LH On/Off Tool	1'
Quinn 2 ½" x 2"' x 26' RHBM Pump	26'

7" 26# HCP-110 from Surface to 6,201'
7" 32# P-110 from 6,201' to 8,141'
7" 26# HCP-110 from 8,141' to 10,520'

4,722' of 4-1/2" 11.6# P-110 liner with 20 packers, 21 sleeves and a liner hanger with pack-off (578'). Set Liner at 14,430'

Lateral TD @ 14,460' MD,
10,230' TVD
3,940' of Open Hole

Updated 7/03/2013
Jer Potthoff

FIGURE 9F

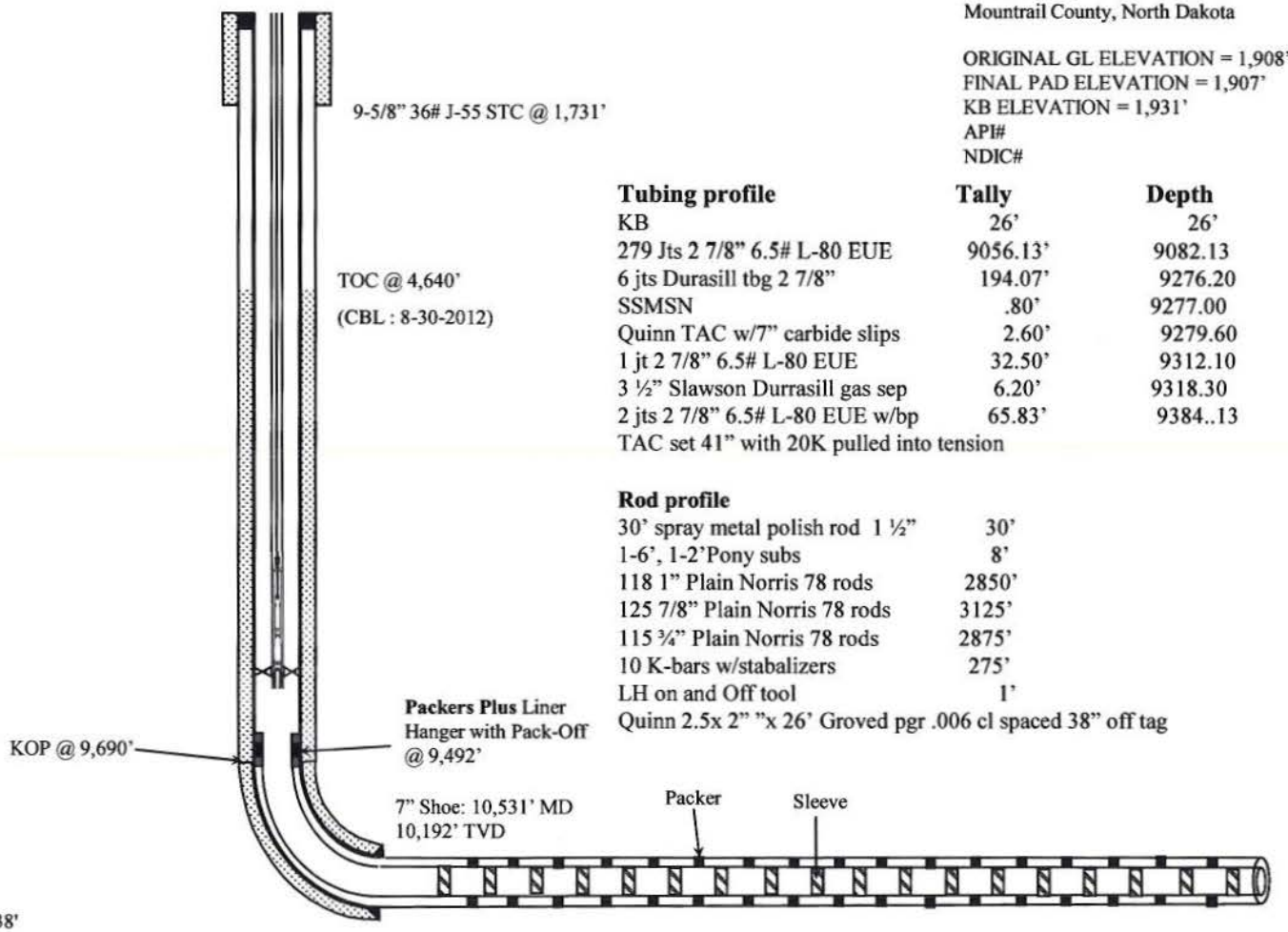
SLAWSON exploration company, inc.

