SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)

RECEIVED
NOV 13 2017
ND Oil & Gas Div.

Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

- [ ] Notice of Intent — Approximate Start Date
- [x] Report of Work Done — Date Work Completed: **October 30, 2017**
- [ ] Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03. — Approximate Start Date

- [ ] Drilling Prognosis
- [ ] Redrilling or Repair
- [ ] Casing or Liner
- [ ] Plug Well
- [ ] Supplemental History
- [ ] Temporarily Abandon
- [x] Other: **converted to rod pump**
- [ ] Spill Report
- [ ] Shooting
- [ ] Acidizing
- [ ] Fracture Treatment
- [x] Change Production Method
- [ ] Reclamation

Well Name and Number: **Angus 3-10 3TFH**

Footages	Qtr-Qtr	Section	Township	Range
320 F N L 1105 F W L	Lot 4	3	153 N	99 W

Field	Pool	County
Long Creek	Bakken	Williams

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s): **Precision Drilling**

Address	City	State	Zip Code
5042 Jackson Street	Williston	ND	58801

DETAILS OF WORK

Zavanna converted the Angus 3-10 3TFH to rod pump effective 10/30/17.
Manufacturer: Weatherford
Model: R1100-320-500-306
Model Type: Rotaflex
Serial #: 17-1173
Pump Size: 1.75

Company	Telephone Number
Zavanna, LLC	(303) 595-8004

Address: **1200 17th St., Ste 1100**

City	State	Zip Code
Denver	CO	80202

Signature	Printed Name
Kimberly Gutierrez	Kimberly Gutierrez
Title: **Env. & Reg. Compliance Specialist**	Date: **November 8, 2017**

Email Address: **kgutierrez@zavanna.com**

FOR STATE USE ONLY

- [x] Received
- [ ] Approved

Date: 11-17-2017
By:
Title: JARED THUNE
Engineering Technician

SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)

Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

☐ Notice of Intent	Approximate Start Date	☐ Drilling Prognosis	☐ Spill Report
☑ Report of Work Done	Date Work Completed: **December 11, 2015**	☐ Redrilling or Repair	☐ Shooting
☐ Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03.	Approximate Start Date	☐ Casing or Liner	☐ Acidizing
		☐ Plug Well	☐ Fracture Treatment
		☐ Supplemental History	☑ Change Production Method
		☐ Temporarily Abandon	☐ Reclamation
		☑ Other **Started Gas Lift**	

Well Name and Number: **Angus 3-10 3TFH**

Footages	Qtr-Qtr	Section	Township	Range
320 F **N** L **1105** F **W** L	**Lot 4**	**3**	**153 N**	**99 W**

Field	Pool	County
Long Creek	**Bakken**	**Williams**

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s)			
Address	City	State	Zip Code

DETAILS OF WORK

Zavanna started gas lift on the Angus 3-10 3TFH well effective 12-11-15. Gas lift is the artificial lift method for this well. The tubing has been run with a packer on bottom to prevent flow up the casing annulus and has gas lift mandrels/valves at specific depths in the tubing. A high pressure gas line has been run to the wellhead to inject gas down the casing annulus. Gas will go from casing to tubing through the gas lift mandrels/valves and will be used as the driver for fluid lift.

Company		Telephone Number
Zavanna, LLC		**(303) 595-8004**
Address: **1200 17th St., Ste 1100**		
City: **Denver**	State: **CO**	Zip Code: **80202**
Signature: Kimberly Gutierrez	Printed Name: **Kimberly Gutierrez**	
Title: **Env. & Reg. Compliance Specialist**	Date: **December 23, 2014**	
Email Address: **kgutierrez@zavanna.com**		

FOR STATE USE ONLY

☑ Received	☐ Approved
Date: 1-14-2016	
By: JT	
Title: JARED THUNE Engineering Technician	

WELL COMPLETION OR RECOMPLETION REPORT - FORM 6

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 2468 (04-2010)

OCT 2015
RECEIVED
ND OIL & GAS DIVISION

Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

Designate Type of Completion
☑ Oil Well ☐ EOR Well ☐ Recompletion ☐ Deepened Well ☐ Added Horizontal Leg ☐ Extended Horizontal Leg
☐ Gas Well ☐ SWD Well ☐ Water Supply Well ☐ Other:

Well Name and Number		Spacing Unit Description
Angus 3-10 3TFH **API# 33-105-03243**		**1280 Acres., Sec. 3 & 10 T153N R99W**
Operator: **Zavanna, LLC**	Telephone Number: **(303) 595-8004**	Field: **Long Creek**
Address: **1200 17th St., Ste 1100**		Pool: **Bakken**
City: **Denver**	State: **CO** Zip Code: **80202**	Permit Type: ☐ Wildcat ☑ Development ☐ Extension

LOCATION OF WELL

At Surface	Qtr-Qtr	Section	Township	Range	County
320 F N L **1105 F W L**	**Lot 4**	**3**	**153 N**	**99 W**	**Williams**

Spud Date	Date TD Reached	Drilling Contractor and Rig Number	KB Elevation (Ft)	Graded Elevation (Ft)
3/22/2014	**9/22/2014**	**Nabors 92 RR 9-25-14**	**2385**	**2356**

Type of Electric and Other Logs Run (See Instructions)
Geologist & Geosteering log,Iso Cmt Eval & Csg Integrity GR/CCL + Short +State 11-23-14, No OHL run

CASING & TUBULARS RECORD (Report all strings set in well)

Well Bore	String Type	String Size (Inch)	Top Set (MD Ft)	Depth Set (MD Ft)	Hole Size (Inch)	Weight (Lbs/Ft)	Anchor Set (MD Ft)	Packer Set (MD Ft)	Sacks Cement	Top of Cement
Lateral1										
	Surface	9 5/8	0	2333	13 1/2	36			660	0
	Production	7		11613	8 3/4	29/32			705	2435
	Liner	4 1/2	10748	21025	6					
	Tubing	2 7/8								

PERFORATION & OPEN HOLE INTERVALS

Well Bore	Well Bore TD Drillers Depth (MD Ft)	Completion Type	Open Hole/Perforated Interval (MD,Ft) Top	Bottom	Kick-off Point (MD Ft)	Top of Casing Window (MD Ft)	Date Perf'd or Drilled	Date Isolated	Isolation Method	Sacks Cement
Lateral1	21040	Perforations	11,680	20,973	10,790		7/10/2015			

PRODUCTION

Current Producing Open Hole or Perforated Interval(s), This Completion, Top and Bottom, (MD Ft)			Name of Zone (If Different from Pool Name)
Three Forks **11,680' / 20,973'**			**Same**
Date Well Completed (SEE INSTRUCTIONS)	Producing Method	Pumping-Size & Type of Pump	Well Status (Producing or Shut-In)
8/23/2015	**Flowing**	**None yet**	**Producing**

Date of Test	Hours Tested	Choke Size	Production for Test	Oil (Bbls)	Gas (MCF)	Water (Bbls)	Oil Gravity-API (Corr.)	Disposition of Gas
9/12/2015	**24**	**42 /64**		**567**	**762**	**507**	**42.5 °**	**Flared**

Flowing Tubing Pressure (PSI)	Flowing Casing Pressure (PSI)	Calculated 24-Hour Rate	Oil (Bbls)	Gas (MCF)	Water (Bbls)	Gas-Oil Ratio
1541	**1546**		**567**	**762**	**507**	**1344**

GEOLOGICAL MARKERS

Formation	MD (Ft)	TVD (Ft)
Pierre Sh	2200	
Greenhorn	4950	
Mowry	5363	
Dakota	5805	
Lakota	6053	
Swift	6295	
Rierdon	6744	
Piper Lime	6943	
Dunham	7230	
Saude	7312	
Pine Salt	7562	
Spearfish	7643	
Minnekahta	7682	
Opeche	7717	
Opeche Salt	7749	
B/ Opeche Salt	7798	
Minnelusa	8035	
Tyler	8215	
Kibbey Lime	8790	
Charles	8942	
Base Last Salt	9650	
Ratcliffe	9702	
Midale	9798	
Mission Canyon	9864	
Lodgepole	10458	
Bakken	11297	

PLUG BACK INFORMATION

Well Bore	Type of Plug	Top (Ft)	Bottom (Ft)	Sacks Cement

CORES CUT

Top (Ft)	Bottom (Ft)	Formation	Top (Ft)	Bottom (Ft)	Formation

Drill Stem Test

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)

Drill Pipe Recovery

Sample Chamber Recovery

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)

Drill Pipe Recovery

Sample Chamber Recovery

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)

Drill Pipe Recovery

Sample Chamber Recovery

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)

Drill Pipe Recovery

Sample Chamber Recovery

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)

Drill Pipe Recovery

Sample Chamber Recovery

Well Specific Stimulations

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
7/10/2015	Three Forks	11680	20973	35	287265	Barrels

Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)
Sand Frac	0	5995758	9500	75.0

Details

1,989,861 lbs 40/70 and 4,005,897 lbs 30/50

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units

Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)

Details

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units

Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)

Details

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units

Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)

Details

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units

Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)

Details

ADDITIONAL INFORMATION AND/OR LIST OF ATTACHMENTS

Geosteering & Geologists log, Schlumberger SlimPulse GR 2"/100' & 5"/100' MD & TVD recorded Mode, Composite Log

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records.	Email Address kgutierrez@zavanna.com		Date 10/26/2015
Signature Kimberly Gutierrez	Printed Name **Kimberly Gutierrez**	Title **Envir. & Reg. Compliance Specialist**	

KR well # 26684 10-20-15

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

ZAVANNA LLC
ATTENTION: JEAN ARNOLD
1200 17TH STREET, STE # 1100
DENVER, CO 80202

9590 9401 0061 5071 6776 56

2. Article Number *(Transfer from service label)*
7014 0150 0000 4833 1032

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
☐ Agent
☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

OCT 2015
RECEIVED
ND OIL & GAS
DIVISION

vice Type
Signature
☐ Adult Signature Restricted Delivery
☑ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
ail
ail Restricted Delivery
)

☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

#26684

Reuther, Rhonda L.

From: Hvinden, Dave C.
Sent: Wednesday, October 28, 2015 8:08 AM
To: Reuther, Rhonda L.
Subject: FW: Angus 3-10 3TFH
Attachments: Angus 3-10 3TFH.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Please place this email in well file number 26684

From: Kimberly Gutierrez [mailto:kgutierrez@zavanna.com]
Sent: Tuesday, October 27, 2015 3:48 PM
To: Hvinden, Dave C.
Subject: Angus 3-10 3TFH

Hi David,

I received the attached letter and wanted to touch base with you on this well. First production began on 8/23/15. We had a delay in our completions schedule due to the economic downturn but it is currently producing. Is there something else you need from me?

Thank you,

Kim Gutierrez
Environmental & Regulatory Compliance Specialist
Zavanna, LLC
1200 17th Street, Suite 700
Denver, CO 80202
Direct: (720) 638-2861
kgutierrez@zavanna.com

NORTH DAKOTA
OIL AND GAS DIVISION

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director
Department of Mineral Resources
Lynn D. Helms - Director
North Dakota Industrial Commission
www.dmr.nd.gov/oilgas

October 20, 2015

RECEIVED
OCT 23 2015

ZAVANNA LLC
ATTENTION: JEAN ARNOLD
1200 17TH STREET, STE # 1100
DENVER, CO 80202

RE: ANGUS 3-10 3TFH
LOT4 3-153N-99W
WILLIAMS COUNTY
WELL FILE NO. 26684

Dear Jean Arnold,

In reviewing the production records for the above captioned well, our files indicate that this well has not produced oil or gas in paying quantities in over one year.

Pursuant to section 38-08-04, paragraph 1, part (l) of the North Dakota Century Code, the Commission has placed this well on abandoned-well status *effective immediately.*

To remove this well from the abandoned-well status, you must within 6 months either;

1. Return the well to production in paying quantities,
2. Obtain a temporarily abandoned status, or
3. Plug the well and reclaim the well site.

If none of the preceding conditions are met, the Commission may require the well to be placed immediately on a single-well bond in an amount equal to the cost of plugging the well and reclaiming the well site.

Once a well has been in abandoned-well status for one year, the well's equipment, related equipment, and salable oil at the well site are subject to forfeiture by the Commission. The single-well bond or any other bond covering the well if the single-well bond has not been obtained is subject to forfeiture by the Commission.

Should you have any questions regarding this matter, please contact me at 701-328-8020.

Sincerely,

David Hvinden / RLR

David C. Hvinden
Field Supervisor

DCH/JLG/RLR
Certified Mail: 7014 0150 0000 4833 1032

NORTH DAKOTA
OIL AND GAS DIVISION

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director
Department of Mineral Resources
Lynn D. Helms - Director
North Dakota Industrial Commission
www.dmr.nd.gov/oilgas

#26684

October 20, 2015

ZAVANNA LLC
ATTENTION: JEAN ARNOLD
1200 17TH STREET, STE # 1100
DENVER, CO 80202

RE: ANGUS 3-10 3TFH
LOT4 3-153N-99W
WILLIAMS COUNTY
WELL FILE NO. 26684

Dear Jean Arnold,

In reviewing the production records for the above captioned well, our files indicate that this well has not produced oil or gas in paying quantities in over one year.

Pursuant to section 38-08-04, paragraph 1, part (l) of the North Dakota Century Code, the Commission has placed this well on abandoned-well status *effective immediately.*

To remove this well from the abandoned-well status, you must within 6 months either;

1. Return the well to production in paying quantities,
2. Obtain a temporarily abandoned status, or
3. Plug the well and reclaim the well site.

If none of the preceding conditions are met, the Commission may require the well to be placed immediately on a single-well bond in an amount equal to the cost of plugging the well and reclaiming the well site.

Once a well has been in abandoned-well status for one year, the well's equipment, related equipment, and salable oil at the well site are subject to forfeiture by the Commission. The single-well bond or any other bond covering the well if the single-well bond has not been obtained is subject to forfeiture by the Commission.

Should you have any questions regarding this matter, please contact me at 701-328-8020.

Sincerely,

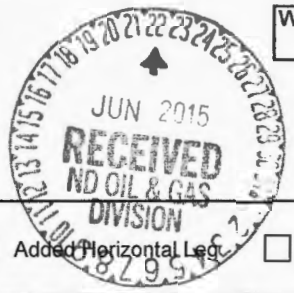
David Hvinden / RLR

David C. Hvinden
Field Supervisor

DCH/JLG/RLR
Certified Mail: 7014 0150 0000 4833 1032

WELL COMPLETION OR RECOMPLETION REPORT - FORM 6

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 2468 (04-2010)



Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

Designate Type of Completion
☑ Oil Well ☐ EOR Well ☐ Recompletion ☐ Deepened Well ☐ Added Horizontal Leg ☐ Extended Horizontal Leg
☐ Gas Well ☐ SWD Well ☐ Water Supply Well ☐ Other:

Well Name and Number		Spacing Unit Description
Angus 3-10 3TFH API# 33-105-03243 "PRELIMINARY"		**1280 Acres., Sec. 3 & 10 T153N R99W**
Operator: **Zavanna, LLC**	Telephone Number: **(303) 595-8004**	Field: **Long Creek**
Address: **1200 17th St., Ste 1100**		Pool: **Bakken**
City: **Denver**	State: **CO** / Zip Code: **80202**	Permit Type: ☐ Wildcat ☑ Development ☐ Extension

LOCATION OF WELL

At Surface	Qtr-Qtr	Section	Township	Range	County
320 F N L 1105 F W L	**Lot 4**	**3**	**153 N**	**99 W**	**Williams**

Spud Date	Date TD Reached	Drilling Contractor and Rig Number	KB Elevation (Ft)	Graded Elevation (Ft)
3/22/2014	**9/22/2014**	**Nabors 92 RR 9-25-14**	**2385**	**2356**

Type of Electric and Other Logs Run (See Instructions)
Geologist & Geosteering log,Iso Cmt Eval & Csg Integrity GR/CCL + Short +State 11-23-14, No OHL run

CASING & TUBULARS RECORD (Report all strings set in well)

Well Bore	String Type	String Size (Inch)	Top Set (MD Ft)	Depth Set (MD Ft)	Hole Size (Inch)	Weight (Lbs/Ft)	Anchor Set (MD Ft)	Packer Set (MD Ft)	Sacks Cement	Top of Cement
Lateral1										
	Surface	9 5/8	0	2333	13 1/2	36			660	0
	Production	7		11613	8 3/4	29/32			705	
	Liner	4 1/2	10748	21025	6					

PERFORATION & OPEN HOLE INTERVALS

Well Bore	Well Bore TD Drillers Depth (MD Ft)	Completion Type	Open Hole/Perforated Interval (MD,Ft) Top	Bottom	Kick-off Point (MD Ft)	Top of Casing Window (MD Ft)	Date Perf'd or Drilled	Date Isolated	Isolation Method	Sacks Cement
Lateral1	21040				10,790					

PRODUCTION

Current Producing Open Hole or Perforated Interval(s), This Completion, Top and Bottom, (MD Ft)							Name of Zone (If Different from Pool Name)	
Date Well Completed (SEE INSTRUCTIONS)		Producing Method		Pumping-Size & Type of Pump			Well Status (Producing or Shut-In)	
Date of Test	Hours Tested	Choke Size	Production for Test	Oil (Bbls)	Gas (MCF)	Water (Bbls)	Oil Gravity-API (Corr.) °	Disposition of Gas
Flowing Tubing Pressure (PSI)	Flowing Casing Pressure (PSI)		Calculated 24-Hour Rate	Oil (Bbls)	Gas (MCF)	Water (Bbls)	Gas-Oil Ratio	

GEOLOGICAL MARKERS

Formation	MD (Ft)	TVD (Ft)

PLUG BACK INFORMATION

Well Bore	Type of Plug	Top (Ft)	Bottom (Ft)	Sacks Cement

CORES CUT

Top (Ft)	Bottom (Ft)	Formation	Top (Ft)	Bottom (Ft)	Formation

Drill Stem Test

Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)
Drill Pipe Recovery								
Sample Chamber Recovery								
Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)
Drill Pipe Recovery								
Sample Chamber Recovery								
Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)
Drill Pipe Recovery								
Sample Chamber Recovery								
Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)
Drill Pipe Recovery								
Sample Chamber Recovery								
Test Date	Formation	Top (Ft)	Bottom (Ft)	BH Temp (°F)	CL ppm	H2S ppm	Shut-in 1 (PSIG)	Shut-in 2 (PSIG)
Drill Pipe Recovery								
Sample Chamber Recovery								

Well Specific Stimulations

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)		
Details						

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)		
Details						

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)		
Details						

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)		
Details						

Date Stimulated	Stimulated Formation	Top (Ft)	Bottom (Ft)	Stimulation Stages	Volume	Volume Units
Type Treatment	Acid %	Lbs Proppant	Maximum Treatment Pressure (PSI)	Maximum Treatment Rate (BBLS/Min)		
Details						

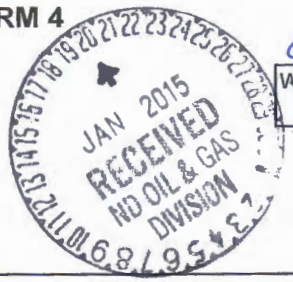
ADDITIONAL INFORMATION AND/OR LIST OF ATTACHMENTS

Geosteering & Geologists log, Schlumberger SlimPulse GR 2"/100' & 5"/100' MD & TVD recorded Mode, Composite Log

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records.	Email Address jarnold@zavanna.com	Date 6-18-15 PRELIMINARY
Signature Jean Arnold	Printed Name **Jean Arnold**	Title **Sr. Prod. Tech.**

SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)



CTB

Well File No. 22682-01

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

☑ Notice of Intent	Approximate Start Date: June / July 2015	☐ Drilling Prognosis	☐ Spill Report
☐ Report of Work Done	Date Work Completed:	☐ Redrilling or Repair	☐ Shooting
☐ Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03.	Approximate Start Date:	☐ Casing or Liner	☐ Acidizing
		☐ Plug Well	☐ Fracture Treatment
		☐ Supplemental History	☑ Change Production Method
		☐ Temporarily Abandon	☐ Reclamation
		☑ Other: Commingle 6 MWP	

Well Name and Number: **Angus 3-10 1H**

Footages	Qtr-Qtr	Section	Township	Range
320 F N L 1045 F W L	Lot 4	3	153 N	99 W

Field	Pool	County
Long Creek	BAKKEN	WILLIAMS

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s)

Address	City	State	Zip Code

DETAILS OF WORK

Zavanna requests approval to commingle the Angus multi-well pad. (Angus 3-10 1H, 3TFH, 5H, 7H, Angus 34-27 2H, 4TFH)(WF#'s 26682, 26684, 26685, 26687, 26683). Please refer to attachments.

Company	Telephone Number
Zavanna, LLC	(303) 595-8004

Address		
1200 17th St., Ste 1100		
City: Denver	State: CO	Zip Code: 80202

Signature	Printed Name
	Jean Arnold
Title: Sr. Prod. Tech.	Date: January 15, 2015

Email Address: jarnold@zavanna.com

FOR STATE USE ONLY

☐ Received ☒ Approved

Date: 1-22-2015

By:

Title: PETROLEUM ENGINEER

Zavanna, LLC is requesting approval to commingle production from the following wells:

Well Name	NDIC WF#	Surface Footages	Location	County
Angus 3-10 1H	26682	320' FNL 1045' FWL	Lot 4 Sec. 3-153N-99W	Williams
Angus 3-10 3TFH	26684	320' FNL 1105' FWL	Lot 4 Sec. 3-153N-99W	Williams
Angus 3-10 5H	26685	320' FNL 1135' FWL	Lot 4 Sec. 3-153N-99W	Williams
Angus 3-10 7H	26687	320' FNL 1195' FWL	Lot 4 Sec. 3-153N-99W	Williams
Angus 34-27 2H	26683	320' FNL 1075' FWL	Lot 4 Sec. 3-153N-99W	Williams
Angus 34-27 4TFH	26686	320' FNL 1165' FWL	Lot 4 Sec. 3-153N-99W	Williams

The above wells will use "Continuous Metering" and as a group have "diverse" ownership. Continuous Metering for above wells will be located at the Angus 3-10 1H, 3TFH, 5H, 7H, Angus 34-27 2H, 4TFH Production Facility in Section 3.

Each individual well will flow into a single separator/treater located at the Production Facility where oil, produced water, and gas will be separated and Continuous Metering for each used on each well as follows:

1. Per well Continuous Metering oil volumes will be used to allocate actual stock tank oil volumes delivered through central facility commingled "oil sales" LACT unit volumes back to individual well(s). Oil measurement device will be Coriolis meter using Electronic Flow Measurement (EFM) and appropriate industry and manufacturer standards. All oil coriolis meters at the Angus Production Facility will be equipped with individual "proving loop" connections so that "custody transfer" meters will be calibrated monthly and "allocation" meters will be calibrated quarterly.
2. Per well Continuous Metering of gas volumes will be used to allocate actual standard condition gas volumes delivered through central facility "gas sales" meter back to individual well(s). Gas measurement device will be orifice plate using EFM and appropriate industry and manufacturer standards.
3. Per well Continuous Metering of water volumes will be used to allocate actual water volumes transported out of the central facility back to individual well(s). Water measurement device will be Turbine meter using EFM and appropriate industry and manufacturer standards.

Please reference, 1) The Facility Commingling Diagram of each well and the flow lines from each well that will produce into the central facility, 2) A list of the manufacturer, size, and type of meters to be used, and 3) The Commingled Production Allocation Method to be used to determine individual well production.

Oil Meter: 2" Emerson Micro Motion 150#, 316 SSL Coriolis Meter
(Model #CMF200M418N2BAEAZZZ)

Gas Meter: 2" NuFlo Scanner 2000 Orifice Plate meter tube with EFM

SW Meter: 2" Kimray Turbine QUICKSERT IN-LINE

Zavanna, LLC shall use the following procedures for allocating production for the associated Continuous Metering wells commingled at the "Angus 3-10 1H, 3TFH, 5H, 7H, 34-27 2H, 34-27 4TFH"" central production facility:

General:

1. Monthly downtime shall be monitored for all commingled wells to determine the exact total number of production hours for each well (NDIC).

Oil Continuous Metering: Individual Well "Allocated Monthly Well Oil Sales:"

1. Volumes of oil shall be metered at a dedicated single well separator/treater (at central facility) using coriolis meters.
2. The total oil volume leaving the central facility shall be metered by LACT unit prior to shipping through pipeline or truck.
    a. LACT metered oil volumes for the month are termed "Actual Monthly Oil Sales."
3. Determine a theoretical monthly oil production volume for each continuously measured well as follows:
    a. "Theoretical Monthly Oil Production" (post-ops review) = Total oil volume continuously measured for the month with Volume corrected as necessary by responsible operations/metering personnel for known upsets/malfunctioning of equipment or measurement devices that impact accuracy of well oil volumes.
4. Sum all the individual well "Theoretical Monthly Oil Production" volumes to determine the "Total Theoretical Monthly Oil Production" for the central facility.
5. Calculate a sales factor by dividing the total Actual Monthly Oil Sales by the Total Theoretical Monthly Oil Production.
6. Determine "Allocated Monthly Oil Production" for each well by multiplying the respective individual well's Theoretical Monthly Oil Production volume by the sales factor calculated in Step 5 above.
7. LACT meter used in the measurement will be calibrated monthly through a proving loop.
8. Well oil allocation meters will be calibrated quarterly through a proving loop.
9. Volumes will be reported to appropriate agencies through routine oil production reports filed monthly.

Gas Continuous Metering: Individual Well "Monthly Well Gas Production/Sales/Flare:"

1. Volumes of gas shall be metered at a dedicated single well separator/treater (at central facility) using orifice plates.
2. Volumes of gas production shall be the volume continuously metered for each well to determine gas production.
3. The total gas volume leaving the central production facility through a gas sales pipeline shall be metered by custody transfer "gas sales" meter prior to delivery into gas gathering pipeline.
    a. Gas Sales meter volumes for the month are termed "Actual Monthly Gas Sales."

4. The total gas volume that is unable to be sold through the gas gathering pipeline will be flared through engineered flare system so that optimal combustion can occur and gas sent to flare will be metered using orifice plates
    a. Gas Flare meter volumes for the month are termed "Actual Monthly Gas Flare."
5. Determine a theoretical monthly gas production volume for each continuously measured well as follows:
    a. "Theoretical Monthly Gas Production" (post-ops review) = Total gas volume continuously measured for month with Volume corrected as necessary by responsible operations/metering personnel for known upsets/malfunctioning of equipment or measurement devices that impact accuracy of well gas volumes.
6. Sum all the individual well Theoretical Monthly Gas Production volumes to determine the "Total Theoretical Monthly Gas Production" for the central production facility.
7. Calculate a sales factor by dividing the total Actual Monthly Gas Sales by the Total Theoretical Monthly Gas Production volumes for the central production facility corrected as necessary for any time wells were producing but measurement was not operational
8. Calculate a flare factor by dividing the total Actual Monthly Gas Flared by the Total Theoretical Monthly Gas Production volumes for the central production facility corrected as necessary for any time wells were producing but measurement was not operational.
9. Determine "Allocated Monthly Gas Sales" for each well by multiplying the respective individual well Theoretical Monthly Gas Production volume by the sales factor calculated in Step 7 above.
10. Determine "Allocated Monthly Gas Flared" for each well by multiplying the respective individual well Theoretical Monthly Gas Production volume by the flare factor calculated in Step 8 above.
11. Gas Sales/Flare meters used in the measurement will be calibrated and maintained according to gas gathering contracts with commercial gathering entities and/or industry standard practices if performed by Zavanna, LLC directly.
12. Well gas allocation meters will be checked and calibrated on a standard timespan reflective of gas volume magnitude (large volumes quarterly, lower volumes every 6 months).
13. Volumes will be reported to appropriate agencies through routine gas production reports filed monthly.

Associated Oil Tank Gas (aka Vapors) Recovered and Sold with Separator Gas:

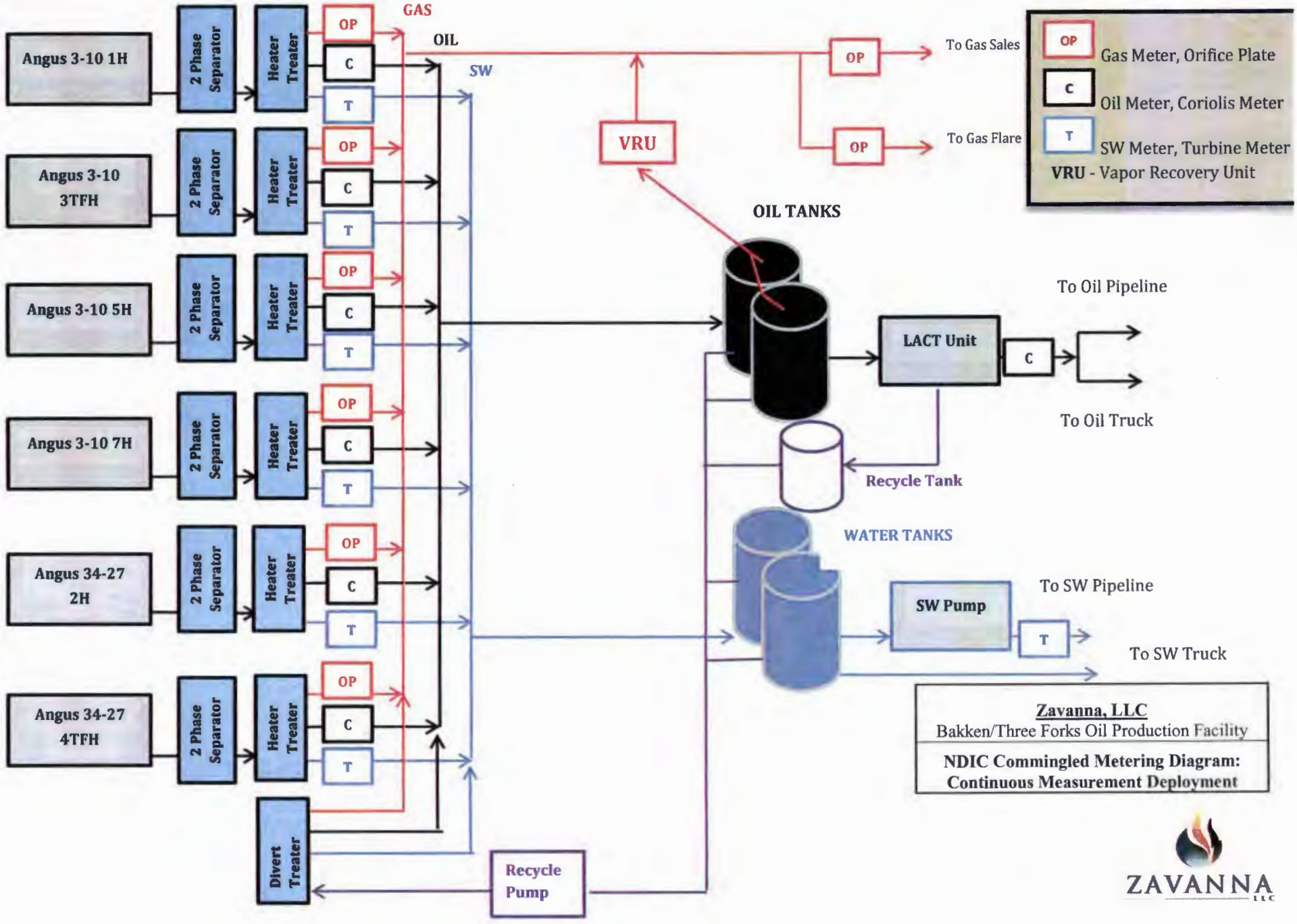
1. Commingled gas from the discharge of Vapor Recovery Unit (VRU) compressors will be measured either through the Gas Sales meter or the Gas Flare meter and will be allocated back to the well as described in Steps 9 and 10 from the previous section. The use of sales and flare factors will bridge the gap between Theoretical Gas Production and Actual Gas Production. Liquids (aka condensates) recovered from the VRU compressor will go to the tanks and quantities allocated by the method described in Step 6 from the Oil Continuous Metering section of these procedures.

Continuous Metering: Individual Well "Monthly Well Water Production:"

1. Volumes of produced salt water ("SW") shall be metered at a dedicated single well separator/treater (at central facility) using turbine meters.
2. The total SW volume leaving the central facility shall be metered by turbine meter prior to shipping through pipeline or truck.
    a. Metered SW volumes and trucked SW volumes for the month are termed "Actual Monthly SW Production."
3. Determine a theoretical monthly SW production volume for each continuously measured well as follows:
    a. "Theoretical Monthly SW Production" (post-ops review) = Total SW volume continuously measured for the month with Volume corrected as necessary by responsible operations/metering personnel for known upsets/malfunctioning of equipment or measurement devices that impact accuracy of well oil volumes.
4. Sum all the individual well Theoretical Monthly SW Production volumes to determine the "Total Theoretical Monthly SW Production" for the central facility.
5. Calculate a production factor by dividing the total Actual Monthly SW Production by the Total Theoretical Monthly SW Production.
6. Determine "Allocated Monthly SW Production" for each well by multiplying the respective individual well's Theoretical Monthly SW Production volume by the production factor calculated in Step 5 above.
7. All turbine meters used in measurement will be checked and calibrated on a standard timespan reflective of SW volume magnitude (large volumes quarterly, lower volumes every 6 months).
8. Volumes will be reported to appropriate agencies through routine SW production reports filed monthly.

Commingled Central Production Facility

Angus 3-10 1H, 3TFH, 5H, 7H, 34-27 2H, 34-27 4TFH– Section 3-153N-99W, Williams County



AUTHORIZATION TO PURCHASE AND TRANSPORT OIL FROM LEASE - FORM 8

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5698 (03-2000)

DEC 2014
RECEIVED
ND OIL & GAS
DIVISION

Well File No.
26684
NDIC CTB No.
12484

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND FOUR COPIES.

Well Name and Number	Qtr-Qtr	Section	Township	Range	County
Angus 3-10 3TFH	Lot 4	3	153 N	99 W	WILLIAMS

Operator	Telephone Number	Field
ZAVANNA, LLC	303-595-8004	Long Creek

Address	City	State	Zip Code
1200 17TH STREET, SUITE 1100	DENVER	CO	80202

Name of First Purchaser	Telephone Number	% Purchased	Date Effective
ARM Energy Management	281-664-0046	100	December 2, 2014

Principal Place of Business	City	State	Zip Code
20329 State Highway 249, Suite 450	Houston	TX	77070

Field Address	City	State	Zip Code
20329 State Highway 249, Suite 450	Houston	TX	77070

Name of Transporter	Telephone Number	% Transported	Date Effective
Meadowlark Midstream Company, LLC	720-452-6220	100	December 2, 2014

Address	City	State	Zip Code
999 18th Street, Ste. 3400 South	Denver	CO	80202

The above named producer authorizes the above named purchaser to purchase the percentage of oil stated above which is produced from the lease designated above until further notice. The oil will be transported by the above named transporter.

Other First Purchasers Purchasing From This Lease	% Purchased	Date Effective
Other First Purchasers Purchasing From This Lease	% Purchased	Date Effective
Other Transporters Transporting From This Lease	% Transported	Date Effective
Other Transporters Transporting From This Lease	% Transported	Date Effective

Comments

Received verbal approval 12-2-14 from Jessica Gilkey NDIC to transport 5,000 BO for each Angus well (Angus 3-10 1H, 3TFH, 5H, 7H, 34-27 2H, 4TFH). If oil is required to be transported Zavanna will submit a revised FM 8.

I hereby swear or affirm that the information provided is true, complete and correct as determined from all available records.

Date: December 2, 2014

Signature	Printed Name	Title
Jean Arnold	Jean Arnold	Sr. Prod. Tech.

Above Signature Witnessed By

Witness Signature	Witness Printed Name	Witness Title
Kimberly Gutierrez	Kimberly Gutierrez	Regulatory Tech.

FOR STATE USE ONLY

Date Approved	DEC 19 2014
By	Annette Fratzke
Title	Oil & Gas Production Analyst

Industrial Commission of North Dakota
Oil and Gas Division
Verbal Approval To Purchase and Transport Oil

Well or Facility No **26684**

Tight Hole **No**

OPERATOR

Operator	Representative	Rep Phone
ZAVANNA, LLC	**Jean Arnold**	

WELL INFORMATION

Well Name
ANGUS 3-10 3TFH

Inspector
Jessica Gilkey

Well Location	QQ	Sec	Twp		Rng	
	LOT4	**3**	**153**	**N**	**99**	**W**

County
WILLIAMS

Field
LONG CREEK

Footages			
	320	Feet From the **N**	Line
	1105	Feet From the **W**	Line

Pool
BAKKEN

Date of First Production Through Permanent Wellhead

This Is Not The First Sales

PURCHASER / TRANSPORTER

Purchaser	Transporter
ARM ENERGY MANAGEMENT LLC	**MEADOWLARK MIDSTREAM COMPANY, LLC**

TANK BATTERY

Single Well Tank Battery Number :

SALES INFORMATION **This Is Not The First Sales**

ESTIMATED BARRELS TO BE SOLD	ACTUAL BARRELS SOLD	DATE
5000 BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	
BBLS	BBLS	

DETAILS

Start Date	**12/9/2014**
Date Approved	**12/9/2014**
Approved By	**Jessica Gilkey**

SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)

RECEIVED
DEC 2014
ND OIL & GAS DIVISION

Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

- [ ] Notice of Intent — Approximate Start Date
- [ ] Report of Work Done — Date Work Completed
- [x] Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03. — Approximate Start Date: **December 2014**

- [ ] Drilling Prognosis
- [ ] Redrilling or Repair
- [ ] Casing or Liner
- [ ] Plug Well
- [ ] Supplemental History
- [ ] Temporarily Abandon
- [ ] Spill Report
- [ ] Shooting
- [ ] Acidizing
- [ ] Fracture Treatment
- [ ] Change Production Method
- [ ] Reclamation
- [x] Other: **Complete - Drill out - Flow without packer**

Well Name and Number					
Angus 3-10 3TFH					
Footages		Qtr-Qtr	Section	Township	Range
320 F N L	**1105 F W L**	**Lot 4**	**3**	**153 N**	**99 W**
Field	Pool	County			
Long Creek	**Bakken**	**WILLIAMS**			

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s)			
Mercer			
Address	City	State	Zip Code
Box 1299	**Gainesville**	**TX**	**76241**

DETAILS OF WORK

Zavanna, LLC requests a waiver from the tubing/pkr requirement included in NDAC 43-02-03-21: Casing, Tubing, and Cementing Requirements during the completion period immediately following the fracture stimulation. The following assurances apply:

1) The well is equipped with new 29# and 32# 7" P-110 casing at surface with an API burst rating of 11,220 psi and 12,460 psi, respectively.
2) The well has been inspected with a SLB USIT log (Ultrasonic) which confirmed 7" casing integrity & cement bond.
3) The well has been successfully pressure tested to 9,700 psi. prior to the fracture stimulation.
4) Damage to the casing during the frac would be detected immediately by monitoring equipment.
5) The casing is exposed to significantly lower rates and pressures during flow back than during the frac job.
6) The frac fluid and formation fluids have very low corrosion and erosion rates.
7) Production equipment will be installed as soon as possible after the well ceases flowing.
8) A 300# gauge will be installed on surface casing during flowback period.

Company		Telephone Number
Zavanna, LLC		**(303) 595-8004**
Address		
1200 17th St., Ste 1100		
City	State	Zip Code
Denver	**CO**	**80202**
Signature	Printed Name	
Jean Arnold	**Jean Arnold**	
Title	Date	
Sr. Prod. Tech.	**December 9, 2014**	
Email Address		
jarnold@zavanna.com		

FOR STATE USE ONLY

- [ ] Received
- [x] Approved

Date: December 22, 2014
By: [signature]
Title: PETROLEUM ENGINEER

Zavanna, LLC

Angus 3-10 3TFH

320' FNL & 1,105' FWL
Lot 4 Section 3, T153N, R99W
Long Creek Field / Three Forks
Williams County, North Dakota

BOTTOM HOLE LOCATION:
9,931.64' S & 202.01' E of surface location or approx.
299.03' FSL & 1,307.01' FWL, SW SW Sec. 10, T153N, R99W

Prepared for:
Jerry Mayer
Zavanna, LLC
1200 17th Street, Ste. 1100
Denver, CO 80802

Prepared by:
Kyle Eno, Jim Gutoski, Evan Hanson
PO Box 80507; Billings, MT 59108
(406) 259-4124
geology@sunburstconsulting.com
www.sunburstconsulting.com

Angus 3-10 3TFH Well Evaluation

Figure 1. Nabors 92 drilling the Zavanna, LLC Angus 3-10 3TFH well from August of 2014, Long Creek Field, Williams County, North Dakota (Jim Gutoski, Sunburst Consulting).

INTRODUCTION

Zavanna, LLC Angus 3-10 3TFH [Lot 4 Section 3, T153N, R99W] is located approximately 13 miles east-south-east of Williston, in the Long Creek Field of Williams County, North Dakota (Figure 1). The well was designed as part of the Angus pad which incorporated both Middle Bakken and Three Forks horizontals. This well was designed as a Three Forks horizontal well with one lateral drilled toward the south to develop Sections 3 and 10. Directional drilling and geo-steering would be employed to land in the first bench of the Three Forks and to maintain maximum exposure to the target zone.

GEOLOGY

Prospective Lithology

The **Ratcliffe** interval was logged at **9,702' MD / 9,700' TVD.** This interval consists of clean, argillaceous and dolomitic lime mudstone which is microcrystalline and interbedded with off white amorphous anhydrite and dolomite. Hydrocarbon shows peaked at 22 units in 10.05 ppg drilling mud.

The **Mission Canyon Formation** was drilled at **9,864' MD / 9,862' TVD**. The Mission Canyon consists primarily of clean, argillaceous and dolomitic limestone interbedded with anhydrite and dolomite. Hydrocarbon shows reached a high of 60 units in 10.05 ppg drilling mud.

The **Lodgepole Formation** was penetrated **10,458' MD / 10,457' TVD**. A normal platform to slope marine environment deposited approximately 740' of consistent argillaceous lime mudstone that was a mottled gray to light gray-brown, microcrystalline, with an earthy texture and trace disseminated pyrite.
Hydrocarbon shows ranged from 34 to 69 units in 9.85-10.55 ppg drilling mud.

The **Scallion** was logged at **11,282' MD / 11,202' TVD**. This clean lime wackestone is cream to very light brown, microcrystalline and firm to hard. A hydrocarbon show peaked at 1,980 units in 10.55 ppg drilling mud.

The **Bakken Formation** has three members here, two organic-rich, pyritic shale units, separated by a siltstone and silty sandstone and dolomitic middle member. The carbonaceous **Upper Bakken Shale** was penetrated at **11,297' MD / 11,210' TVD**. Measured gas levels peaked at 1,500 units in 10.55 ppg drilling mud. The **Middle Bakken** was entered at **11,334' MD / 11,230' TVD.** The middle member consisted of relatively thin siltstone overlying a thin layer of an off-white, lime packstone which is atop a silty sandstone with interbedded sucrosic dolomite. Gas shows ranged from 172 units to 1,134 units. The **Lower Bakken Shale** was logged at **11,434' MD/ 11,269' TVD**. Observed gas levels peaked at 1,889 units in 10.55 ppg drilling mud.

The **Three Forks** was penetrated at **11,516' MD/ 11,293' TVD**. The formation is composed of a sucrosic cream to off white dolomite with interbedded layers of a light gray, bluish-green shale. Nodular and disseminated pyrite is observed throughout the formation, with greater concentrations being observed in the upper portion of formation. Hydrocarbon shows ranged from ~200 units to 5,985 units.