WELLBORE DIAGRAM
Jericho 3-5H

Location: 290' FNL and 1,330' FWL
NENW Sec 5, T151N-R92W
Mountrail County, North Dakota

ORIGINAL GL ELEVATION = 1,908'
FINAL PAD ELEVATION = 1,907'
KB ELEVATION = 1,931'
API#
NDIC#

Formation	TVD
Pierre/base Foxhills	1,621'
Dakota (marine)	4,939'
Dunham Salt	6,301'
Base Dunham Salt	6,334'
Pine Salt	6,609'
Base Pine Salt	6,660'
Opeche	6,680'
Minnelussa	7,034'
Kibbey Lime	7,883'
Charles	8,038'
base last Charles salt	8,546'
Mission Canyon	8,712'
Lodgepole	9,372'
Upper Bakken shale	9,192'
Top of Target	10,221'
Target	10,231'



Tubing profile	Tally	Depth
KB	26'	26'
279 Jts 2 7/8" 6.5# L-80 EUE	9056.13'	9082.13
6 jts Durasill tbg 2 7/8"	194.07'	9276.20
SSMSN	.80'	9277.00
Quinn TAC w/7" carbide slips	2.60'	9279.60
1 jt 2 7/8" 6.5# L-80 EUE	32.50'	9312.10
3 ½" Slawson Durrasill gas sep	6.20'	9318.30
2 jts 2 7/8" 6.5# L-80 EUE w/bp	65.83'	9384..13

TAC set 41" with 20K pulled into tension

Rod profile	
30' spray metal polish rod 1 ½"	30'
1-6', 1-2'Pony subs	8'
118 1" Plain Norris 78 rods	2850'
125 7/8" Plain Norris 78 rods	3125'
115 ¾" Plain Norris 78 rods	2875'
10 K-bars w/stabalizers	275'
LH on and Off tool	1'

Quinn 2.5x 2" "x 26' Groved pgr .006 cl spaced 38" off tag

7" 32# P-110 from	Surface	to	238'
7" 29# P-110 from	238'	to	6,085'
7" 32# P-110 from	6,085'	to	8,751'
7" 29# P-110 from	8,751'	to	10,531'

Packers Plus Completion System:

4,539' of 4-1/2" 11.6# P-110 liner with 15 mech packers, 15 sleeves and a liner hanger with pack-off.
Set Liner at 14,458'

Lateral TD @ 14,670' MD, 10,200' TVD
4,139' of Open Hole

Updated 8/16/13
Jeremiah Potthoff

FIGURE 9G

Formation	TVD
Pierre/base Foxhills	1,673'
Dakota (marine)	4,889'
Dunham Salt	6,234'
Base Dunham Salt	6,271'
Pine Salt	6,527'
Base Pine Salt	6,561'
Opeche	6,562'
Minnelussa	6,974'
Kibbey Lime	7,823'
Charles	7,975'
Base last Charles salt	8,525'
Mission Canyon	8,699'
Lodgepole	9,319'
Upper Bakken shale	10,125'
Top of Middle Bakken Target	10,157'
Middle Bakken Target	10,165'
Base of Middle Bakken Target	10,172'

RockSeal Packers @

PKR 1	14,446'	PKR 11	12,089'
PKR 2	14,211'	PKR 12	11,852'
PKR 3	13,974'	PKR 13	11,615'
PKR 4	13,740'	PKR 14	11,377'
PKR 5	13,504'	PKR 15	11,144'
PKR 6	13,270'	PKR 16	10,909'
PKR 7	13,035'	PKR 17	10,678'
PKR 8	12,799'		
PKR 9	12,562'		
PKR 10	12,326'		

FracPorts @

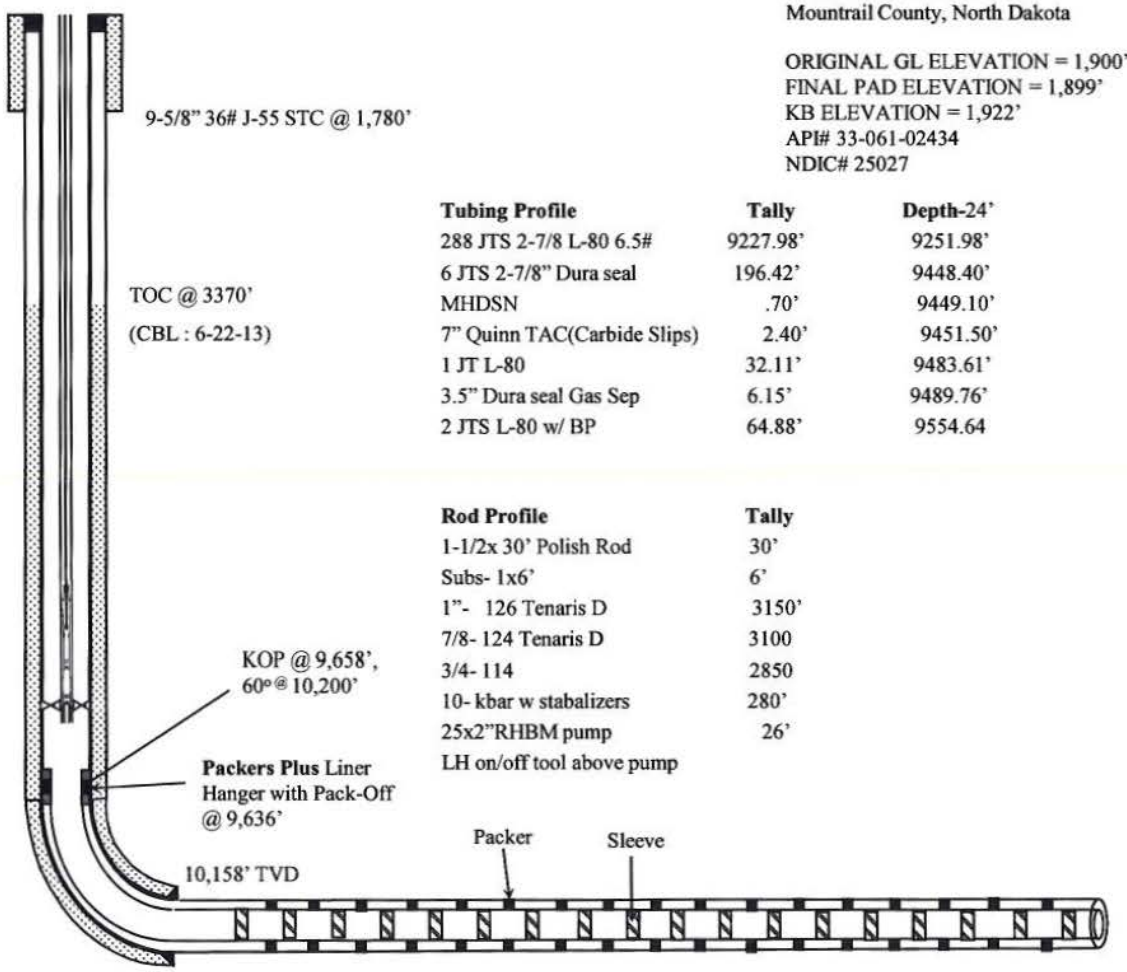
DEH	14,586'	3.063	11,950'
2.438	14,308'	3.125	11,713'
2.500	14,073'	3.188	11,476'
2.563	13,838'	3.250	11,238'
2.625	13,602'	3.313	11,007'
2.688	13,366'	3.375	10,775'
2.750	13,133'	3.438	10,544'
2.813	12,898'		
2.875	12,661'		
2.938	12,424'		
3.000	12,187'		

SLAWSON exploration company, inc.