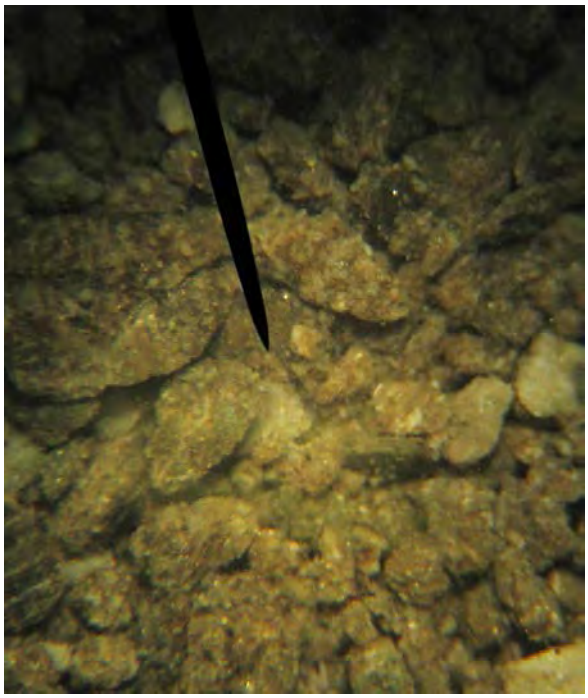


Figure 2: Wet cutting of the lower Middle Bakken.

Lateral Gas and Oil Shows

The background gas for the Angus 3-10 3TFH ranged from ~40 to ~2,000 units during the course of the lateral and averaged between 500 and 800 units. The highest gas show was 5,985 units at 19,955' in 10.1 ppg mud weight. A trip gas at 17,605' measured 1,581 total units. The gas was not circulated through the gas buster during the drilling of the lateral, primarily because the use of heavier mud weights. There was noticeable trends across the lateral for hydrocarbon shows, specifically higher gas shows above and below our ideal target zone. Oil shows were constant throughout the well, trace to common spotty to even brown oil staining in the dolomite and trace spotty brown oil staining in the shale.

Geo-steering

A 6’ target zone was chosen for the Angus 3-10 3TFH by Zavanna geologists. The previously drilled Angus 34-27 4TFH curve was used as a primary offset to establish the landing target (Figure 3). The target zone was bounded by a distinct high gamma marker above (~115 API) and another high gamma marker below (~100 API), with a low gamma marker (~45 API) separating the peaks. Beneath the established target, gamma readings drop down to the lowest marker (~40 API) in the first bench of the Three Forks. Below that gamma increases to ~120+ API which indicates the presence of the “claystone” in the second bench.

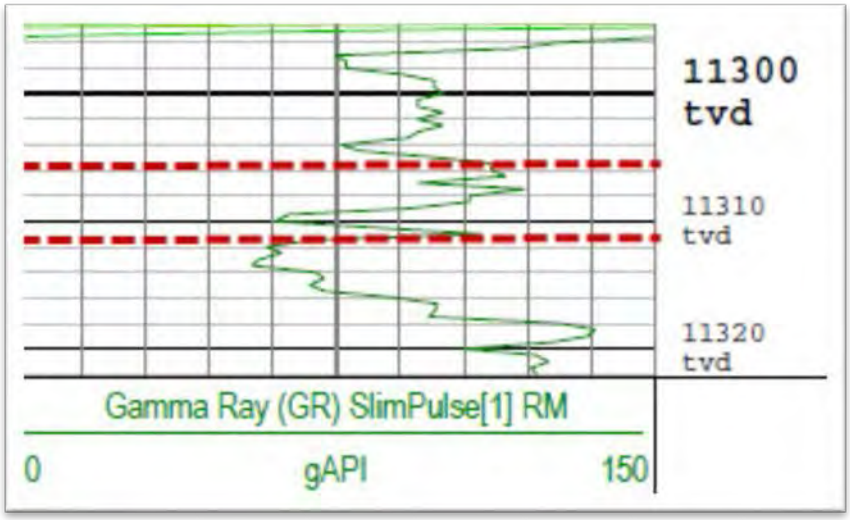


Figure 3. Gamma type log of the Three Forks from the curve landing from the Angus 34-27 4TFH well. Dashed red lines represent the established target zone.

The prognosis suggested a landing target of 11,313’ TVD. The Middle Bakken came in at 11,230’ TVD which projected the landing target to be 11,304’ TVD and so the landing target was officially changed accordingly. After penetrating the Three Forks at 11,293’ TVD, a final landing target of 11,307’ TVD was established. The curve was successfully landed five feet high at 11,302’ TVD.

The previously drilled Angus 3-10 1H Middle Bakken well was chosen as our primary lateral offset due to the close proximity and the confidence in the profile based off repeated encounters with the packstone. Based off this well it was expected that the Three Forks would mirror the same overall 0.01º down dip. What was observed matched the Angus 3-10 1H well. There was a general 0.18° down dip until approximately 15,500’. The formation then flattened out for approximately 2,000’ after which there was a general up dip of about 0.13° until TD was reached. Upon completion, the overall apparent dip was calculated to be 0.03º for the lateral (Figure 4).

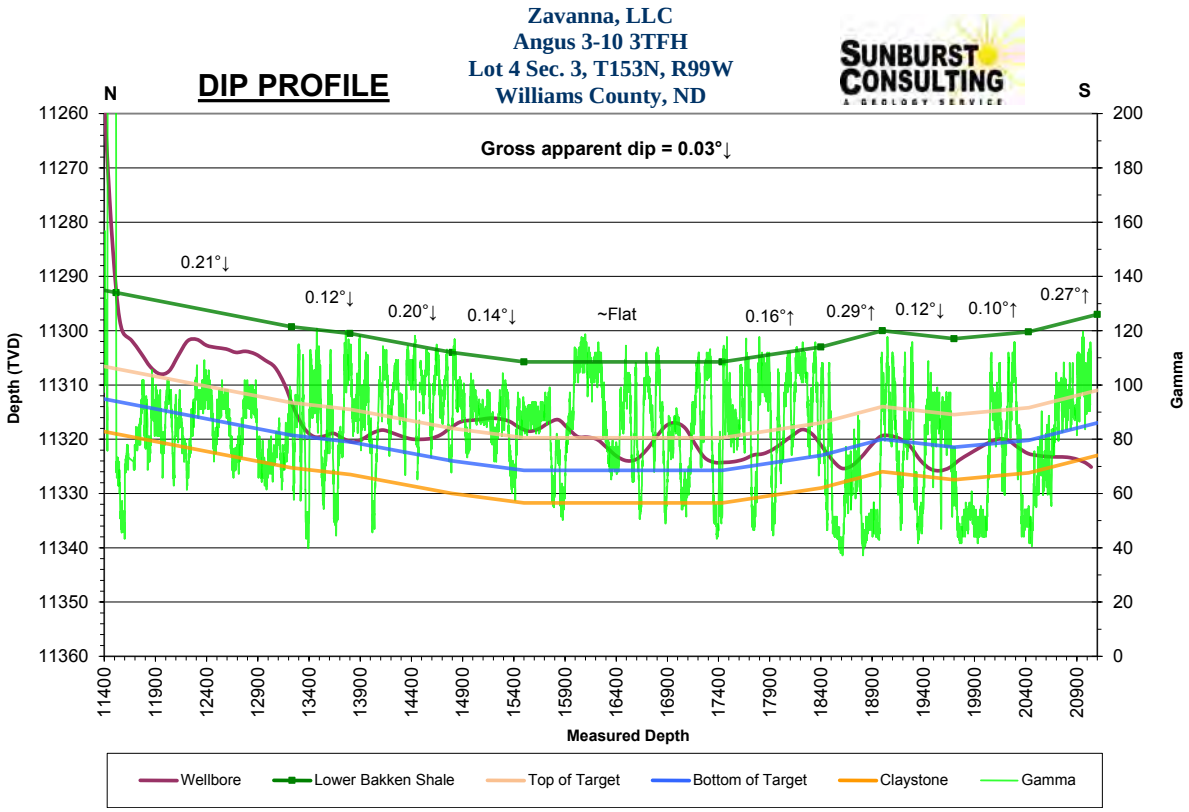


Figure 4. Complete dip profile of the Angus 3-10 3TFH lateral. Gamma represented is from recorded mode data.

Bottom Hole Location

Total depth resulted in a closure azimuth of 178.83° and a closure distance of 9,933.69'. The bottom-hole location is projected to be 9,931.64' south and 202.01' east of the surface location or approximately 299.03' FSL and 1,307.01' FWL, SW SW Section 10, T153N, R99W.

SUMMARY

The Zavanna, LLC Angus 3-10 3TFH was spud on March 22, 2014 and re-entered by Nabors rig #92 on July 24, 2014 for the vertical and curve and then again on September 13, 2014 for the lateral. The well efficiently reached TD in 22 total drilling days on September 22, 2014. Samples from the Three Forks target contained oil staining that was described as trace to occasional with trace visible intercrystalline porosity. MWD gamma ray markers, sample analysis, and ROP were successfully utilized to expose 100% of the lateral borehole to the Three Forks. The Angus 3-10 3TFH awaits completion operations to maximize its production potential.

Respectfully submitted,
Kyle Eno & Jim Gutoski
Sunburst Consulting, Inc.
September 24, 2014

WELL DATA SUMMARY

OPERATOR:	**Zavanna, LLC**
ADDRESS:	1200 17th Street, Ste. 1100 Denver, CO 80802
WELL NAME:	**Angus 3-10 3TFH**
API #:	33-105-03243
WELL FILE #:	26684
SURFACE LOCATION:	320' FNL & 1,105' FWL Lot 4 Section 3, T153N, R99W
FIELD/ OBJECTIVE:	Long Creek Field / Three Forks
COUNTY, STATE	Williams County, North Dakota
BASIN:	Williston
WELL TYPE:	Three Forks Horizontal
ELEVATION:	GL: 2,358' KB: 2,385'
SPUD/ RE-ENTRY DATE:	Spud - 3/22/2014, Re-entry - 6/24/2014 Re-entry 9/13/2014
BOTTOM HOLE LOCATION:	9,931.64' S & 202.01' E of surface location or approx. 299.03' FSL & 1,307.01' FWL, SW SW Sec. 10, T153N, R99W
CLOSURE COORDINATES:	Closure Azimuth: 178.83° Closure Distance: 9,933.69'
TOTAL DEPTH / DATE:	21,040' on September 22, 2014 54% within target interval
TOTAL DRILLING DAYS:	19 days
CONTRACTOR:	Nabors #92

PUMPS:	H&H 1600 (stroke length - 12")
TOOLPUSHERS:	Herman Metcalf, Brian Engelhorn
FIELD SUPERVISORS:	Josh Roshto, Patrick Bidegaray
CHEMICAL COMPANY:	Fluid Control
MUD ENGINEER:	Vic Dossat, Troy Beckert
MUD TYPE:	Fresh water in surface hole Diesel invert in vertical/curve; Salt water in lateral
MUD LOSSES:	Invert Mud: 303 bbls., Salt Water: 971 bbls
PROSPECT GEOLOGIST:	Jerry Mayer
WELLSITE GEOLOGISTS:	Kyle Eno, Jim Gutoski, Evan Hanson
GEOSTEERING SYSTEM:	Sunburst Digital Wellsite Geological System
ROCK SAMPLING:	30' from 9,600' - 11,310', 10' from 11,310-11,460', 30' from 11,460'-21,040' (TD)
SAMPLE EXAMINATION:	Binocular microscope & fluoroscope
SAMPLE CUTS:	Trichloroethylene
GAS DETECTION:	MSI (Mudlogging Systems, Inc.) TGC - total gas with chromatograph Serial Number(s): ML-101
ELECTRIC LOGS:	N/A
DRILL STEM TESTS:	N/A
DIRECTIONAL DRILLERS:	Denver Energy Zachary Grove, Coty Rose
MWD:	Schlumberger Tasha Rogers

CASING: Surface: 9 5/8" 36# J-55 set to 2,311'

Intermediate: 7" 29# & 32# HCP-110 set to 11,634'

SAFETY/ H_2S MONITORING: Airgas Onsite Safety Services

KEY OFFSET WELLS:

Zavanna, LLC
Angus 34-27 4TFH
Lot 4 Section 3, T153N, R99W
Williams County, ND
KB: 2,385'

Zavanna, LLC
Nelson 3-10 1H
Lot 2 Section 3, T153N, R99W
Williams County, ND
KB: 2,378'

Louisiana Land & Exploration Co.
Brogger 21-4 1
NE NW Sec. 4, T153N, R99W
Williams County, North Dakota
KB: 2,374'

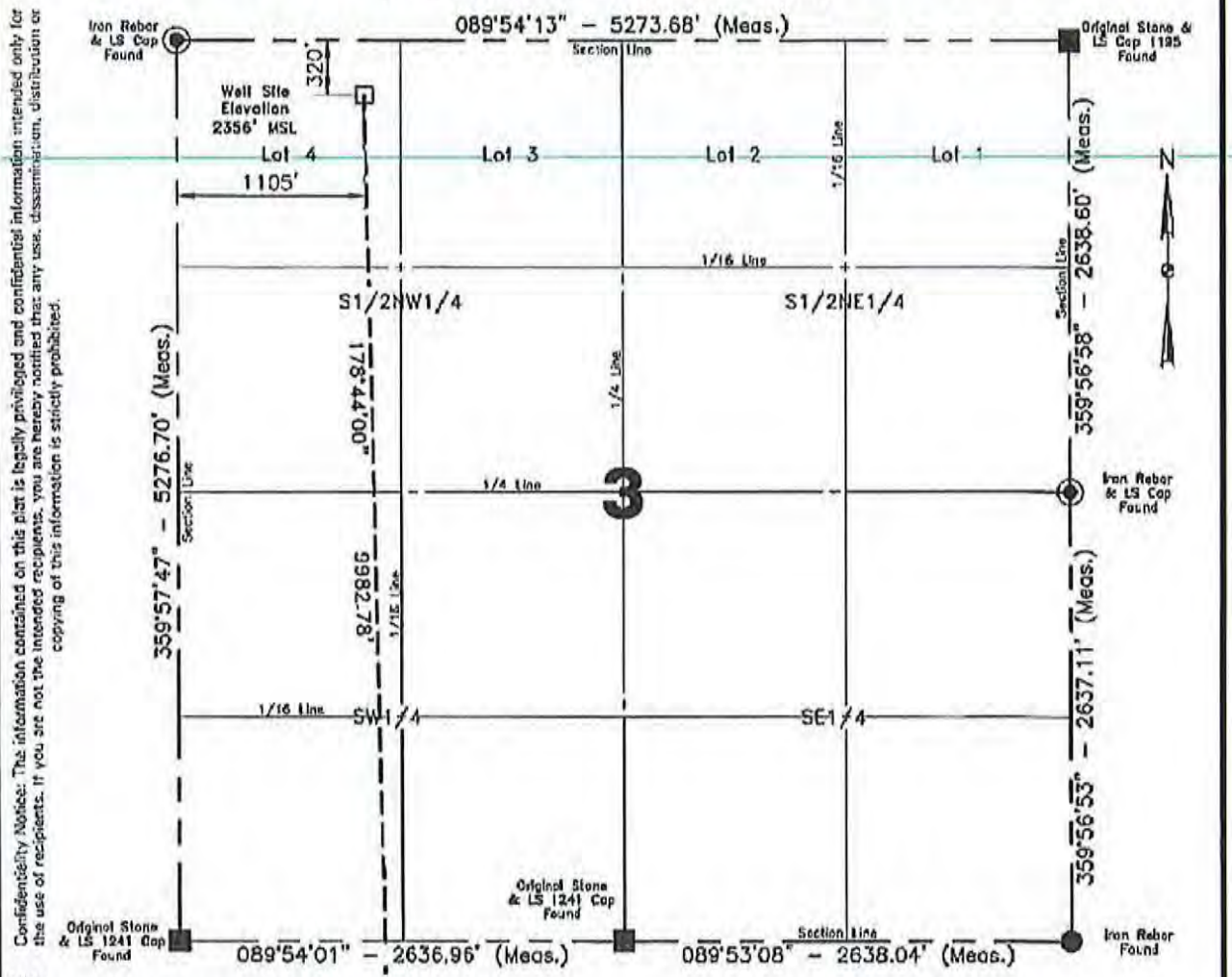
WELL LOCATION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site - Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



Confidentiality Notice: The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°08'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Scale 1"=1000'

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

Andy Staloch — Surveyed By
07/01/2013 — Date

RICK LEACH
REGISTERED
LAND
SURVEYOR
L.S. 3496
NORTH DAKOTA

Vertical Control Datum Used
North American Vertical Datum 1988 (NAVD 88)
Based on elevation derived from OPUS Solution on GPS "NGS Willow (Brass Cap) Located a distance of 7929.06' on an azimuth of 272°05'04" from the NW corner of Section 3 T.153N., R.99W., 5th P.M. being at 2466.62' Elevation MSL.

Professional Consulting Engineers and Surveyors
Registered in
North Dakota, South Dakota
Montana, Wyoming & Minnesota
Tele-Fax No. 701-572-2019
Bus. Phone No. 701-572-6352
820 East Broadway, Suite 1
Williston, North Dakota 58801-6126
Certificate of Authorization #C-061

Project No. 8713245
Book O-139 Pg. 57-63 Staking

Revised: 08/28/2013

KLJ

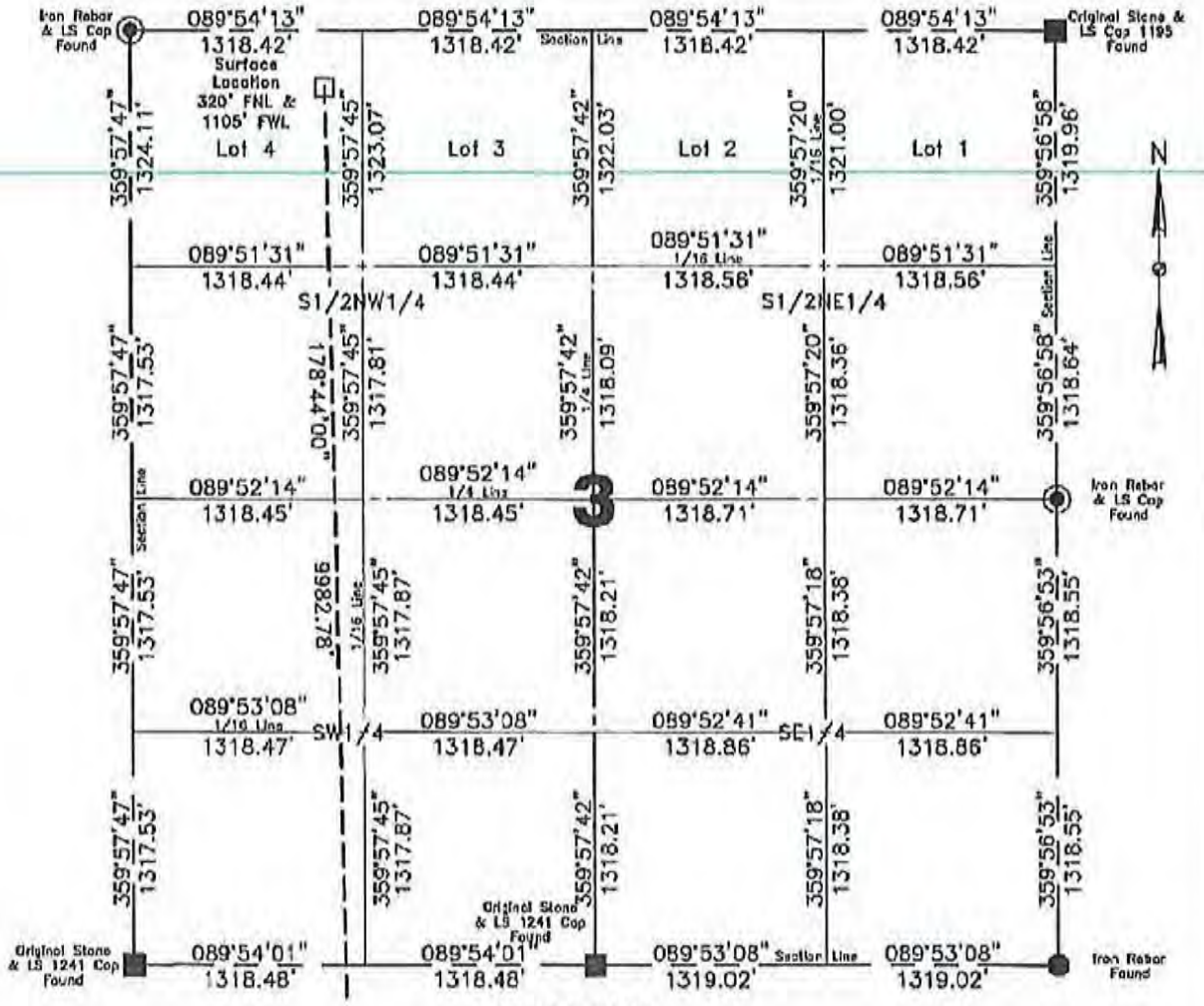
HORIZONTAL SECTION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site - Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



Confidentiality Notice
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED LAND SURVEYOR
L.S. 3496
8/28/13
NORTH DAKOTA

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH all well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°09'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

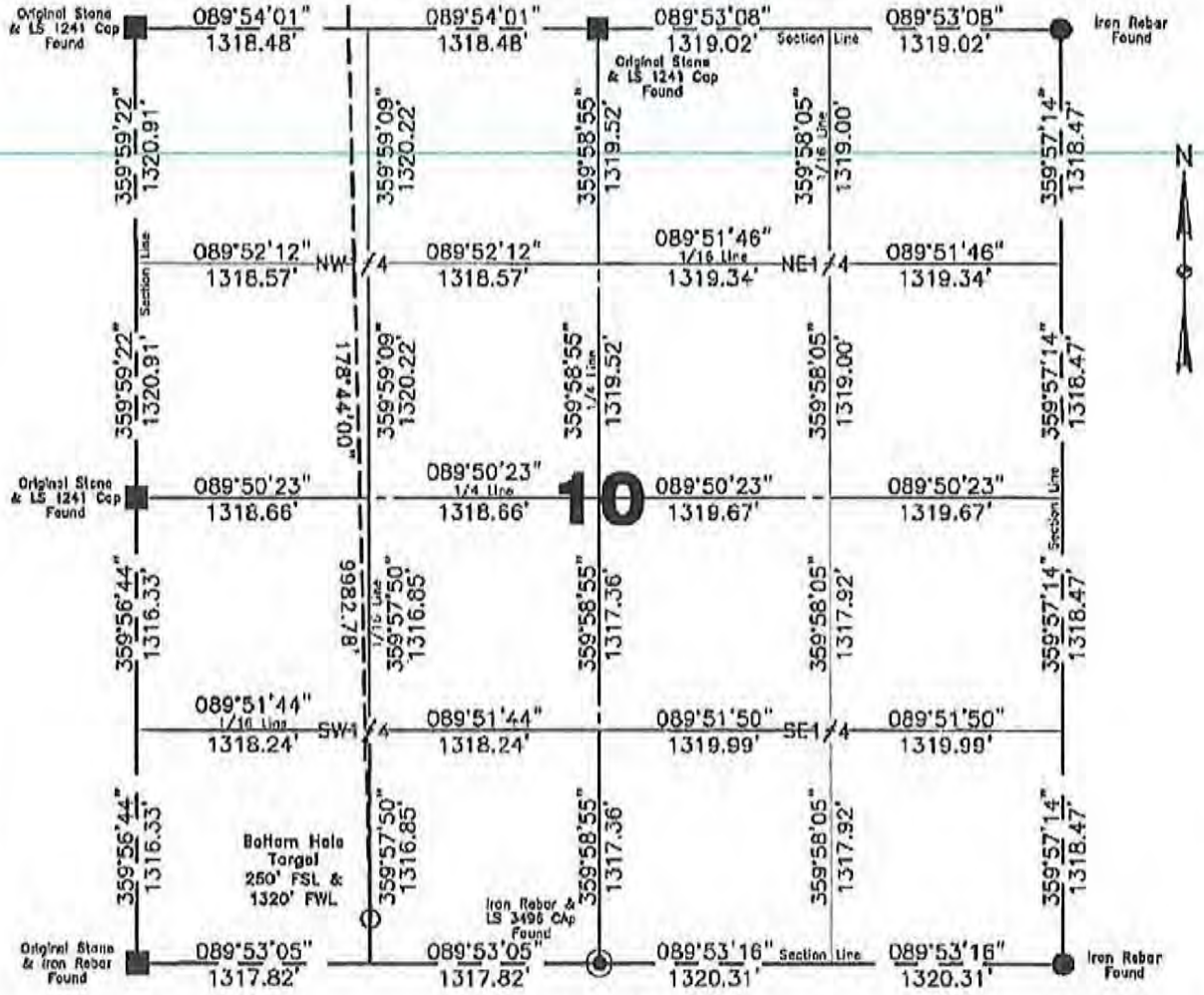
Surveyed By	Field Book
A. Staloch	O-139
Computed & Drawn By	Project No.
A. Nielsen	8713245

Revised:08/28/2013

KLJ

HORIZONTAL SECTION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202
Angus 3-10 #3TFH
320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site – Robert J. Lynch
Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



Scale 1"=1000'

Confidentiality Notice:
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°05'14.721" North; Longitude 103°29'59.050" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

RICK LEACH
REGISTERED LAND SURVEYOR
L.S. 3496
8/29/13
NORTH DAKOTA

Surveyed By	Field Book
A. Staloch	O-139
Computed & Drawn By	Project No.
A. Nielsen	8713245

Revised:08/28/2013

KLJ

BOTTOM HOLE LOCATION PLAT

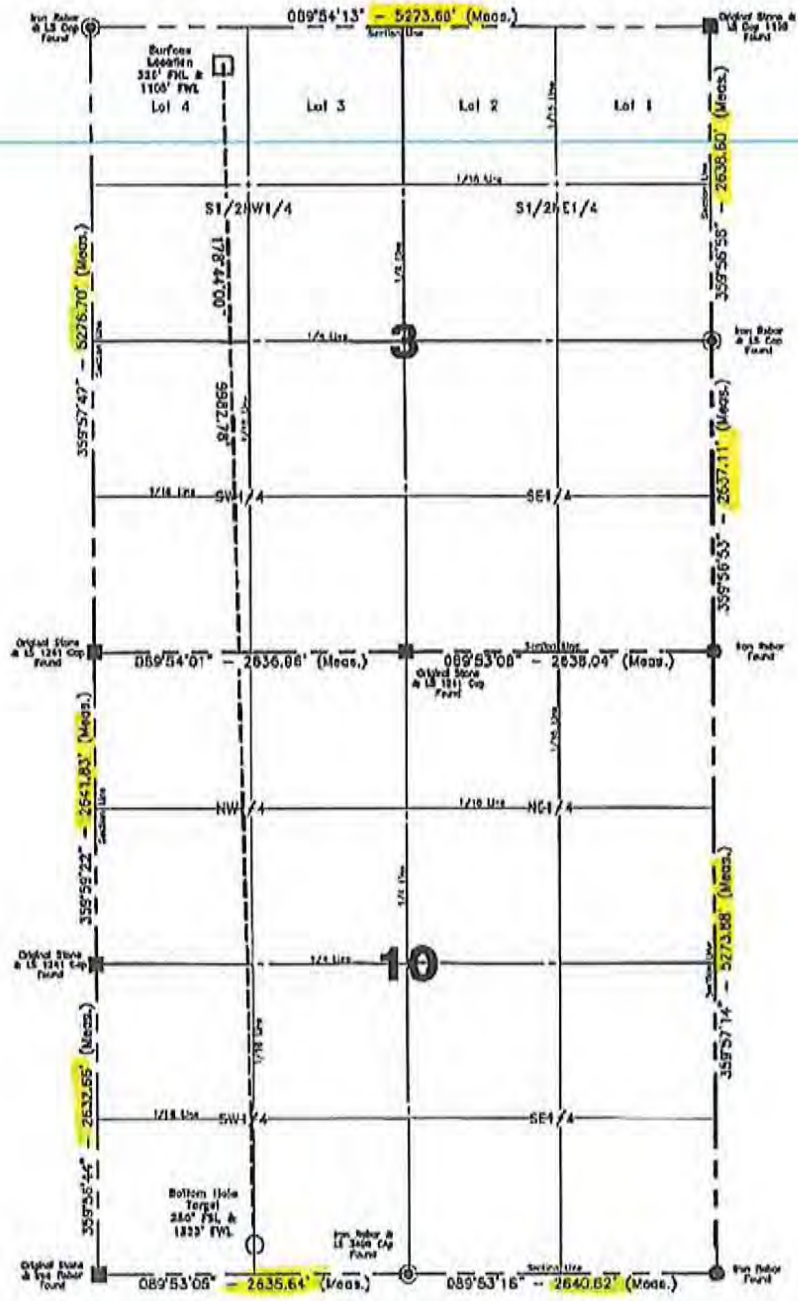
Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota

Surface owner & well site – Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

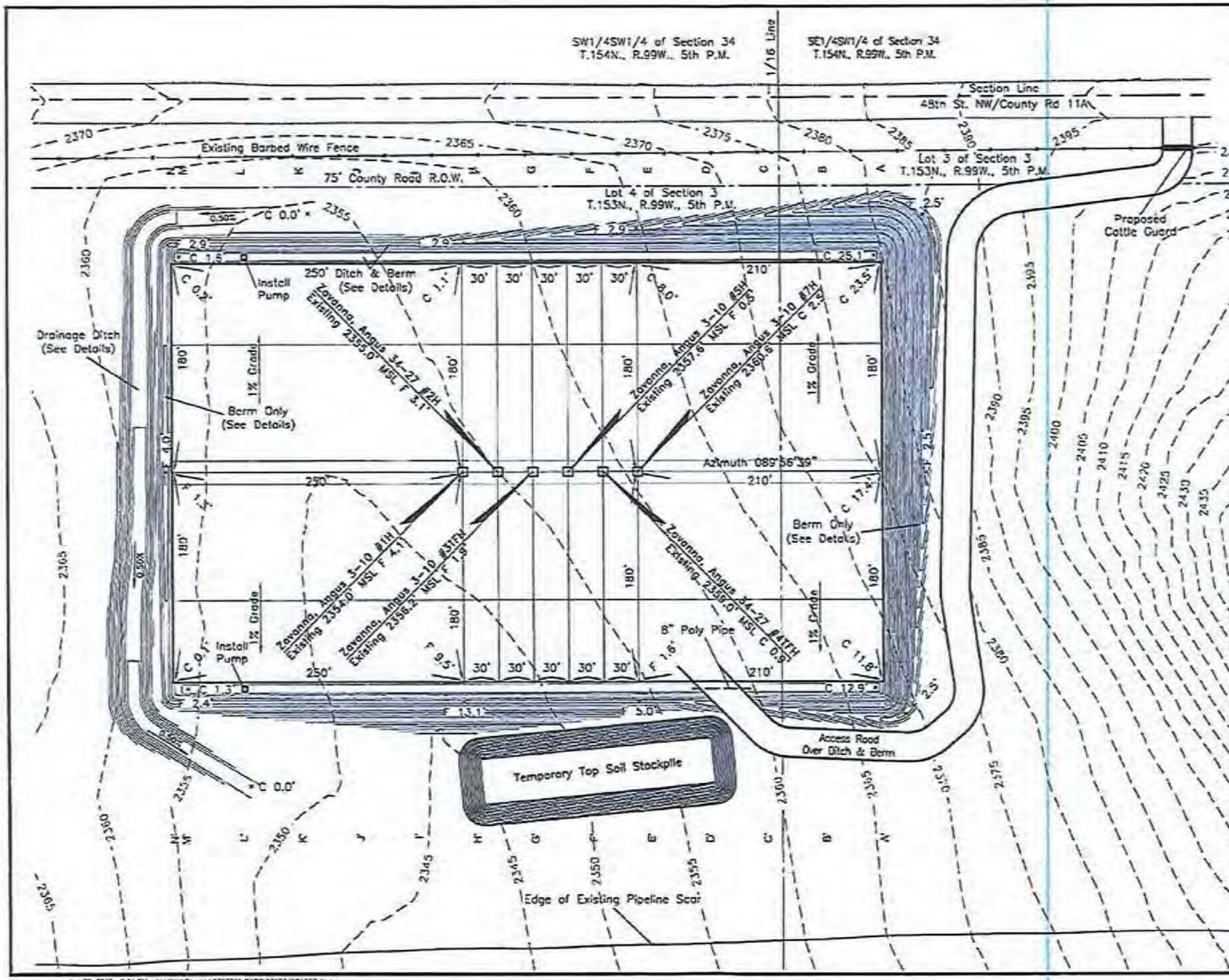
RICK LEACH
REGISTERED
LAND
SURVEYOR
L.S. 3496
8/29/13
NORTH DAKOTA

Confidentiality Notice:
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #1H oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 163 N., R. 99 W., 5th P.M. Latitude 48°05'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Computed & Drawn By	Surveyed By	Approved By	Scale	Date
A. Nielsen	A. Staloch	R. Leach	1"=1500'	08/05/2013
Field Book	**Material**	**Revised**	**Project No.**	**Drawing No.**
O-139	B.H. Layout	08/28/2013	8713245	4

KLJ



Confidentiality Notice: The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

Note:
All construction material shall be clean, fine earth, rock or sand, and free of vegetation or organic material.
All fill material shall be compacted to 95% standard proctor with moisture content between -2% to 3% of optimum in accordance with the requirements of ASTM D698 and ASTM D2922.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED LAND SURVEYOR
L.S. 3496
NORTH DAKOTA

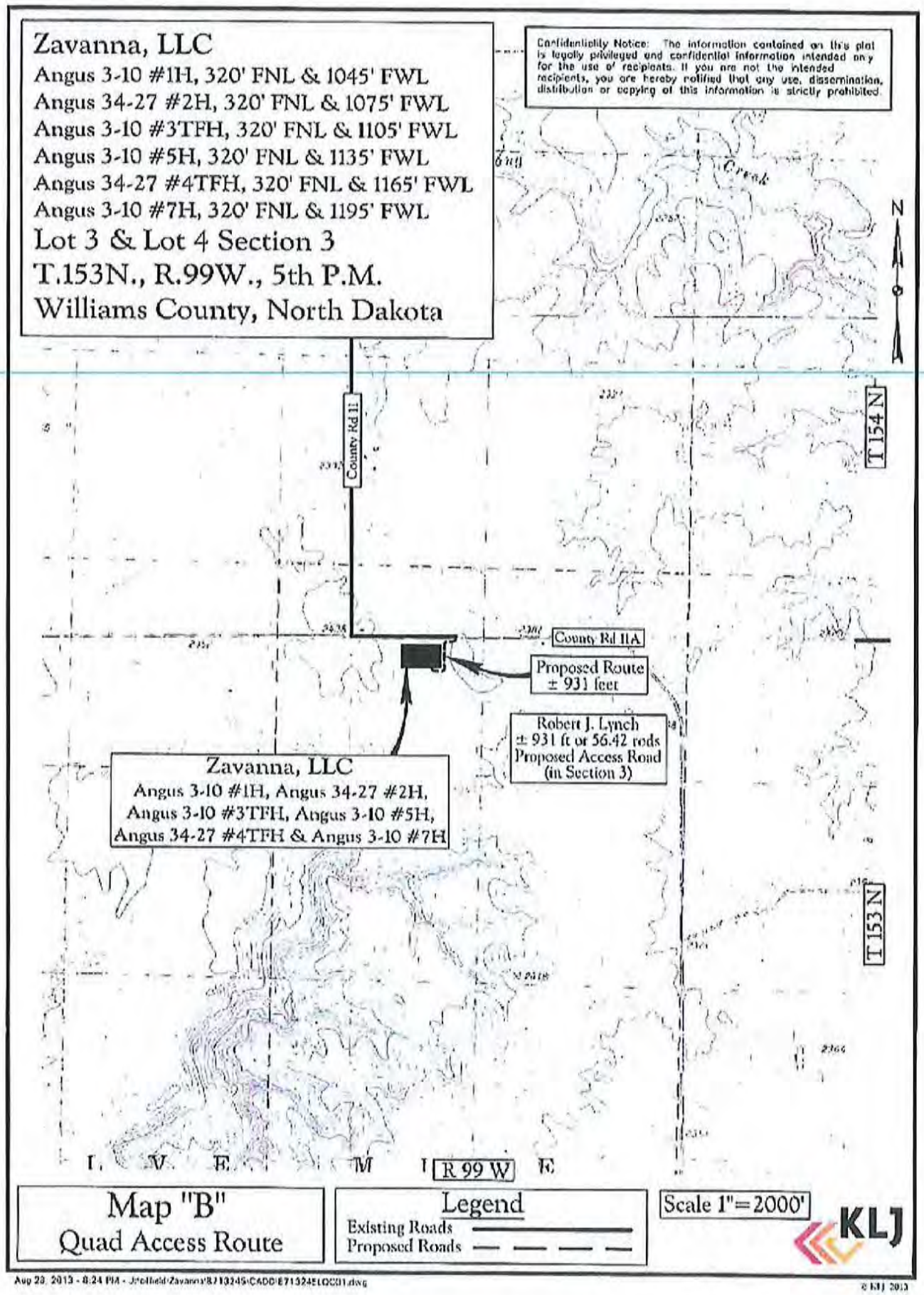
Field Book O-139

Original Ground
Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

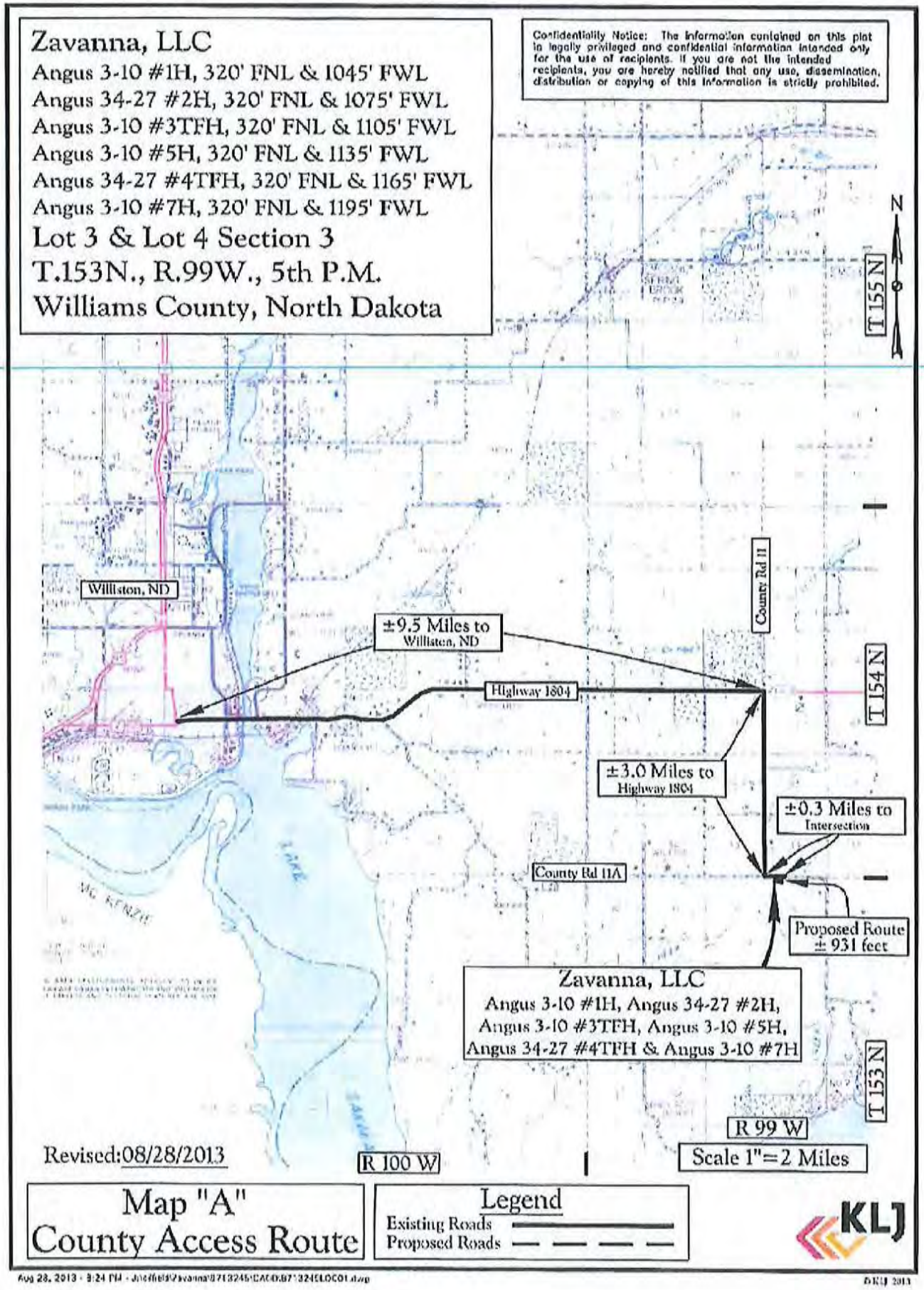
6

KLJ

Angus 3-10 #3TFH
Lot 4 of Section 3
T.153N., R.99W., 5th P.M.
Williams County, ND



Aug 28, 2013 - 8:24 PM - J:\Oilfield\Zavanna\8713245\CADD\E713245ELOC01.dwg



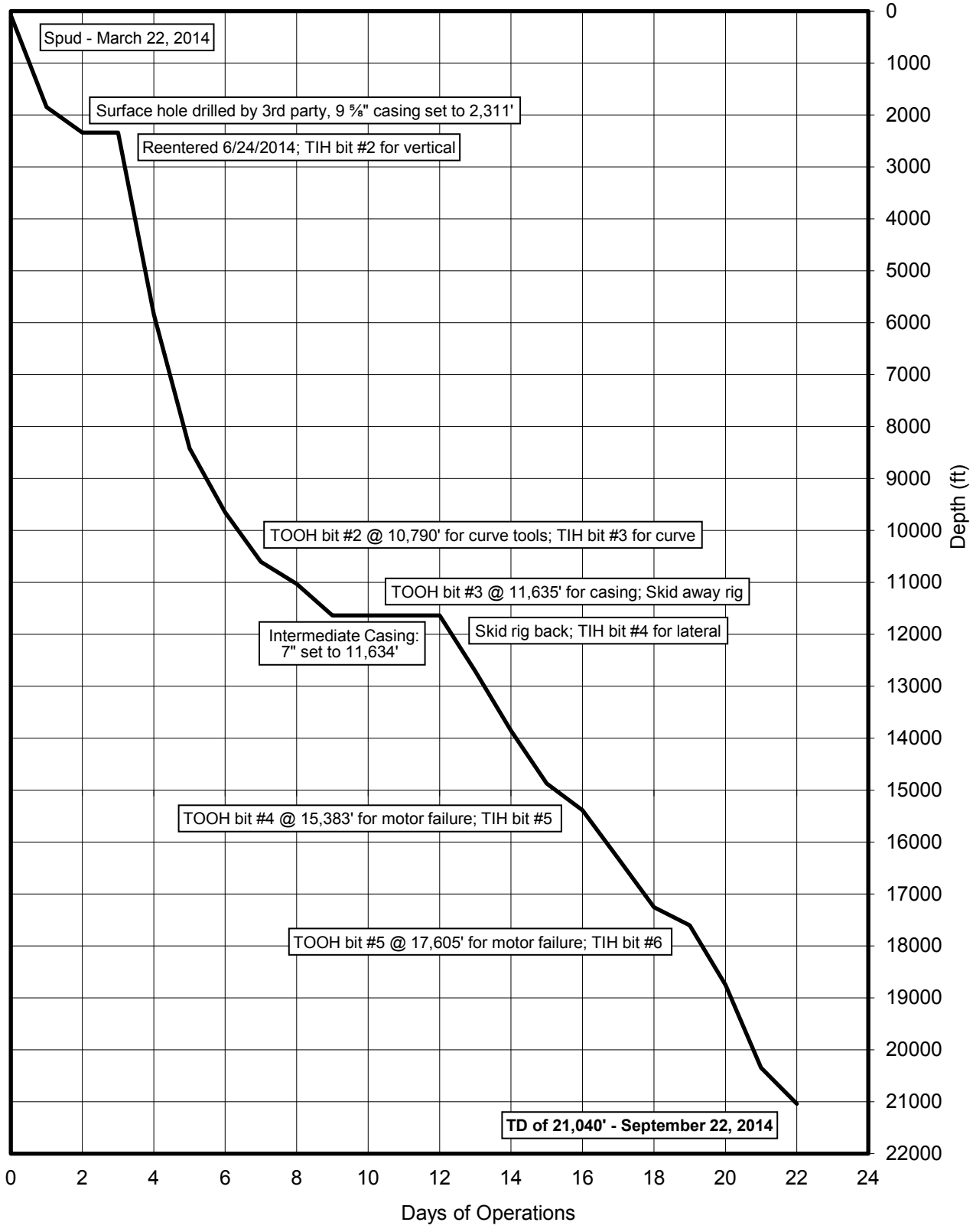
Aug 28, 2013 - 9:24 PM - J:\Jobfiles\Zavanna\071324S\CAD\071324SLOC01.dwg