WELLBORE DIAGRAM
Jericho 4-5H

Location: 275' FNL and 2,615' FWL
NENW Sec 5, T151N-R92W
Mountrail County, North Dakota

ORIGINAL GL ELEVATION = 1,900'
FINAL PAD ELEVATION = 1,899'
KB ELEVATION = 1,922'
API# 33-061-02434
NDIC# 25027



Tubing Profile	Tally	Depth-24'
288 JTS 2-7/8 L-80 6.5#	9227.98'	9251.98'
6 JTS 2-7/8" Dura seal	196.42'	9448.40'
MHDSN	.70'	9449.10'
7" Quinn TAC(Carbide Slips)	2.40'	9451.50'
1 JT L-80	32.11'	9483.61'
3.5" Dura seal Gas Sep	6.15'	9489.76'
2 JTS L-80 w/ BP	64.88'	9554.64

Rod Profile	Tally
1-1/2x 30' Polish Rod	30'
Subs- 1x6'	6'
1"- 126 Tenaris D	3150'
7/8- 124 Tenaris D	3100
3/4- 114	2850
10- kbar w stabalizers	280'
25x2"RHBM pump	26'
LH on/off tool above pump	

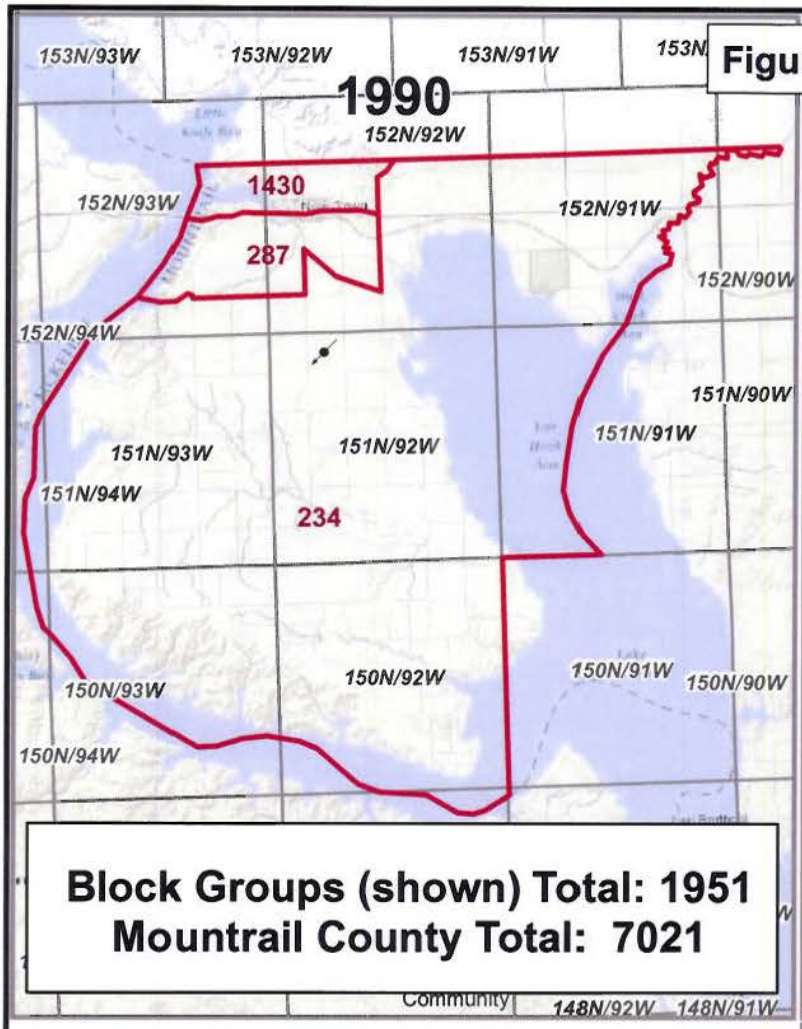
7" 32# P-110 from	Surface	to	199'
7" 29# P-110 from	199'	to	5,964'
7" 32# P-110 from	5,964'	to	8,568'
7" 29# P-110 from	8,568'	to	10,437'

Packers Plus Completion System:

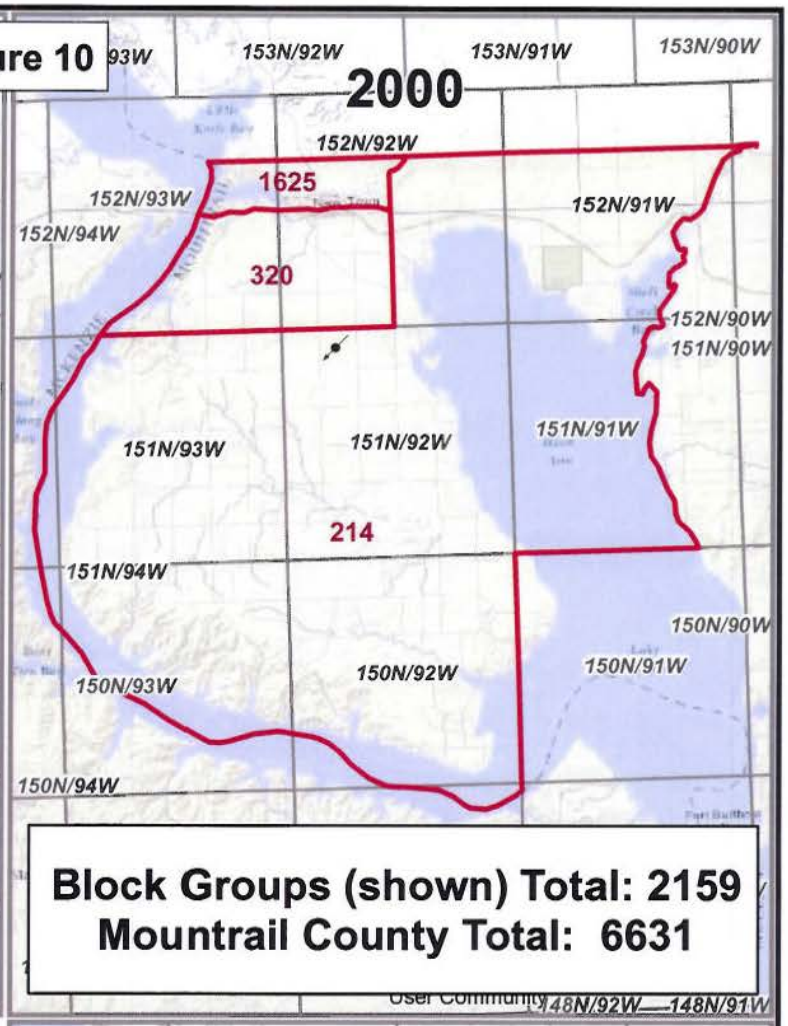
5,313' of 4-1/2" 13.5# P-110 BTC liner with 17 mech packers, 18 sleeves and a liner hanger with pack-off. Set Liner at 14,695'