©KLJ 2013

TIME VS. DEPTH

Zavanna, LLC

Angus 3-10 3TFH



MORNING REPORT SUMMARY

Day	Date 2014	Depth (0600 Hrs)	24 Hr Footage	Bit #	WOB (Klbs) RT	WOB (Klbs) MM	RPM (RT)	RPM (MM)	PP	SPM 1	SPM 2	GPM	24 Hr Activity Summary	Formation
0	3/22	80	0	-	-	-	-	-	-	-	-	-	Prepare to Spud	-
1	3/23	1850	1,770	1	-	-	-	-	-	-	-	-	Rig up on Angus 3-10 3TFH, Drill and survey from 80'-1850'	-
2	3/24	2339	489	1	-	-	-	-	-	-	-	-	Drill and survey from 1850'-2339', circulate wellbore clean, short trip, survey, drop gyro, TOOH, L/D drilling assembly, battery dead on tool last 600', R/U to run casing, run casing, circulate, cement casing, R/D and move to 2H	-
3	6/23	2,339'	0	-	-	-	-	-	-	-	-	-	Skid rig from Angus 3-10 5H to Angus 3-10 3TFH, Nipple up BOP, test BOP, working as directed by operator, tightened turn buckles, installed mouse holes, changed expansion joint on flow line scaffolding, adjusted top drive, cellar covers in place, buffer zone up, changed shaker screens, pre-spud checklist & 29 page inspection, install/remove wear bushing, Drills-BOP etc. BOP drill 2 min 45 sec, mud wt 10.2, prejob/prespud safety meeting, pick up BHA, trip in hole, displace to oil base, cut drilling line 10 wraps, drilling cement and float, shoe at 2,311'.	-
4	6/24	5,837'	3498	2	32	-	55	-	2500	65	65	545	Drilling cement and shoe, Rotary drilling F/3666' T/5837', circulate and condition while changing 2 Springs on Shaker #1 and 2 on #2 because they were compressed to 5" (min 5 3/4" spec) as per Swaco hand DJ, c/o screens to MI swaco screens and removed elliptical motor from both shakers to lighten shaker load. Circulate and condition, rotary drilling F/3666' T/5837', directional surveys	Dakota
5	6/25	8,421'	2584	2	26	-	40	-	3600	65	65	545	Rotary drilling F/5837' T/5932', Service Rig - Downtime Mud Pump rebuild 4" valve, Rotary drilling F/5932' T/7414', Rotary Drilling F/7414' T/8421', Directional Surveys	Tyler
6	6/26	9,650'	1229	2	32	-	42	-	3800	65	65	545	Rotary drilling F/8421' T/9147', Service Rig, Rotary Drilling F/9147' T/9650', Directional Surveys	Charles
7	6/27	10,604'	954	2	38	-	45	-	3600	65	65	545	Drill from 9520'-10216', Directional Surveys, Drill from 10216' -10604'	Lodgepole
8	6/28	11,027'	423	3	36	37	45	250	3800	60	60	503	Rotary Drill 10604'-10790', Trip Out of Hole, Lay down BHA, Pick up BHA, Trip In, Wash and Ream Salts, Reaming/washing relog every 15' F/10775' T/10790', Slide drilling 10790'-11027', Directional Surveys	Lodgepole
9	6/29	11,635'	608	3	-	35	-	250	3800	60	60	545	Rotary drilling from 11,027'-11,218', working as directed by operator to relog gamma, slide drilling from 11,218'-11,370', service rig, slide drilling from 11,370'-11,470', directional surveys, drill from 11,470'-11,635', directional surveys, circulate and condition, short trip to 10,800', circulate and condition, pump slug, TOOH	Three Forks
10	6/30	11,635'	0	3	-	-	-	-	-	-	-	-	Circulate and condition and pump slug. Trip out of hole. Service rig. Downtime-powered wrench. Trip out of hole. Lay down BHA. Working as directed by operator. Ready floor for casing. Install remove wear bushing. Remove wear bushing. Rig up to run casing. Run casing. Rig up to run casers. R/d casers. L/d truck and crt-tool Circulate and condition. Prejob safety and rig up Sanjel.	Three Forks

MORNING REPORT SUMMARY

Day	Date 2014	Depth (0600 Hrs)	24 Hr Footage	Bit #	WOB (Klbs) RT	WOB (Klbs) MM	RPM (RT)	RPM (MM)	PP	SPM 1	SPM 2	GPM	24 Hr Activity Summary	Formation
11	7/1	11,635'	0	3	-	-	-	-	-	-	-	-	Primary cementing, rig up cementers, primary cementing, rig down cementers, install/ remove wear bushing, install bit guide, nipple down BOPs, nipple up BOPs and secure well	Three Forks
12	9/13	11,635'	0	4	-	-	-	-	-	-	-	-	Skid Rig, Nipple Up BOPS c/o Pipe Rams, Test BOPS, Service Rig, Held Pre-Spud Safety Meeting, Pick Up, BHA and Scribe, TIH	Three Forks
13	9/14	12,708'	1073	4	15	25	50	225	2900	80	0	282	Trip in Hole, Drilling cement float @ 11554', shoe @ 11603', rotary drilling from 11603' to 11721', service rig, greased t.d. draw works , fixed flow sensor, wildcat &scr#4 function annular & pipe rams, rotary drilling from 11721' to 12708'	Three Forks
14	9/15	13,852'	1144	4	15	25	50	225	3000	83	0	282	Drills-BOP ETC B.O.P. 3-Min Mud Wt = 9.9 Functioned Ann & Pipe Rams, Drilling from 12708' to 13327', Service Rig, Greased T.D. Crown, Blks, Draw works , Directional Surveys, Rotary Drilling from 13327' to 13852', Directional Surveys	Three Forks
15	9/16	14,873'	1021	4	12	35	52	230	3200	82	0	288	Rotary and slide drilling F/13852 to 14170. Service rig greased TD, draw works function annular. Rotary drilling from 14170 to 14266. Directional surveys. Rotational drilling from 14266 to 14837. Directional surveys.	Three Forks
16	9/17	15,385'	512	5	15	35	65	225	3200	82	0	282	Rotary drilling from 14837' to 15330', Service Rig, Greased T.D. DRWKS BLCK JCK, Directional Surveys, Rotary Drilling from 15330 to 15383, Trip Out of Hole, Lay Down and Pick Up Bottom Hole Assembly, TIH	Three Forks
17	9/18	16,318'	933	5	20	35	65	225	3200	82	0	282	Trip in hole. Cut drilling line 15 wraps. Service rig greased TD draw works and blocks. Trip in hole. Rotary drilling from 15383 to 15793. Directional surveys. Rotary drilling from 15793 to 16318. Directional surveys.	Three Forks
18	9/19	17,255'	937	5	15	40	66	230	3500	82	0	287	Rotary drilling f 16318 t 16747. Service rig. Greased TD draw works, block jack. Drills. BOP. Etx BOP drill 3 min. MDWT 10.1 discussed shit in procedures with crew while drilling after drill. Function annular. Rotary drilling 16747 to 17255. Directional surveys.	Three Forks
19	9/20	17,604'	349	5	22	40	65	230	3700	82	0	287	Rotary drilling 17255 to 17604. Circulate and condition & pump slug. Trip out of hole. Lay down BHA. C/O mud motor and MWD. Trip in hole.	Three Forks
20	9/21	18,751'	1147	6	25	40	65	230	3500	82	0	287	rubber, install new rubber. Rotary drilling from 17604 to 18106. Service rig greased draw works. Directional surveys. Rotary drilling from 18106' to 18751'.	Three Forks
21	9/22	20,347'	1596	6	20	45	50	227	3800	0	68	283	Rotary drilling from 18751' to 19460', Directional Surveys, Drilling from 19460' to 20347'.	Three Forks
22	9/23	21,040'	693	6	20	45	50	227	3800	0	68	283	Rotary drilling 20347 to 21040. Circulate and condition pump bottoms up. Flow check. No flow. Pump slug. Trip of hole f/21040 to 11626. Change rotating head rubber. Service rig, adjust brakes on draw works. Reaming washing from 11626 to 13306.	Three Forks

DAILY MUD SUMMARY

Date 2014	Mud Depth	Mud WT (ppg)	VIS (sec/ qt)	PV (cP)	YP (lbs/ 100 ft^2)	Gels (lbs/ 100 ft^2)	600/ 300	NAP/ H_20 (ratio)	NAP/ H_20 (% by vol)	Cake (API/ HTHP)	Cor. Solids (%)	Oil/ H_20 (%)	Alk	pH	Excess Lime (lb/bbl)	Cl^- (mg/L)	LGS/ HGS (%)	Salinity (ppm)	Electrical Stability	Gain/ Loss (bbls)
06/25	9,136'	9.85	42	12	11	6/8/-	35/23	81.6/18.4	71/16	2	13	71/16	2.4	-	3.1	34k	3.9/7.1	259,369	811	-/88
06/26	9,136'	9.85	42	12	11	-	36/23	80.9/19.1	72/17	2	8.7	72/17	1.1	-	1.4	41k	1.9/9.2	264,320	726	-/135
06/27	9,865'	10.05	41	15	9	-	41/23	83/17	73/15	2	10	73/15	2	-	2.6	41k	2.4/7.6	264,914	914	-/191
06/28	10,753'	9.85	43	14	8	-	44/26	82.8/17.2	72/15	2	11	72/15	1.8	-	2.3	41k	2.5/8.5	248,966	776	-/210
06/29	11,086'	9.95	42	15	9	-	43/26	84.9/15.1	73/13	2	12.3	73/13	2.9	-	3.8	41k	3.7/8.6	240,926	676	-/280
06/30	11,222'	10.55	43	15	13	-	43/28	83.7/16.3	72/14	2	12.1	72/14	3.1	-	4	39k	4.3/7.8	264,320	974	-/303
07/01	11,635'	Change mud from diesel invert to salt water																		
09/13	11,715'	9.9	28	1	1	-	3/2	-	99.5/-	-	11	99.5/-	0.2	10	-	166k	-	-	-	-
09/14	12,924'	10.0	27	1	1	-	3/2	-	99.5/-	-	12.2	99.5/-	0.3	10	-	178k	-	-	-	-
09/15	14,211'	10	27	1	1	-	3/3	-	99.5/-	-	11.5	99.5/-	0.5	9.5	-	190k	-	-	-	-
09/16	15,040'	9.95	27	1	1	-	3/4	-	99.5/-	-	12.5	99.5/-	0.2	10.5	-	190k	-	-	-	-
09/17	15,383'	10.2	27	1	1	-	3/2	-	86/1	-	13	86/1	0.2	9	-	188k	-	-	-	-
09/18	16,516'	10.1	27	1	1	-	3/2	-	85.6/2	-	12.4	85.6/2	0.6	10	-	180k	-	-	-	-
09/19	17,424'	10.1	27	1	1	-	3/2	-	87/1.5	-	11.5	87/1.5	0.4	10	-	190k	-	-	-	-
09/20	17,699'	10.1	27	1	1	-	3/2	-	87.4/0.5	-	12.1	87.4/0.5	0.3	9.5	-	198k	-	-	-	-
09/21	18,944'	10.1	27	1	1	-	3/2	-	88/2	-	12.2	88/2	0.2	9	-	204k	-	-	-	-
09/22	20,558'	10	27	1	1	-	3/2	-	86.5/2	-	11.5	86.5/2	0.3	9.5	-	190k	-	-	-	-
09/23	21,040'	10	27	1	1	-	3/2	-	86.5/2	-	115	86.5/2	0.4	9.5	0.1	196k	0/.1	-	-	-

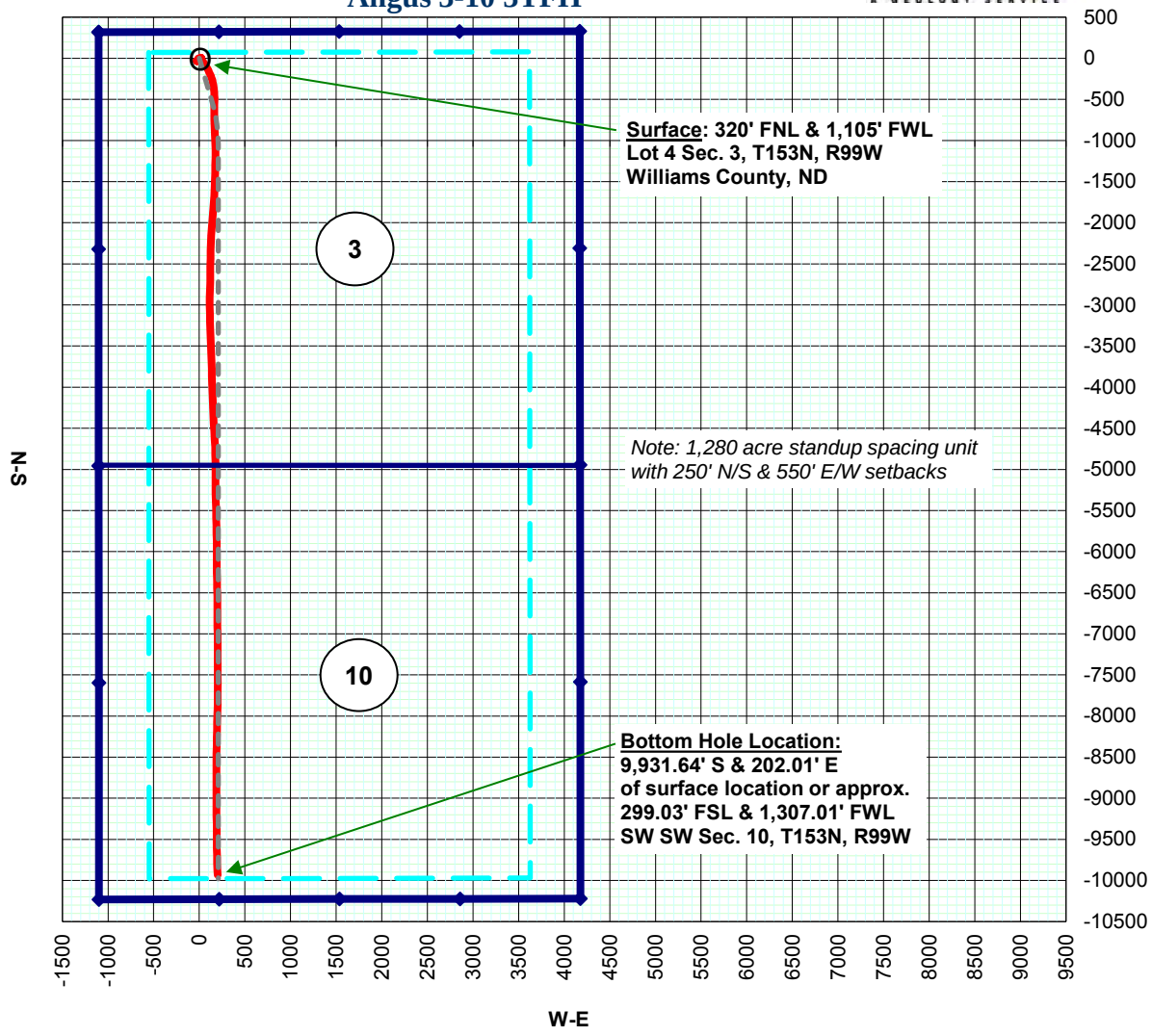
BOTTOM HOLE ASSEMBLY RECORD

Bit Data											Motor Data				Reason For Removal
Bit #	Size (in.)	Type	Make	Model	Depth In	Depth Out	Footage	Hours	Σ hrs	Vert. Dev.	Make	Model	Bend	Rev/Gal	
1	13 1/2	Milltooth	JZ	-	80'	2,339'	2,259'	14.5	14.5	Surface	-	-	-	-	TD surface
2	8 3/4	PDC	Security	MM65D	2,339'	10,790'	8,451'	107	121.5	Vertical	Hunting	-	1.50°	0.24	TD vertical
3	8 3/4	PDC	Security	MMD55M	10,790'	11,635'	845'	18	139.5	Curve	Hunting	-	2.38°	0.49	TD Curve
4	6	PDC	Security	MDSi613	11,635'	15,383'	3,748'	72	211.5	Lateral	Phoenix	-	1.50°	0.8	Motor Failure
5	6	PDC	Security	MDSi616	15,383'	17,605'	2,222'	55	266.5	Lateral	Phoenix	-	1.50°	0.8	Motor Failure
6	6	PDC	Security	MDSi616	17,605'	21,040'	3,435'	56	322.5	Lateral	Predator	-	1.50°	0.8	TD well