Lateral TD @ 14,710' MD,
10,182' TVD
4,500' of Open Hole

Figure 10



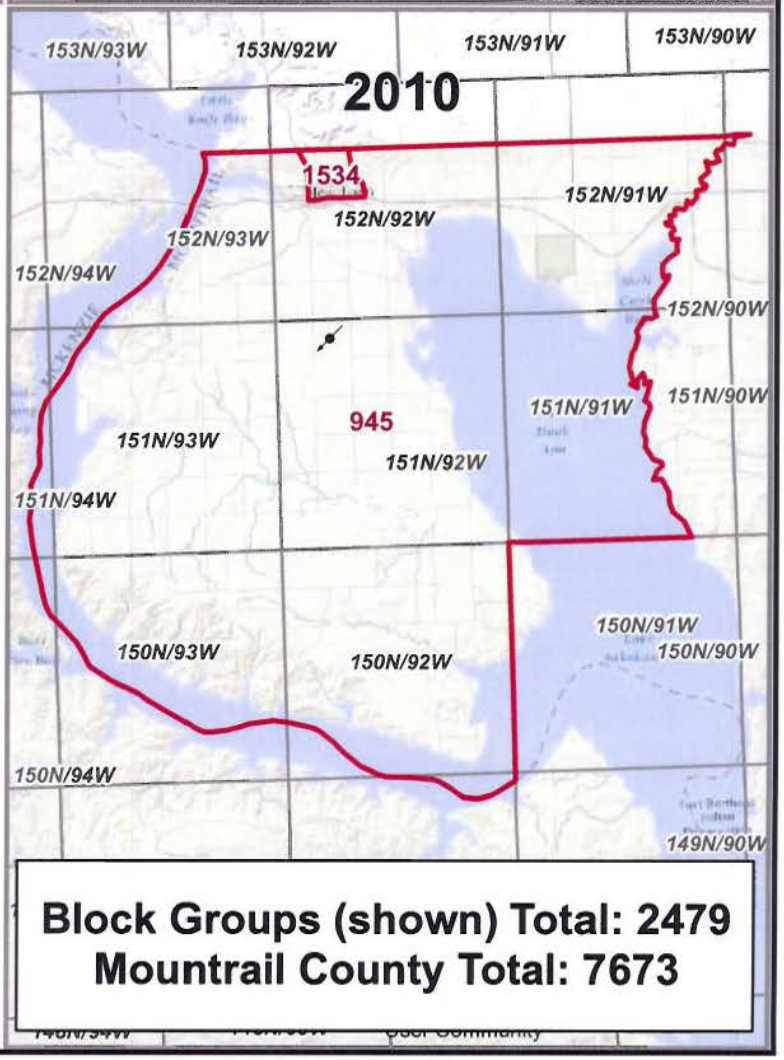
Block Groups (shown) Total: 1951
Mountrail County Total: 7021



Block Groups (shown) Total: 2159
Mountrail County Total: 6631

2012 Estimate

Block Groups (shown) Total: dna
Mountrail County Total: 8734



Block Groups (shown) Total: 2479
Mountrail County Total: 7673

Big Bend 1-5 SWD

Census Block Group*

Source for Population Data & Block Group outlines:
http://www.census.gov/ &
http://www2.cdc.gov/nceh/lead/census90/house11/download.htm
*Note: US Census blocks were redrawn for each decadal survey.

SLAWSON
exploration company, inc.

US Census Data
Population Information

Author:	Scale:	Date:
ifer	1:320,000	February 11, 2014

BigBend_USCensusPopInfo.mxd

SLAWSON
exploration company, inc.

BIG BEND 1-5 SWD
Sec 5-T151N-R92W
Mountrail County, ND

Geological Data Sheet Update

Expected depths, thicknesses and general lithology of units to be encountered in Big Bend 1-5 SWD.

Note: tops and thicknesses from surface through base of Foxhills/top Pierre are inferred from surface exposures and shallow boreholes. Top of Pierre, and tops and thicknesses of units below this point, are projected from deep well-log control.

Measured Depth (thickness), Formation , ((Formation code) used on cross section)

0 (23) Coleharbor, Pleistocene: unconsolidated sediments, genetically related to glacial processes and a northerly clastic sediment source area. Three general categories: pebbly, sandy, silty clay (87%); sand and gravel (8%); and silt and clay (5%). The "pebbly, sandy, silty clay" unit is inferred to be glacial till, has low permeability, and consequently is an "aquitard" (as opposed to "aquifer"). The "sand and gravel" unit, thought to be derived from glacial rivers, is a well-sorted, highly-permeable aquifer, and is the largest source of potable groundwater in Mountrail County. The "silt and clay" unit is another low-permeability aquitard, and was deposited in larger glacial lakes.

23 (535) Bullion Creek, Paleocene: Silt and clay, brownish-gray, varying amounts of sand, lignite, natural brick, limestone, and sandstone; river, lake, and swamp sediment. Equivalent to strata previously referred to the Tongue River Formation.

558 (485) Cannonball, Paleocene: Sand and mudstone, brownish-yellow and light gray, with lenticular and concretionary sandstone, marine shoreline and offshore sediment.

1043 (370) Hell Creek, Cretaceous: sand, somber shades of light-gray to brownish-gray, and cross bedded sandstone with lignite shale and dark-purple, manganese-oxide –stained concretions; river sediment and some estuarine sediment.

1413 (300) Fox Hills, Cretaceous: Silt and shale, sandy shale, sandstone, and siltstone, shades of buff to yellowish-brown; interbedded with lignitic shale laminae; some beds fossiliferous; intermittent sandstone at top is grayish-brown to white, fine, siliceous; silt and shale gradational downward with shale of the Pierre Formation; largely marine coastal sediment.

1705 (1899) Pierre, (Kp) Cretaceous: Shale, light to medium or dark-gray, fissile, flaky to blocky, generally noncalcareous; marine offshore sediment.

3604 (266) Niobrara, (Kn) Cretaceous: Shale, medium-light-gray to medium-gray, calcareous with white, limey inclusions ("First White Specks"); marly zone near the middle.

3870 (234) Carlile, (Kc) Cretaceous: Shale, medium-dark-gray to black, non-calcareous, soft; large ellipsoidal concretions containing abundant gypsum (selenite); zone of fine, secondary crystals at the top.

4104 (188) Greenhorn, (Kgh) Cretaceous: Shale, dark gray, calcareous, soft; thin-bedded shaly limestone; good electric and radioactivity log marker; ("Second White Specks").

4292 (211) Belle Fourche, (Kbf) Cretaceous: Shale, medium to dark-gray, soft, micaceous, lumpy to massive, spongy, includes beds of light-bluish-gray bentonitic clay.

4503 (368) Mowry, (Km) Shale, medium to dark gray, soft, flakey to splintery, spongy; traces of light-blue-gray bentonitic clay with no effective porosity or permeability; top is marked by radioactive zone. In the New Town area, the sandy Newcastle Formation ("Muddy") is absent, and the Mowry is instead underlain by the Skull Creek: shale, medium to dark gray, micaceous, soft, flaky to lumpy.

Note: with respect to the proposed saltwater injection, the "upper confining interval" consists of all of the shaley units described above, from Skull Creek/Mowry through Pierre.

4871 (403) Inyan Kara, (Kik) Cretaceous (Injection Zone): Upper part is mainly marine sandstone, light-gray, fine to coarse, quartzose; and shale, gray, silty, and lumpy. Lower part is mainly nonmarine sandstone, medium to coarse, angular to subrounded, quartzose, occasional lenses of gray, bentonitic shale commonly contains manganese-siderite spherulites (pellets).

5274 (470) Swift, (Js) Jurassic (Lower Confining Interval): Shale, dark-gray to greenish, fissile, waxy, silty, calcareous; local limestone and glauconitic sandstone.

5744 (90) Rierdon, (Jr) Jurassic: Shale, varicolored shades of gray, green, and red, calcareous; some limestone. Offshore marine deposits.

References:

1. Clayton, Lee, 1972. "Geology of Mountrail County, North Dakota", *North Dakota Geological Survey Bulletin 55-IV.*

2. Murphy, Edward, State Geologist, Helms, Lynn, Director of Department Minerals, North Dakota Geologic Society, "North Dakota Stratigraphic Column" Miscellaneous Series 91, 2009

3. Bluemle, John P., Sidney B. Anderson, John A. Andrew, David W. Fischer and Julie A. LeFever, 1986. "North Dakota Stratigraphic Column", *North Dakota Geological Survey Miscellaneous Series 66.*

BEFORE THE INDUSTRIAL COMMISSION

OF THE STATE OF NORTH DAKOTA

CASE NO. 2717
ORDER NO. 3062

IN THE MATTER OF A HEARING CALLED ON A MOTION OF THE COMMISSION TO CONSIDER THE DAKOTA FORMATION FOR "EXEMPTED AQUIFER STATUS" IN RENVILLE COUNTY AND PARTS OF BOTTINEAU, WARD, MCHENRY, MERCER, MCLEAN, OLIVER, STARK, MORTON, HETTINGER, GRANT, AND ADAMS COUNTIES, NORTH DAKOTA, AS PROVIDED IN THE SAFE DRINKING WATER ACT.

ORDER OF THE COMMISSION

BY THE COMMISSION:

Pursuant to legal notice this cause came on for hearing at 2:00 p.m. on the 2nd day of February, 1983, in Bismarck, North Dakota, before an examiner appointed by the Industrial Commission of North Dakota, hereinafter referred to as the "Commission."