PLAN VIEW

Zavanna, LLC
Angus 3-10 3TFH

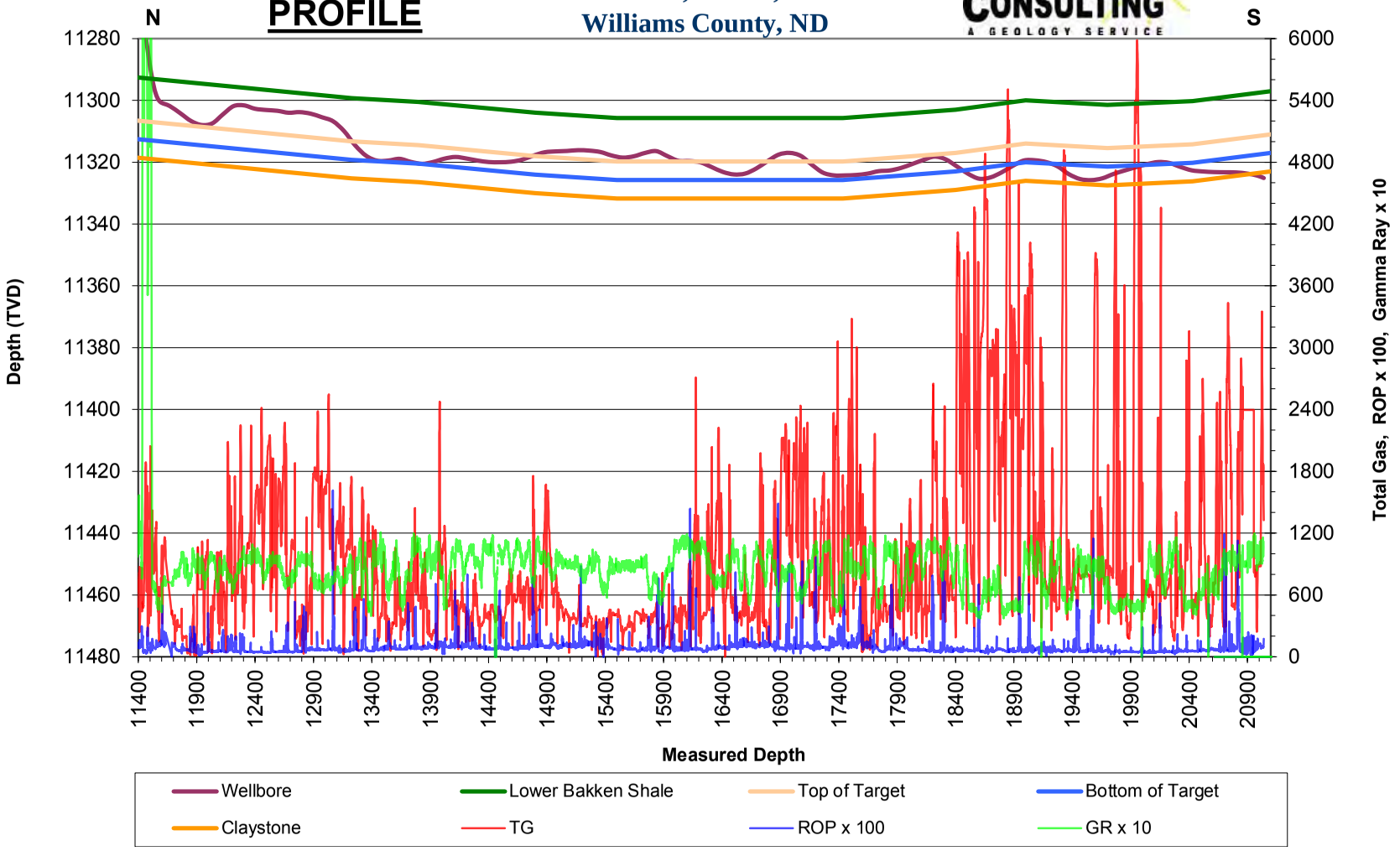
SUNBURST CONSULTING
A GEOLOGY SERVICE



Zavanna, LLC
Angus 3-10 3TFH
Lot 4 Sec. 3, T153N, R99W
Williams County, ND

SUNBURST CONSULTING
A GEOLOGY SERVICE

PROFILE



FORMATION MARKERS & DIP ESTIMATES

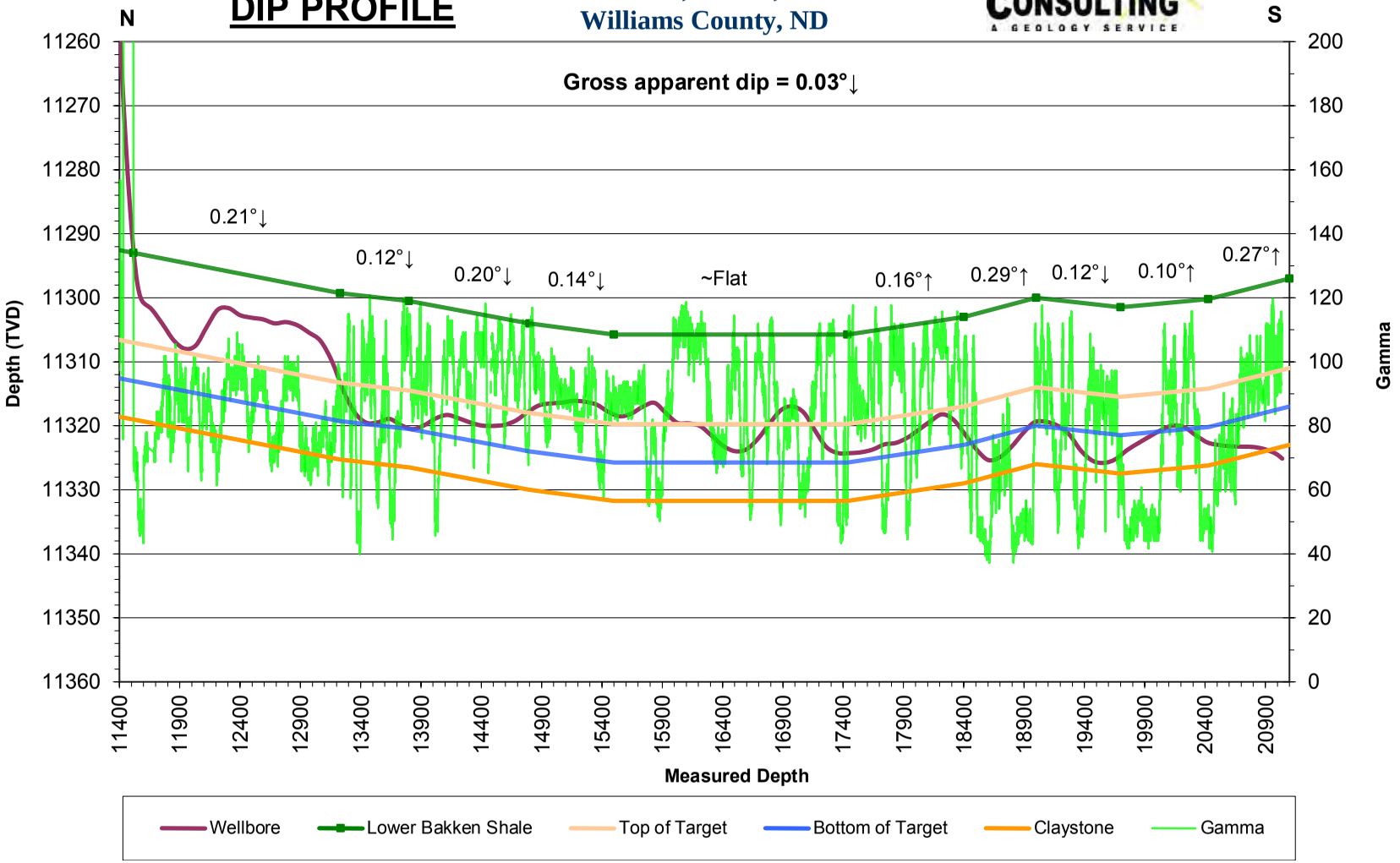
Zavanna, LLC - Angus 3-10 3TFH

Dip Change Points	MD	TVD	TVD diff.	MD diff.	Dip	Dipping up/down	Type of Marker
Marker							
Base Lower Bakken Shale	11,517'	11,293.00					Gamma
	13,230'	11,299.27	6.27	1713.00	***-0.21***	Down	Gamma
	13,800'	11,300.50	1.23	570.00	***-0.12***	Down	Gamma
	14,800'	11,304.00	3.50	1000.00	***-0.20***	Down	Gamma
	15,500'	11,305.75	1.75	700.00	***-0.14***	Down	Gamma
	17,435'	11,305.75	0.00	1935.00	***0.00***	Down	Gamma
	18,400'	11,303.00	-2.75	965.00	***0.16***	Up	Gamma
	19,000'	11,300.00	-3.00	600.00	***0.29***	Up	Gamma
	19,700'	11,301.47	1.47	700.00	***-0.12***	Down	Gamma
	20,428'	11,300.21	-1.25	728.00	***0.10***	Up	Gamma
	21,040'	11,297.33	-2.88	612.00	***0.27***	Up	Gamma
Gross Dip							
Initial Three Forks Contact	11,517'	11,293.00					
Projected Final TF Contact	21,040'	11,297.33	4.33	9523.00	***-0.03***	Down	Projection

DIP PROFILE

Zavanna, LLC
Angus 3-10 3TFH
Lot 4 Sec. 3, T153N, R99W
Williams County, ND

SUNBURST CONSULTING
A GEOLOGY SERVICE



SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	
Minimum Curvature Method (SPE-3362)				Proposed dir:	178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
Tie	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	23.00	0.00	0.00	23.00	0.00	0.00	0.00	0.00
2	123.00	0.36	244.44	123.00	-0.14	-0.28	0.13	0.36
3	223.00	0.28	231.56	223.00	-0.42	-0.76	0.41	0.11
4	323.00	0.15	219.75	323.00	-0.68	-1.03	0.65	0.14
5	423.00	0.07	208.68	423.00	-0.83	-1.15	0.81	0.08
6	523.00	0.09	199.54	523.00	-0.96	-1.20	0.93	0.02
7	623.00	0.05	278.82	623.00	-1.02	-1.27	1.00	0.09
8	723.00	0.03	334.40	723.00	-0.99	-1.33	0.97	0.04
9	823.00	0.09	44.31	823.00	-0.91	-1.28	0.89	0.08
10	923.00	0.13	75.83	923.00	-0.83	-1.12	0.81	0.07
11	1023.00	0.26	89.17	1023.00	-0.80	-0.78	0.78	0.14
12	1123.00	0.13	41.01	1123.00	-0.71	-0.48	0.70	0.20
13	1223.00	0.23	52.28	1222.99	-0.50	-0.25	0.50	0.11
14	1323.00	0.33	40.67	1322.99	-0.16	0.10	0.16	0.11
15	1423.00	0.43	58.29	1422.99	0.25	0.61	-0.24	0.15
16	1523.00	0.48	66.55	1522.99	0.62	1.31	-0.59	0.08
17	1623.00	0.51	63.95	1622.98	0.98	2.10	-0.94	0.04
18	1723.00	0.25	50.99	1722.98	1.31	2.66	-1.26	0.27
19	1823.00	0.17	36.80	1822.98	1.57	2.92	-1.51	0.09
20	1923.00	0.08	253.73	1922.98	1.67	2.94	-1.61	0.24
21	2023.00	0.07	64.75	2022.98	1.68	2.93	-1.61	0.15
22	2123.00	0.14	136.26	2122.98	1.61	3.07	-1.55	0.14
23	2223.00	0.31	181.02	2222.98	1.25	3.15	-1.19	0.23
24	2293.00	0.36	210.02	2292.98	0.87	3.04	-0.81	0.25
25	2378.00	0.52	249.05	2377.98	0.51	2.55	-0.45	0.39
26	2473.00	1.24	256.43	2472.97	0.11	1.14	-0.09	0.77
27	2568.00	1.34	248.42	2567.94	-0.54	-0.89	0.52	0.22
28	2663.00	1.70	249.63	2662.91	-1.44	-3.24	1.37	0.38
29	2759.00	2.29	245.95	2758.85	-2.72	-6.33	2.58	0.63
30	2854.00	2.12	244.40	2853.78	-4.25	-9.65	4.05	0.19
31	2948.00	0.28	219.99	2947.75	-5.18	-11.36	4.94	1.99
32	3043.00	0.86	199.48	3042.75	-6.03	-11.75	5.78	0.64
33	3138.00	1.27	177.05	3137.73	-7.75	-11.93	7.50	0.61
34	3232.00	1.99	194.72	3231.70	-10.37	-12.29	10.11	0.93

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	
Minimum Curvature Method (SPE-3362)				Proposed dir:	178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
35	3326.00	1.70	207.54	3325.65	-13.18	-13.35	12.90	0.53
36	3421.00	1.56	213.42	3420.61	-15.51	-14.72	15.20	0.23
37	3516.00	1.62	216.71	3515.57	-17.67	-16.23	17.32	0.11
38	3612.00	1.85	221.18	3611.53	-19.92	-18.06	19.54	0.28
39	3711.00	1.68	227.46	3710.48	-22.11	-20.19	21.68	0.26
40	3799.00	1.54	216.44	3798.45	-23.93	-21.84	23.47	0.39
41	3892.00	1.61	229.09	3891.41	-25.79	-23.57	25.29	0.38
42	3986.00	1.28	222.09	3985.38	-27.43	-25.27	26.90	0.40
43	4080.00	1.18	210.79	4079.36	-29.04	-26.47	28.48	0.28
44	4175.00	0.86	195.55	4174.34	-30.57	-27.16	30.00	0.44
45	4270.00	0.63	354.45	4269.34	-30.74	-27.40	30.16	1.54
46	4364.00	0.57	194.46	4363.34	-30.68	-27.57	30.09	1.26
47	4456.00	0.66	174.85	4455.33	-31.65	-27.64	31.06	0.25
48	4552.00	0.49	157.02	4551.33	-32.58	-27.43	32.00	0.26
49	4650.00	0.32	130.59	4649.33	-33.14	-27.05	32.57	0.25
50	4746.00	0.08	184.85	4745.33	-33.38	-26.86	32.81	0.29
51	4839.00	0.20	31.96	4838.33	-33.31	-26.78	32.74	0.29
52	4934.00	0.31	67.55	4933.33	-33.07	-26.45	32.51	0.20
53	5029.00	0.25	64.53	5028.32	-32.88	-26.03	32.33	0.07
54	5123.00	0.29	99.61	5122.32	-32.83	-25.61	32.29	0.18
55	5218.00	0.42	35.51	5217.32	-32.59	-25.17	32.06	0.41
56	5311.00	0.17	310.84	5310.32	-32.22	-25.07	31.69	0.47
57	5405.00	0.22	47.20	5404.32	-32.01	-25.05	31.48	0.31
58	5499.00	0.28	77.54	5498.32	-31.84	-24.69	31.31	0.15
59	5592.00	1.10	107.53	5591.31	-32.06	-23.62	31.56	0.93
60	5687.00	1.55	89.61	5686.29	-32.32	-21.46	31.87	0.64
61	5782.00	1.67	82.81	5781.25	-32.14	-18.80	31.74	0.24
62	5877.00	1.96	84.08	5876.20	-31.80	-15.82	31.46	0.31
63	5972.00	2.00	83.65	5971.15	-31.45	-12.55	31.18	0.04
64	6067.00	2.08	75.51	6066.09	-30.83	-9.23	30.63	0.32
65	6160.00	2.07	72.30	6159.02	-29.90	-6.00	29.77	0.13
66	6256.00	1.67	66.06	6254.97	-28.81	-3.07	28.74	0.47
67	6349.00	1.34	61.45	6347.94	-27.74	-0.88	27.71	0.38
68	6444.00	1.18	72.61	6442.92	-26.91	1.03	26.93	0.31
69	6539.00	1.27	68.33	6537.90	-26.23	2.94	26.29	0.14

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	
Minimum Curvature Method (SPE-3362)				Proposed dir:	178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
70	6634.00	1.21	53.69	6632.87	-25.25	4.73	25.34	0.34
71	6729.00	1.24	44.16	6727.85	-23.92	6.26	24.04	0.22
72	6823.00	1.10	50.48	6821.83	-22.62	7.66	22.77	0.20
73	6918.00	1.23	52.15	6916.81	-21.41	9.17	21.60	0.14
74	7012.00	0.97	44.12	7010.80	-20.22	10.52	20.43	0.32
75	7107.00	1.09	44.39	7105.78	-19.00	11.71	19.24	0.13
76	7202.00	1.10	29.79	7200.76	-17.56	12.80	17.82	0.29
77	7295.00	1.34	23.80	7293.74	-15.79	13.68	16.07	0.29
78	7391.00	1.59	31.28	7389.71	-13.62	14.82	13.93	0.33
79	7485.00	1.36	24.56	7483.68	-11.49	15.96	11.83	0.31
80	7580.00	1.00	33.87	7578.66	-9.78	16.89	10.13	0.43
81	7673.00	0.87	30.70	7671.65	-8.50	17.71	8.87	0.15
82	7768.00	0.87	15.45	7766.64	-7.18	18.27	7.57	0.24
83	7862.00	0.66	2.91	7860.63	-5.96	18.49	6.34	0.28
84	7957.00	0.59	2.84	7955.62	-4.92	18.54	5.31	0.07
85	8051.00	0.46	26.48	8049.62	-4.10	18.73	4.49	0.27
86	8146.00	0.29	14.87	8144.62	-3.53	18.96	3.92	0.20
87	8240.00	0.52	49.86	8238.61	-3.02	19.35	3.43	0.35
88	8335.00	0.63	53.18	8333.61	-2.43	20.10	2.85	0.12
89	8430.00	0.55	41.00	8428.60	-1.77	20.81	2.21	0.16
90	8523.00	0.48	30.13	8521.60	-1.10	21.30	1.55	0.13
91	8619.00	0.49	31.76	8617.60	-0.40	21.72	0.86	0.02
92	8713.00	0.35	42.18	8711.60	0.15	22.12	0.31	0.17
93	8807.00	0.52	50.28	8805.59	0.64	22.64	-0.16	0.19
94	8902.00	0.62	42.91	8900.59	1.29	23.33	-0.80	0.13
95	8998.00	0.25	304.35	8996.59	1.79	23.51	-1.29	0.73
96	9092.00	0.49	272.74	9090.58	1.92	22.94	-1.44	0.33
97	9187.00	0.49	273.57	9185.58	1.97	22.12	-1.50	0.01
98	9282.00	0.53	263.76	9280.58	1.94	21.28	-1.50	0.10
99	9378.00	0.48	255.35	9376.57	1.79	20.45	-1.37	0.09
100	9471.00	0.20	265.75	9469.57	1.68	19.91	-1.27	0.31
101	9566.00	0.24	348.29	9564.57	1.87	19.71	-1.45	0.31
102	9658.00	0.25	338.38	9656.57	2.24	19.59	-1.83	0.05
103	9752.00	0.37	315.56	9750.57	2.65	19.31	-2.24	0.18
104	9846.00	0.42	331.10	9844.57	3.17	18.93	-2.77	0.13

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	

Minimum Curvature Method (SPE-3362) Proposed dir: 178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
105	9939.00	0.30	336.62	9937.56	3.69	18.67	-3.30	0.13
106	10034.00	0.19	333.29	10032.56	4.06	18.50	-3.67	0.12
107	10129.00	0.32	333.36	10127.56	4.44	18.31	-4.05	0.14
108	10225.00	0.43	307.18	10223.56	4.89	17.90	-4.52	0.21
109	10319.00	0.39	347.71	10317.56	5.42	17.55	-5.05	0.30
110	10414.00	0.33	342.70	10412.56	6.00	17.40	-5.63	0.07
111	10508.00	0.31	330.64	10506.55	6.48	17.20	-6.12	0.07
112	10602.00	0.60	320.65	10600.55	7.08	16.76	-6.73	0.32
113	10697.00	0.39	314.39	10695.55	7.69	16.21	-7.35	0.23
114	10740.00	0.47	324.81	10738.55	7.94	16.01	-7.60	0.26
115	10792.00	1.54	158.83	10790.54	7.46	16.14	-7.12	3.84
116	10824.00	6.43	153.07	10822.45	5.46	17.10	-5.10	15.31
117	10855.00	10.82	151.56	10853.10	1.35	19.28	-0.95	14.18
118	10884.00	14.71	153.84	10881.37	-4.35	22.20	4.81	13.52
119	10915.00	18.28	157.26	10911.10	-12.37	25.81	12.91	11.93
120	10948.00	21.96	153.02	10942.08	-22.64	30.61	23.28	11.99
121	10979.00	25.84	151.38	10970.41	-33.75	36.48	34.50	12.70
122	11011.00	29.23	149.86	10998.79	-46.63	43.75	47.53	10.82
123	11043.00	30.75	149.25	11026.50	-60.42	51.85	61.49	4.84
124	11075.00	34.20	148.85	11053.49	-75.15	60.69	76.40	10.80
125	11107.00	37.90	149.36	11079.36	-91.31	70.36	92.76	11.60
126	11138.00	39.52	150.22	11103.55	-108.06	80.11	109.71	5.51
127	11170.00	42.12	153.65	11127.77	-126.52	89.93	128.37	10.73
128	11201.00	45.63	156.72	11150.11	-146.02	98.93	148.06	13.24
129	11233.00	49.49	157.52	11171.70	-167.78	108.10	170.00	12.20
130	11264.00	54.01	157.51	11190.89	-190.26	117.41	192.68	14.58
131	11296.00	57.19	159.45	11208.97	-214.82	127.09	217.44	11.12
132	11327.00	59.92	163.23	11225.14	-239.88	135.53	242.66	13.63
133	11359.00	63.28	166.73	11240.36	-267.06	142.81	269.99	14.24
134	11391.00	67.15	169.45	11253.78	-295.48	148.80	298.53	14.34
135	11422.00	68.62	169.81	11265.45	-323.73	153.96	326.88	4.86
136	11453.00	71.87	171.31	11275.93	-352.50	158.75	355.75	11.43
137	11485.00	74.49	174.70	11285.19	-382.90	162.47	386.22	13.03
138	11517.00	78.41	177.08	11292.68	-413.92	164.69	417.28	14.22
139	11548.00	82.98	179.12	11297.70	-444.49	165.70	447.86	16.11

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	

Minimum Curvature Method (SPE-3362) Proposed dir: 178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
140	11587.00	88.90	179.86	11300.46	-483.37	166.05	486.74	15.30
141	11668.00	89.18	181.13	11301.81	-564.35	165.35	567.69	1.61
142	11760.00	87.87	180.66	11304.18	-656.31	163.91	659.60	1.51
143	11851.00	89.00	178.90	11306.67	-747.27	164.26	750.55	2.30
144	11943.00	89.38	177.34	11307.97	-839.21	167.28	842.53	1.75
145	12034.00	91.30	177.06	11307.43	-930.09	171.72	933.48	2.13
146	12124.00	92.37	178.48	11304.55	-1019.97	175.22	1023.42	1.97
147	12215.00	91.00	179.23	11301.87	-1110.91	177.04	1114.38	1.72
148	12306.00	89.31	181.56	11301.62	-1201.90	176.41	1205.33	3.16
149	12399.00	89.35	180.88	11302.71	-1294.87	174.43	1298.24	0.73
150	12496.00	90.17	180.31	11303.12	-1391.87	173.43	1395.19	1.03
151	12591.00	89.52	181.58	11303.37	-1486.85	171.86	1490.12	1.50
152	12687.00	89.73	182.86	11304.00	-1582.78	168.14	1585.95	1.35
153	12781.00	90.52	182.93	11303.80	-1676.65	163.39	1679.71	0.84
154	12876.00	88.87	183.80	11304.30	-1771.48	157.82	1774.40	1.96
155	12971.00	89.76	184.30	11305.44	-1866.24	151.11	1868.99	1.07
156	13067.00	88.69	184.11	11306.74	-1961.97	144.07	1964.56	1.13
157	13162.00	87.46	184.53	11309.93	-2056.65	136.92	2059.06	1.37
158	13257.00	86.98	182.87	11314.54	-2151.33	130.80	2153.60	1.82
159	13352.00	88.90	181.38	11317.95	-2246.20	127.28	2248.37	2.56
160	13447.00	89.21	181.22	11319.52	-2341.16	125.12	2343.27	0.37
161	13542.00	90.86	181.18	11319.46	-2436.14	123.13	2438.18	1.74
162	13638.00	89.79	180.54	11318.92	-2532.12	121.69	2534.12	1.30
163	13734.00	89.04	180.61	11319.90	-2628.11	120.73	2630.06	0.78
164	13831.00	90.21	181.67	11320.53	-2725.09	118.80	2726.98	1.63
165	13925.00	90.52	181.64	11319.93	-2819.05	116.08	2820.86	0.33
166	14021.00	90.76	180.22	11318.86	-2915.03	114.53	2916.78	1.50
167	14117.00	89.90	179.64	11318.31	-3011.02	114.64	3012.76	1.08
168	14213.00	89.48	179.18	11318.83	-3107.02	115.63	3108.76	0.65
169	14308.00	89.73	178.57	11319.48	-3201.99	117.50	3203.75	0.69
170	14402.00	89.69	177.41	11319.96	-3295.93	120.79	3297.74	1.23
171	14498.00	90.24	178.32	11320.01	-3391.87	124.37	3393.73	1.11
172	14594.00	89.97	177.95	11319.84	-3487.81	127.49	3489.72	0.48
173	14689.00	90.86	177.59	11319.15	-3582.74	131.19	3584.70	1.01
174	14784.00	90.69	178.90	11317.87	-3677.68	134.10	3679.69	1.39