NOW, on this 23rd day of February, 1983, the Commission, a quorum being present, having considered the testimony adduced and the exhibits received at said hearing, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the Commission is requesting an exempted aquifer status for the Dakota aquifer under lands defined in this order, as provided in the Safe Drinking Water Act and Section 43-02-05-03 of the North Dakota Administrative Code.

(3) That the Dakota aquifer does not currently serve as a source of drinking water in the proposed exempted area.

(4) That the Dakota aquifer ranges from a depth of 2,000 feet to 5,000 feet in the proposed exempted area, economically impractical for the recovery of drinking water.

(5) That the water quality of the Dakota aquifer in the proposed exempted area ranges from 4,000 to 10,000 mg/l which makes it economically impractical to render the water fit for human consumption.

(6) That the Dakota aquifer in the proposed exempted area is not reasonable expected to supply a public water system, because the higher water quality and shallower depth of the glacial drift and aquifers of Tertiary and Upper Cretaceous age.

(7) That the granting of this application will not adversely affect correlative rights and should be granted.

IT IS THEREFORE ORDERED:

(1) That the Dakota aquifer is hereby granted an exempted aquifer status, as provided under Section 43-02-05-03 of the North Dakota Administrative Code, under the following lands, inclusive, excluding the Fort Berthold Indian Reservation:

TOWNSHIP 164 NORTH, RANGE 76-87 WEST, TOWNSHIP 163 NORTH, RANGE 76-87 WEST,

TOWNSHIP 162 NORTH, RANGE 76-87 WEST, TOWNSHIP 161 NORTH, RANGE 76-87 WEST,

TOWNSHIP 160 NORTH, RANGE 75-87 WEST, TOWNSHIP 159 NORTH, RANGE 75-87 WEST,

TOWNSHIP 158 NORTH, RANGE 75-87 WEST, TOWNSHIP 157 NORTH, RANGE 75-87 WEST,

TOWNSHIP 156 NORTH, RANGE 77-87 WEST, TOWNSHIP 155 NORTH, RANGE 77-87 WEST,

TOWNSHIP 154 NORTH, RANGE 78-87 WEST, TOWNSHIP 153 NORTH, RANGE 78-87 WEST,

TOWNSHIP 152 NORTH, RANGE 79-87 WEST, TOWNSHIP 151 NORTH, RANGE 79-87 WEST,

TOWNSHIP 150 NORTH, RANGE 80-87 WEST, TOWNSHIP 149 NORTH, RANGE 80-87 WEST,

TOWNSHIP 148 NORTH, RANGE 81-87 WEST, TOWNSHIP 147 NORTH, RANGE 81-85 WEST,

TOWNSHIP 146 NORTH, RANGE 81-90 WEST, TOWNSHIP 145 NORTH, RANGE 81-90 WEST,

TOWNSHIP 144 NORTH, RANGE 84-90 WEST, TOWNSHIP 143 NORTH, RANGE 84-90 WEST,

TOWNSHIP 142 NORTH, RANGE 84-90 WEST, TOWNSHIP 141 NORTH, RANGE 84-90 WEST,

TOWNSHIP 140 NORTH, RANGE 85-94 WEST, TOWNSHIP 139 NORTH, RANGE 85-94 WEST,

TOWNSHIP 138 NORTH, RANGE 86-94 WEST, TOWNSHIP 137 NORTH, RANGE 86-94 WEST,

TOWNSHIP 136 NORTH, RANGE 89-94 WEST, TOWNSHIP 135 NORTH, RANGE 89-94 WEST,

TOWNSHIP 134 NORTH, RANGE 89-94 WEST, TOWNSHIP 133 NORTH, RANGE 89-94 WEST,

TOWNSHIP 132 NORTH, RANGE 91-94 WEST, TOWNSHIP 131 NORTH, RANGE 91-94 WEST,

TOWNSHIP 130 NORTH, RANGE 91-94 WEST, TOWNSHIP 129 NORTH, RANGE 91-94 WEST,

(2) That this order shall remain in full force and effect until further order of the Commission.

Dated this 23rd day of February, 1983.

INDUSTRIAL COMMISSION
STATE OF NORTH DAKOTA

/s/ Allen I. Olson, Governor

/s/ , Attorney General

/s/ Kent Jones, Commissioner of Agriculture