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	

Minimum Curvature Method (SPE-3362) Proposed dir: 178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
175	14881.00	90.58	179.11	11316.79	-3774.66	135.78	3776.68	0.24
176	14976.00	89.76	178.80	11316.51	-3869.65	137.52	3871.68	0.92
177	15071.00	90.41	177.80	11316.37	-3964.60	140.33	3966.67	1.26
178	15167.00	89.90	177.74	11316.11	-4060.53	144.07	4062.66	0.53
179	15262.00	89.93	178.69	11316.25	-4155.48	147.03	4157.65	1.00
180	15358.00	89.52	177.26	11316.71	-4251.42	150.42	4253.64	1.55
181	15453.00	89.14	177.37	11317.82	-4346.31	154.87	4348.60	0.42
182	15549.00	90.03	177.55	11318.52	-4442.21	159.13	4444.57	0.95
183	15644.00	90.48	177.10	11318.09	-4537.10	163.56	4539.53	0.67
184	15739.00	90.82	176.26	11317.02	-4631.94	169.06	4634.46	0.95
185	15835.00	89.90	178.21	11316.41	-4727.82	173.69	4730.42	2.25
186	15930.00	88.18	179.05	11318.00	-4822.77	175.96	4825.40	2.01
187	16025.00	89.97	179.54	11319.54	-4917.75	177.13	4920.38	1.95
188	16120.00	89.93	179.87	11319.62	-5012.75	177.62	5015.37	0.35
189	16215.00	89.55	180.69	11320.05	-5107.74	177.16	5110.33	0.95
190	16310.00	88.63	179.62	11321.56	-5202.73	176.90	5205.29	1.49
191	16406.00	89.49	178.48	11323.14	-5298.70	178.49	5301.28	1.49
192	16502.00	89.52	178.49	11323.96	-5394.66	181.03	5397.27	0.03
193	16598.00	90.82	178.81	11323.68	-5490.64	183.29	5493.27	1.39
194	16694.00	91.17	178.89	11322.01	-5586.60	185.22	5589.25	0.37
195	16789.00	91.65	178.82	11319.68	-5681.55	187.11	5684.23	0.51
196	16885.00	90.89	178.90	11317.55	-5777.51	189.02	5780.20	0.80
197	16979.00	89.79	179.91	11316.99	-5871.50	190.00	5874.19	1.59
198	17075.00	89.04	179.53	11317.97	-5967.49	190.47	5970.17	0.88
199	17170.00	87.49	179.57	11320.85	-6062.44	191.21	6065.12	1.63
200	17264.00	89.42	179.62	11323.38	-6156.40	191.88	6159.07	2.05
201	17360.00	89.52	179.07	11324.27	-6252.39	192.98	6255.06	0.58
202	17455.00	90.48	178.71	11324.27	-6347.37	194.82	6350.06	1.08
203	17551.00	89.69	179.39	11324.13	-6443.36	196.41	6446.06	1.09
204	17646.00	90.82	180.18	11323.70	-6538.35	196.76	6541.04	1.45
205	17741.00	90.14	179.48	11322.91	-6633.35	197.05	6636.02	1.03
206	17836.00	90.14	179.75	11322.68	-6728.35	197.68	6731.01	0.28
207	17931.00	90.82	179.40	11321.88	-6823.34	198.39	6826.00	0.81
208	18027.00	90.69	179.56	11320.61	-6919.33	199.26	6921.98	0.21
209	18123.00	90.89	178.95	11319.29	-7015.31	200.51	7017.97	0.67

SUNBURST CONSULTING, INC.

Operator:	Zavanna, LLC			Kick-off:	6/28/2014 Check this!!
Well :	Angus 3-10 3TFH			Finish:	9/22/2014 Check this!!
County:	Williams	State:	ND	Directional Supervision:	
QQ:	Lot 4	Section:	3	Denver Energy	Check this!!
Township:	153	N/S:	N		
Range:	99	E/W:	W	Date:	10/2/2014
Footages:	320	FN/SL:	N	Time:	10:20
	1105	FE/WL:	W	**F9 to re-calculate**	
Minimum Curvature Method (SPE-3362)				Proposed dir:	178.8

[North and East are positive and South and West are negative, relative to surface location]

No.	MD	INC	TRUE AZM	TVD	N-S	E-W	SECT	DLS/ 100
210	18219.00	90.41	180.41	11318.20	-7111.30	201.04	7113.95	1.60
211	18315.00	88.56	180.30	11319.06	-7207.29	200.45	7209.91	1.93
212	18411.00	88.70	179.93	11321.36	-7303.26	200.26	7305.85	0.41
213	18507.00	88.46	179.37	11323.74	-7399.23	200.84	7401.81	0.63
214	18603.00	89.62	179.01	11325.35	-7495.21	202.20	7497.80	1.27
215	18699.00	90.89	179.87	11324.92	-7591.20	203.14	7593.79	1.60
216	18795.00	91.06	180.20	11323.29	-7687.18	203.08	7689.75	0.39
217	18892.00	91.48	180.41	11321.14	-7784.16	202.56	7786.69	0.48
218	18987.00	90.58	180.81	11319.43	-7879.14	201.55	7881.63	1.04
219	19083.00	89.48	182.52	11319.38	-7975.09	198.76	7977.50	2.12
220	19179.00	89.79	180.70	11319.99	-8071.05	196.07	8073.38	1.92
221	19274.00	88.56	181.52	11321.36	-8166.02	194.23	8168.29	1.56
222	19371.00	88.46	181.23	11323.88	-8262.96	191.90	8265.16	0.32
223	19467.00	89.66	180.81	11325.46	-8358.93	190.19	8361.07	1.32
224	19562.00	89.93	181.00	11325.80	-8453.91	188.69	8456.01	0.35
225	19657.00	90.76	180.41	11325.22	-8548.90	187.52	8550.95	1.07
226	19753.00	90.93	180.36	11323.81	-8644.89	186.88	8646.91	0.18
227	19848.00	90.41	180.24	11322.70	-8739.88	186.38	8741.87	0.56
228	19943.00	90.86	179.87	11321.64	-8834.88	186.29	8836.84	0.61
229	20039.00	90.34	179.12	11320.64	-8930.87	187.13	8932.83	0.95
230	20135.00	90.48	178.85	11319.95	-9026.85	188.83	9028.82	0.32
231	20231.00	89.17	180.36	11320.24	-9122.84	189.50	9124.81	2.08
232	20327.00	89.28	179.52	11321.54	-9218.83	189.60	9220.78	0.88
233	20423.00	89.42	178.90	11322.63	-9314.81	190.92	9316.77	0.66
234	20519.00	90.14	180.08	11323.00	-9410.81	191.77	9412.76	1.44
235	20614.00	89.62	179.38	11323.20	-9505.81	192.22	9507.75	0.92
236	20710.00	90.31	179.82	11323.26	-9601.80	192.89	9603.74	0.85
237	20805.00	89.62	178.85	11323.32	-9696.79	194.00	9698.73	1.25
238	20900.00	89.93	178.29	11323.69	-9791.76	196.37	9793.73	0.67
239	20987.00	89.18	177.42	11324.37	-9878.70	199.62	9880.71	1.32
240	21040.00	89.18	177.42	11325.12	-9931.64	202.01	9933.69	0.00

FORMATION TOPS & STRUCTURAL RELATIONSHIPS

Operator: / Well Name: / Location: / Elevation:	Subject Well: Zavanna, LLC; Angus 3-10 3TFH; 320' FNL & 1,105' FWL; Lot 4 Section 3, T153N, R99W; GL: 2,358' Sub: 27' KB: 2,385'								Offset Wells:		
Formation/ Marker	**Prog. Top**	**Prog. Datum (MSL)**	**Driller's Depth Top (MD)**	**Driller's Depth Top (TVD)**	**Datum (MSL)**	**Interval Thickness**	**Thickness to Target**	**Dip To Prog.**	**Dip To Angus 34-27 4TFH**	**Dip To Nelson 3-10 1H**	**Dip To Brogger 21-4 1**
Base Last Salt	9,650'	-7,265'	9,651'	9,650'	-7,265'	50'	1,655'	0'	0'	19'	7'
Ratcliffe	9,702'	-7,317'	9,702'	9,700'	-7,315'	96'	1,605'	2'	-1'	20'	6'
Midale	9,795'	-7,410'	9,798'	9,796'	-7,411'	66'	1,509'	-1'	-7'	16'	-15'
Mission Canyon	9,860'	-7,475'	9,864'	9,862'	-7,477'	57'	1,443'	-2'	-4'	21'	-6'
Bluell	9,919'	-7,534'	9,921'	9,919'	-7,534'	538'	1,386'	0'	-1'	45'	16'
Lodgepole	10,464'	-8,079'	10,458'	10,457'	-8,072'	169'	848'	7'	1'	12'	-10'
Lodgepole A	10,633'	-8,248'	10,628'	10,626'	-8,241'	104'	679'	7'	-3'	39'	-9'
Lodgepole B	10,743'	-8,358'	10,731'	10,730'	-8,345'	174'	575'	13'	0'	17'	-36'
Lodgepole C	10,897'	-8,512'	10,906'	10,904'	-8,519'	158'	401'	-7'	-8'	3'	-23'
Lodgepole D	11,076'	-8,691'	11,088'	11,062'	-8,677'	44'	243'	14'	6'	19'	-8'
Lodgepole E	11,119'	-8,734'	11,142'	11,106'	-8,721'	41'	199'	13'	5'	21'	-7'
Lodgepole F	11,158'	-8,773'	11,198'	11,147'	-8,762'	23'	158'	11'	1'	18'	-11'
Lodgepole G	11,181'	-8,796'	11,230'	11,170'	-8,785'	26'	135'	11'	6'	12'	-13'
False Bakken	11,207'	-8,822'	11,272'	11,196'	-8,811'	6'	109'	11'	8'	22'	-11'
Scallion	11,215'	-8,830'	11,282'	11,202'	-8,817'	8'	103'	13'	9'	18'	-11'
Upper Bakken Shale	11,220'	-8,835'	11,297'	11,210'	-8,825'	20'	95'	10'	8'	21'	-12'
Middle Bakken	11,241'	-8,856'	11,334'	11,230'	-8,845'	39'	75'	11'	8'	21'	-12'
Lower Bakken Shale	11,277'	-8,892'	11,434'	11,269'	-8,884'	24'	36'	8'	5'	21'	-12'
Three Forks	11,301'	-8,916'	11,516'	11,293'	-8,908'	12'	12'	8'	3'	19'	-12'
Three Forks Target	11,313'	-8,928'	11,620'	11,305'	-8,920'	-	0'	8'	4'	20'	-10'

CONTROL DATA

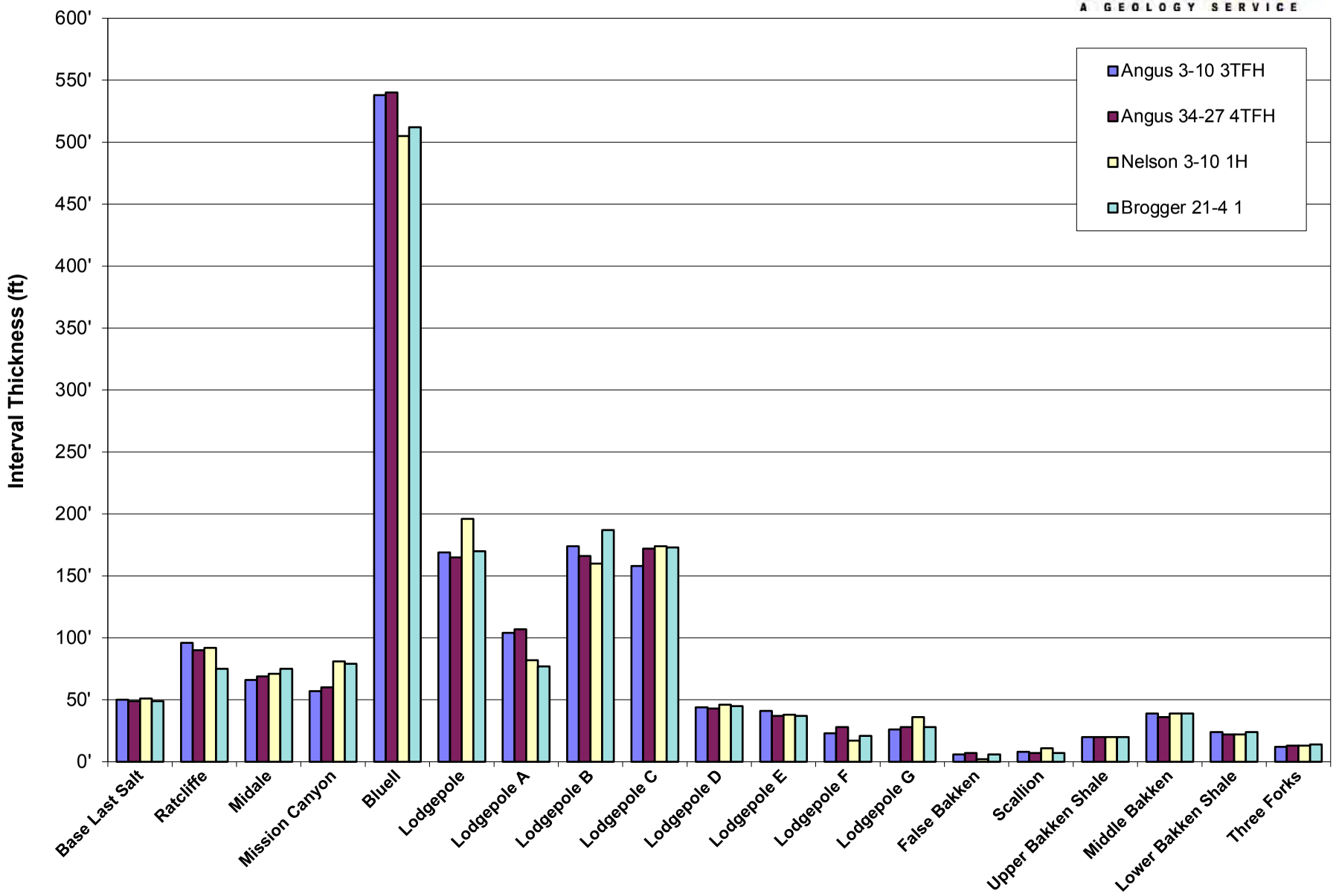
Operator:	Zavanna, LLC				Zavanna, LLC				Louisiana Land & Exploration Co.			
Well Name:	Angus 34-27 4TFH				Nelson 3-10 1H				Brogger 21-4 1			
Location:	Lot 4 Section 3, T153N, R99W Williams County, ND shares pad with subject well				Lot 2 Section 3, T153N, R99W Williams County, ND 0.5 miles E of subject well				NE NW Sec. 4, T153N, R99W Williams County, North Dakota 0.8 miles W of subject well			
Elevation:	KB: 2,385'				KB: 2,378'				KB: 2,374'			
Formation/ Zone	**E-Log Top**	**Datum (MSL)**	**Interval Thickness**	**Thickness to Target**	**E-Log Top**	**Datum (MSL)**	**Interval Thickness**	**Thickness to Target**	**E-Log Top**	**Datum (MSL)**	**Interval Thickness**	**Thickness to Target**
Base Last Salt	9,650'	-7,265'	49'	1,659'	9,662'	-7,284'	51'	1,656'	9,646'	-7,272'	49'	1,638'
Ratcliffe	9,699'	-7,314'	90'	1,610'	9,713'	-7,335'	92'	1,605'	9,695'	-7,321'	75'	1,589'
Midale	9,789'	-7,404'	69'	1,520'	9,805'	-7,427'	71'	1,513'	9,770'	-7,396'	75'	1,514'
Mission Canyon	9,858'	-7,473'	60'	1,451'	9,876'	-7,498'	81'	1,442'	9,845'	-7,471'	79'	1,439'
Bluell	9,918'	-7,533'	540'	1,391'	9,957'	-7,579'	505'	1,361'	9,924'	-7,550'	512'	1,360'
Lodgepole	10,458'	-8,073'	165'	851'	10,462'	-8,084'	196'	856'	10,436'	-8,062'	170'	848'
Lodgepole A	10,623'	-8,238'	107'	686'	10,658'	-8,280'	82'	660'	10,606'	-8,232'	77'	678'
Lodgepole B	10,730'	-8,345'	166'	579'	10,740'	-8,362'	160'	578'	10,683'	-8,309'	187'	601'
Lodgepole C	10,896'	-8,511'	172'	413'	10,900'	-8,522'	174'	418'	10,870'	-8,496'	173'	414'
Lodgepole D	11,068'	-8,683'	43'	241'	11,074'	-8,696'	46'	244'	11,043'	-8,669'	45'	241'
Lodgepole E	11,111'	-8,726'	37'	198'	11,120'	-8,742'	38'	198'	11,088'	-8,714'	37'	196'
Lodgepole F	11,148'	-8,763'	28'	161'	11,158'	-8,780'	17'	160'	11,125'	-8,751'	21'	159'
Lodgepole G	11,176'	-8,791'	28'	133'	11,175'	-8,797'	36'	143'	11,146'	-8,772'	28'	138'
False Bakken	11,204'	-8,819'	7'	105'	11,211'	-8,833'	2'	107'	11,174'	-8,800'	6'	110'
Scallion	11,211'	-8,826'	7'	98'	11,213'	-8,835'	11'	105'	11,180'	-8,806'	7'	104'
Upper Bakken Shale	11,218'	-8,833'	20'	91'	11,224'	-8,846'	20'	94'	11,187'	-8,813'	20'	97'
Middle Bakken	11,238'	-8,853'	36'	71'	11,244'	-8,866'	39'	74'	11,207'	-8,833'	39'	77'
Lower Bakken Shale	11,274'	-8,889'	22'	35'	11,283'	-8,905'	22'	35'	11,246'	-8,872'	24'	38'
Three Forks	11,296'	-8,911'	13'	13'	11,305'	-8,927'	13'	13'	11,270'	-8,896'	14'	14'
Three Forks Target	11,309'	-8,924'	-	0'	11,318'	-8,940'	-	0'	11,284'	-8,910'	-	0'

Values in grey use interval thicknesses from the Brogger 21-4 1 to project tops below the Middle Bakken

INTERVAL THICKNESS

Zavanna, LLC - Angus 3-10 3TFH

SUNBURST CONSULTING
A GEOLOGY SERVICE



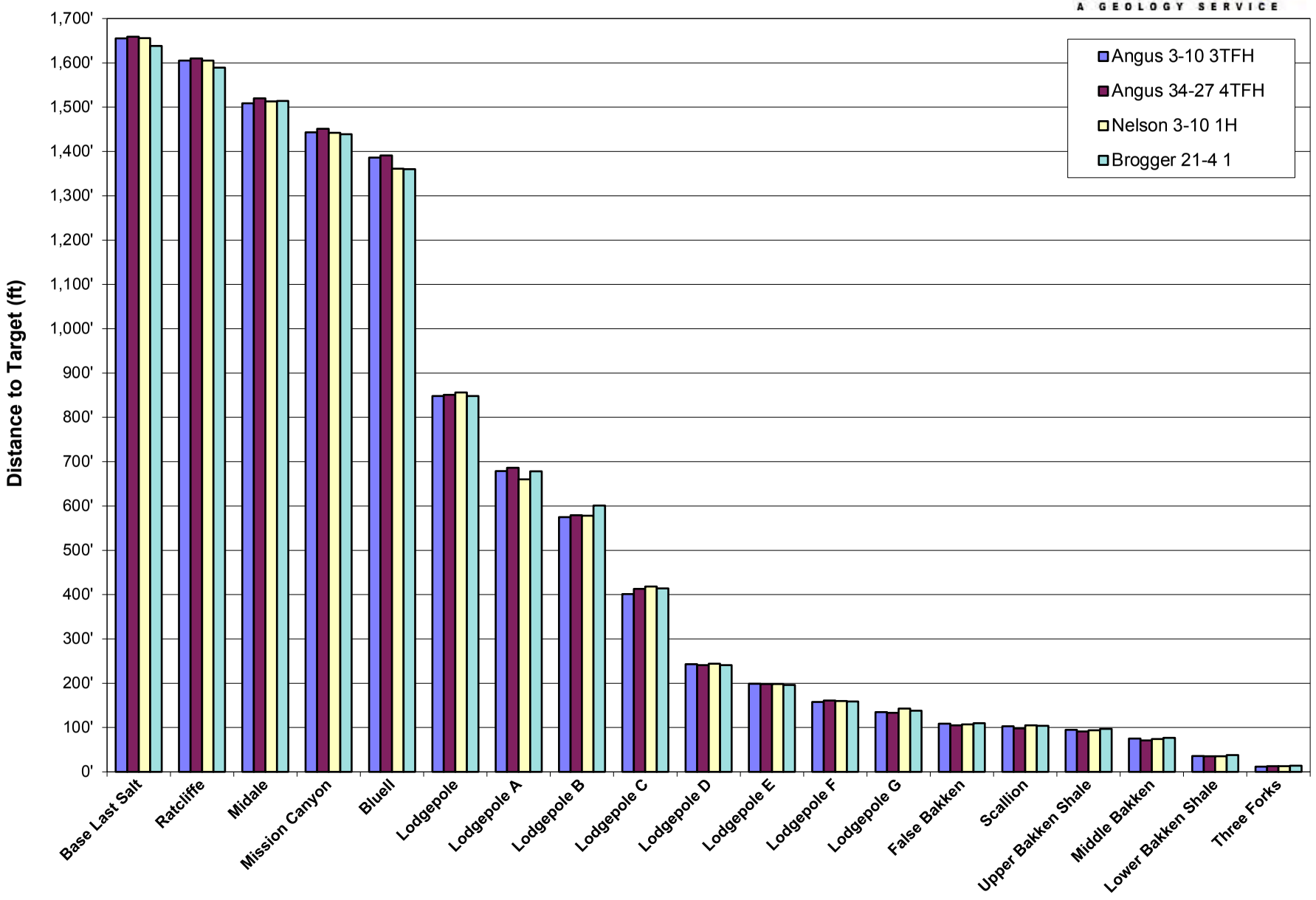
LANDING PROJECTION

Formation/ Zone:	Proposed Top of Target From:			
	Angus 34-27 4TFH	Nelson 3-10 1H	Brogger 21-4 1	Average of Offset Wells
Base Last Salt	11,309'	11,306'	11,288'	11,301'
Ratcliffe	11,310'	11,305'	11,289'	11,301'
Midale	11,316'	11,309'	11,310'	11,312'
Mission Canyon	11,313'	11,304'	11,301'	11,306'
Bluell	11,310'	11,280'	11,279'	11,290'
Lodgepole	11,308'	11,313'	11,305'	11,309'
Lodgepole A	11,312'	11,286'	11,304'	11,301'
Lodgepole B	11,309'	11,308'	11,331'	11,316'
Lodgepole C	11,317'	11,322'	11,318'	11,319'
Lodgepole D	11,303'	11,306'	11,303'	11,304'
Lodgepole E	11,304'	11,304'	11,302'	11,303'
Lodgepole F	11,308'	11,307'	11,306'	11,307'
Lodgepole G	11,303'	11,313'	11,308'	11,308'
False Bakken	11,301'	11,303'	11,306'	11,303'
Scallion	11,300'	11,307'	11,306'	11,304'
Upper Bakken Shale	11,301'	11,304'	11,307'	11,304'
Middle Bakken	11,301'	11,304'	11,307'	11,304'
Lower Bakken Shale	11,304'	11,304'	11,307'	11,305'
Three Forks	11,306'	11,306'	11,307'	11,306'
Three Forks Target	11,305'	11,305'	11,305'	11,305'

ISOPACH TO TARGET

Zavanna, LLC - Angus 3-10 3TFH

SUNBURST CONSULTING
A GEOLOGY SERVICE



LITHOLOGY

Zavanna Angus 3-10 3TFH

Geologists caught samples in 30' intervals from 9,570'–11,310', 10' samples from 11,310'–11,460', 30' intervals from 11,460'- 21,040'. Gamma ray marker tops have been inserted into the sample descriptions below for reference. Samples were examined wet and dry under a binocular microscope. Sample descriptions begin in the Charles Salt. Drilling fluid was fresh water in the surface hole; diesel invert in the vertical, curve and saltwater in the lateral.

Drilling in Charles Formation

9570-9600 DOLOMITIC LIMESTONE: mudstone, light to medium gray, microcrystalline, friable to firm, dense, earthy texture, no visible porosity, no visible oil stain; occasional ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

9600-9630 SALT: translucent to clear, crystalline, hard, anhedral, crystalline texture, no visible oil stain

Base of Last Charles Salt 9,651' MD (9,650' TVD, -7,265' MSL)

9630-9660 DOLOMITE: mudstone, light to medium gray, microcrystalline, friable to firm, dense, earthy texture, no visible porosity, no visible oil stain; abundant ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

9660-9690 DOLOMITE: mudstone, light to medium gray, microcrystalline, friable to firm, dense, earthy texture, no visible porosity, no visible oil stain; common ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

Ratcliffe 9,702' MD (9,700' TVD, -7,315' MSL)

9690-9720 DOLOMITE: mudstone, it to medium gray, microcrystalline, friable to firm, dense, earthy texture, no visible porosity, no visible oil stain; common ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

9720-9750 ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain; common DOLOMITE: mudstone, brown to gray, microcrystalline, friable to firm, dense, earthy txt, no visible porosity, no visible oil stain

9750-9780 DOLOMITE: mudstone, gray, microcrystalline, friable to firm, dense, earthy, algal laminated, argillaceous in part, no porosity, no oil stain; common ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

Midale 9,798' MD (9,796' TVD, -7,411' MSL)

9780-9810 DOLOMITE: mudstone, gray, microcrystalline, friable to fair, dense, earthy, algal laminated, argillaceous in part, no porosity, no oil stain; common ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

9810-9840 DOLOMITIC LIMESTONE: mudstone, gray, microcrystalline, friable to fair, dense, earthy, algal laminated, argillaceous in part, no porosity, no oil stain; rare ANHYDRITE: off white, milky, soft, microcrystalline, massive, amorphous texture, no visible oil stain

Mission Canyon 9,864' MD (9,862' TVD, -7,477' MSL)

9840-9870 DOLOMITIC LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to fair, dense, earthy, algal laminated, argillaceous in part, sparry calcite, pyrite, no porosity, no oil stain

9870-9900 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to fair, dense, earthy, algal laminated, argillaceous in part, dolomitic in part, sparry calcite, pyrite, no porosity, no oil stain

Bluell 9,921' MD (9,919' TVD, -7,534' MSL)

9910-9930 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to fair, dense, earthy, algal laminated, argillaceous in part, dolomitic in part, sparry calcite, pyrite, no porosity, no oil stain

9930-9960 NO SAMPLE

9960-9990 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, argillaceous in part, sparry calcite, pyrite, no porosity, no oil stain

9990-10020 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, argillaceous in part, sparry calcite, pyrite, no porosity, no oil stain

10020-10050 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, argillaceous in part, sparry calcite, pyrite, bioclast, no porosity, no oil stain

10050-10080 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, argillaceous in part, sparry calcite, pyrite, bioclast, no porosity , no oil stain

10080-10110 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, disseminated pyrite, bioclast, no visible porosity, no oil stain

10110-10140 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, disseminated pyrite, bioclast, no visible porosity, no oil stain

10140-10170 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, disseminated pyrite, bioclast, no visible porosity, no oil stain

10170-10200 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, disseminated pyrite, bioclast, no visible porosity, no oil stain

10200-10230 LIMESTONE: mudstone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, disseminated pyrite, bioclast, no visible porosity, no oil stain

10230-10260 LIMESTONE: mudstone to wackestone, mottled cream brown gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, no visible porosity, no oil stain

10260-10290 LIMESTONE: mudstone to wackestone, mottled cream brown gray, occasional medium gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, no visible porosity, no oil stain

10290-10320 LIMESTONE: mudstone to wackestone, mottled cream brown gray, occasional medium gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, no visible porosity, no oil stain

10320-10350 LIMESTONE: mudstone to wackestone, mottled cream brown gray, occasional medium gray, microcrystalline, friable to firm, dense, earthy, algal laminated, sparry calcite, no visible porosity, no oil stain

10350-10380 LIMESTONE: mudstone to wackestone, light brown gray, occasional medium gray brown, mottled in part, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10380-10410 LIMESTONE: mudstone to wackestone, light brown gray, occasional medium gray brown, mottled in part, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10410-10440 LIMESTONE: mudstone to wackestone, light brown gray, occasional medium gray brown, mottled in part, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

Lodgepole 10,458' MD (10,457' TVD, -8,072' MSL)

10440-10470 LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10470-10500 LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10500-10530 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10530-10560 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10560-10590 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10590-10620 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10620-10650 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10650-10680 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10680-10710 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10710-10740 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10740-10770 ARGILLACEOUS LIMESTONE: mudstone, medium gray, occasional light gray brown, microcrystalline, friable to firm, dense, earthy, sparry calcite, no visible porosity, no oil stain

10770-10800 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10800-10830 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10830-10860 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10860-10890 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10890-10920 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10920-10950 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10950-10980 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, no visible porosity, no visible oil stain

10980-11010 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11010-11040 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11040-11070 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11070-11100 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11100-11130 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11130-11160 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11160-11190 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11190-11220 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

11220-11250 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, rare cream gray, microcrystalline, friable to firm, earthy texture, spotty calcite, no visible porosity, no visible oil stain

False Bakken 11,272' MD (11,196' TVD, -8,811' MSL)

11250-11280 ARGILLACEOUS LIMESTONE: mudstone, medium gray brown, rare cream gray, microcrystalline, friable to firm, earthy texture, sparry calcite, no visible porosity, no visible oil stain; occasional SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain

Scallion 11,282' MD (11,202' TVD, -8,817' MSL)

Upper Bakken Shale 11,297' MD (11,210' TVD, -8,825' MSL)

11280-11310 SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain

11310-11320 SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain

11320-11330 SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain

Middle Bakken 11,334' MD (11,230' TVD, -8,845' MSL)

11330-11340 SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain

11340-11350 SHALE: black, firm, blocky, earthy, petroliferous, carbonaceous, calcareous, trace disseminated pyrite, no visible porosity, even oil stain; trace SILTSTONE: cream, cream gray, brown, soft, sub-blocky, dolomite cement, poorly cemented, slightly bioturbated, no visible porosity, occasional spotty brown oil stain

11350-11360 SILTSTONE: light gray to cream, brown, soft to firm, sub-blocky, dolomite cement, poorly cemented, slightly bioturbated, no visible porosity, occasional spotty brown oil stain

11360-11370 SILTSTONE: light gray to cream, brown, soft to firm, sub-blocky, dolomite cement, poorly cemented, slightly bioturbated, no visible porosity, occasional spotty brown oil stain

11370-11380 SILTSTONE: cream, cream gray, brown, soft, sub-blocky, dolomite cement, poorly cemented, slightly bioturbated, trace interbedded dolomite, occasional pyrite, no visible porosity, occasional spotty brown oil stain

11380-11390 DOLOMITE: wackestone, translucent brown, very fine crystalline, friable, sucrosic texture, trace nodular pyrite, visible intergranular porosity, spotty to even brown oil stain interbedded with SILTY SANDSTONE: light gray, cream to brown, very fine grained, friable, subangular to subrounded, moderately sorted, dolomite cement, moderately cemented, occasional visible porosity, occasional spotty brown oil stain

11390-11400 SILTY SANDSTONE: light gray, cream to brown, very fine grained, friable, subangular to subrounded, moderately sorted, dolomite cement, moderately cemented, occasional visible porosity, occasional spotty brown oil stain

11400-11410 SILTY SANDSTONE: light gray, cream to brown, very fine grained, friable, subangular to subrounded, moderately sorted, dolomite cement, moderately cemented, occasional visible porosity, occasional spotty brown oil stain

11410-11420 DOLOMITE: wackestone, translucent brown, very fine crystalline, friable, sucrosic texture, trace nodular pyrite, visible intergranular porosity, spotty to even brown oil stain interbedded with SILTY SANDSTONE: light gray, cream to brown, very fine grained, friable, subangular to subrounded, moderately sorted, dolomite cement, moderately cemented, occasional visible porosity, occasional spotty brown oil stain

11420-11430 DOLOMITE: wackestone, translucent brown, very fine crystalline, friable, sucrosic texture, trace nodular pyrite, visible intergranular porosity, spotty to even brown oil stain interbedded with SILTY SANDSTONE: light gray, cream to brown, very fine grained, friable, subangular to subrounded, moderately sorted, dolomite cement, moderately cemented, occasional visible porosity, occasional spotty brown oil stain; SHALE: black, friable to firm, sub-blocky, earthy texture, petroliferous, carbonaceous, common disseminated pyrite, trace calcite, no visible porosity

Lower Bakken Shale 11,434' MD (11,269' TVD, -8,884' MSL)

11430-11460 SHALE: black, friable to firm, sub-blocky, earthy texture, petroliferous, carbonaceous, common disseminated pyrite, trace calcite, no visible porosity

11460-11490 SHALE: black, friable to firm, sub-blocky, earthy texture, petroliferous, carbonaceous, common disseminated pyrite, trace calcite, no visible porosity

Three Forks 11,516' MD (11,293' TVD, -8,908' MSL)

11490-11520 SHALE: black, friable to firm, sub-blocky, earthy texture, petroliferous, carbonaceous, common disseminated pyrite, trace calcite, no visible porosity

11520-11550 SHALE: black, friable to firm, sub-blocky, earthy texture, petroliferous, carbonaceous, common disseminated pyrite, trace calcite, no visible porosity; occasional DOLOMITE: mudstone to packstone, light to medium gray, off white brown, very fine grained, friable, crystalline texture, trace disseminated pyrite, intercrystalline porosity, occasional light brown oil stain

11550-11580 DOLOMITE: mudstone to packstone, light to medium gray, off white brown, very fine grained, friable, crystalline texture, trace disseminated pyrite, intercrystalline porosity, occasional light brown oil stain

11580-11610 DOLOMITE: mudstone to packstone, light to medium gray, off white brown, very fine grained, friable, crystalline texture, trace disseminated pyrite, intercrystalline porosity, occasional light brown oil stain

11610-11640 DOLOMITE: mudstone to packstone, light to medium gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace light brown oil stain; trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace light brown oil stain

11640-11670 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; rare SHALE; light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11670-11700 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

11700-11730 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

11730-11760 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11760-11790 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11790-11820 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11820-11850 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11850-11880 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11880-11910 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11910-11940 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11940-11970 DOLOMITE: mudstone to packstone, light gray, off white brown, very fine grained, friable, crystalline to sucrosic texture, trace disseminated pyrite, intercrystalline porosity, trace brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

11970-12000 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12000-12030 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12030-12060 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12060-12090 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12090-12120 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12120-12150 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain; occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12150-12180 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12180-12210 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12210-12240 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12240-12270 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12270-12300 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12300-12330 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12330-12360 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12360-12390 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12390-12420 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12420-12450 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty to even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12450-12480 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12480-12510 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12510-12540 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12540-12570 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12570-12600 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12600-12630 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12630-12660 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12660-12690 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12690-12720 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12720-12750 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with

SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12750-12780 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12780-12810 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12810-12840 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12840-12870 DOLOMITE: mudstone, brown, cream, off white brown, very fine grained, friable, sucrosic to micro sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12870-12900 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12900-12930 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12930-12960 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12960-12990 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

12990-13020 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13020-13050 DOLOMITE: mudstone, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty brown oil stain, interbedded with SHALE: light gray blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13050-13080 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13080-13110 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13110-13140 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13140-13170 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13170-13200 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13200-13230 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13230-13260 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13260-13290 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13290-13320 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, visible spotty even brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13320-13350 DOLOMITE: mudstone, cream, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13350-13380 DOLOMITE: mudstone, cream, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with SHALE: light gray, blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13380-13410 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13410-13440 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13440-13470 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13470-13500 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13500-13530 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13530-13560 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13560-13590 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13590-13620 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13620-13650 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13650-13680 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13680-13710 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13710-13740 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13740-13770 DOLOMITE: mudstone, cream off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13770-13800 DOLOMITE: mudstone, cream off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with trace SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13800-13830 DOLOMITE: mudstone, cream off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with occasional SHALE: light to gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13830-13860 DOLOMITE: mudstone, cream off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with occasional SHALE: light to gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13860-13890 DOLOMITE: mudstone, cream off white, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with occasional SHALE: light to gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13890-13920 DOLOMITE: mudstone, cream off white, very fine grained, friable, micro sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with occasional SHALE: light blue to gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13920-13950 DOLOMITE: mudstone, cream off white, very fine grained, friable, micro sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with occasional SHALE: light blue to gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

13950-13980 DOLOMITE: mudstone, cream, off to white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with rare SHALE: light blue gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

13980-14010 DOLOMITE: mudstone, cream, off to white brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with rare SHALE: light blue gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14010-14040 DOLOMITE: mudstone, cream, off to white brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with rare SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14040-14070 DOLOMITE: mudstone, cream, off to white brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain, interbedded with rare SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14070-14100 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14100-14130 DOLOMITE: mudstone, cream, off white brown, very fine grained, friable, microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14130-14160 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14160-14190 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14190-14220 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14220-14250 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14250-14280 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14280-14310 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14310-14340 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14340-14370 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14370-14400 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14400-14430 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14430-14460 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14460-14490 DOLOMITE: mudstone, cream, off white brown to brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14490-14520 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14520-14550 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14550-14580 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14580-14610 SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain; DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, trace spotty to even brown oil stain

14610-14640 SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain; DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, trace spotty to even brown oil stain

14640-14670 SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain; DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, trace spotty to even brown oil stain

14670-14700 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14700-14730 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14730-14760 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14760-14790 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14790-14820 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14820-14850 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14850-14880 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14880-14910 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14910-14940 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14940-14970 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

14970-15000 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, microsucrosic to sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15000-15030 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15030-15060 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15060-15090 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15090-15120 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15120-15150 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15150-15180 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15180-15210 DOLOMITE: mudstone, cream to off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, occasional visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with common SHALE: light gray to blue, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15210-15240 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15240-15270 DOLOMITE: mudstone, cream to off white, brown, very fine grained, friable, sucrosic to microsucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15270-15300 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15300-15330 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15330-15360 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15360-15390 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15390-15420 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15420-15450 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15450-15480 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15480-15510 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15510-15540 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15540-15570 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15570-15600 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with common SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15600-15630 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15630-15660 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15660-15690 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15690-15720 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15720-15750 DOLOMITE: mudstone, cream, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain

15750-15780 DOLOMITE: mudstone, cream, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain

15780-15810 DOLOMITE: mudstone, cream, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain

15810-15840 DOLOMITE: mudstone, cream, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, trace spotty brown oil stain

15840-15870 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15870-15900 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15900-15930 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15930-15960 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15960-15990 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

15990-16020 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

16020-16050 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

16050-16080 DOLOMITE: mudstone, cream to brown, very fine grained, friable, sucrosic texture, trace disseminated pyrite, possible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray, soft, sub-blocky, earthy texture, trace nodular and disseminated pyrite, trace light brown oil stain

16080-16110 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16110-16140 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16140-16170 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16170-16200 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16200-16230 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE:

light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16230-16260 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16260-16290 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16290-16320 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16320-16350 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16350-16380 DOLOMITE: mudstone, off white to cream, occasional light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16380-16410 DOLOMITE: mudstone, off white to cream, occasional light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16410-16440 DOLOMITE: mudstone, off white to cream, occasional light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16440-16470 DOLOMITE: mudstone, off white to cream, occasional light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16470-16500 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16500-16530 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16530-16560 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16560-16590 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16590-16620 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16620-16650 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16650-16680 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16680-16710 DOLOMITE: mudstone, off white to cream, rare light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace disseminated pyrite, no visible porosity, trace light brown oil stain

16710-16740 DOLOMITE: mudstone, cream to off white, occasional light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16740-16770 DOLOMITE: mudstone, cream to off white, occasional light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16770-16800 DOLOMITE: mudstone, cream to off white, occasional light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16800-16830 DOLOMITE: mudstone, cream to off white, occasional light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16830-16860 DOLOMITE: mudstone, cream to off white, occasional light gray to tan, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16860-16890 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16890-16920 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional

SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16920-16950 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16950-16980 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

16980-17010 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic texture, very trace disseminated pyrite, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17010-17040 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17040-17070 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17070-17100 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17100-17130 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17130-17160 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17160-17190 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17190-17220 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17220-17250 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17250-17280 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17280-17310 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17310-17340 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17340-17370 DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17370-17400 Sample contaminated well lube, DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17400-17430 Sample contaminated well lube, DOLOMITE: mudstone, cream to brown, trace off white, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17430-17460 DOLOMITE: mudstone, cream to off white, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17460-17490 DOLOMITE: mudstone, cream to off white, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17490-17520 DOLOMITE: mudstone, cream to off white, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17520-17550 DOLOMITE: mudstone, cream to off white, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17550-17580 DOLOMITE: mudstone, cream to off white, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17580-17610 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray

to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17610-17640 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17640-17670 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17670-17700 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17700-17730 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17730-17760 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17760-17790 DOLOMITE: mudstone, off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17790-17820 DOLOMITE: mudstone, light gray to off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17820-17850 DOLOMITE: mudstone, light gray to off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17850-17880 DOLOMITE: mudstone, light gray to off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17880-17910 DOLOMITE: mudstone, light gray to off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17910-17940 DOLOMITE: mudstone, light gray to off white to cream, occasional tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17940-17970 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

17970-18000 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18000-18030 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18030-18060 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18060-18090 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18090-18120 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18120-18150 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18150-18180 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18180-18210 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18210-18240 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18240-18270 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18270-18300 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional

SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18300-18330 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18330-18360 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18360-18390 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18390-18420 DOLOMITE: mudstone, light gray to off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18420-18450 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18450-18480 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18480-18510 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18510-18540 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18540-18570 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18570-18600 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18600-18630 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18630-18660 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18660-18690 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with trace SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18690-18720 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18720-18750 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18750-18780 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18780-18810 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18810-18840 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18840-18870 DOLOMITE: mudstone, off white to cream, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18870-18900 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18900-18930 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18930-18960 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18960-18990 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional

SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

18990-19020 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19020-19050 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19050-19080 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19080-19110 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19110-19140 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19140-19170 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19170-19200 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19200-19230 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, occasional spotty to even brown oil stain, interbedded with occasional SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19230-19260 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19260-19290 DOLOMITE: mudstone, cream to off white, occasional brown, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19290-19320 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19320-19350 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19350-19380 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19380-19410 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19410-19440 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19440-19470 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19470-19500 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19500-19530 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19530-19560 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, sucrosic to microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue green, firm, sub-blocky, earthy texture, very trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19560-19590 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to brown oil stain, interbedded with rare SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19590-19620 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to brown oil stain, interbedded with rare SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19620-19650 DOLOMITE: mudstone, cream to off white, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to brown oil stain, interbedded with rare SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19650-19680 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19680-19710 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19710-19740 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19740-19770 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19770-19800 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19800-19830 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19830-19860 DOLOMITE: mudstone, cream to off white trace tan, very fine grained, friable, microsucrosic texture, visible intercrystalline porosity, rare spotty to even brown oil stain, interbedded with rare SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19860-19890 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic rare sucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19890-19920 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic rare sucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19920-19950 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic rare sucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19950-19980 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic rare sucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

19980-20010 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic rare sucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light gray to blue, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20010-20040 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20040-20070 DOLOMITE: mudstone, cream to off white tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20070-20100 DOLOMITE: mudstone, cream to off white rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20100-20130 DOLOMITE: mudstone, cream to off white rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20130-20160 DOLOMITE: mudstone, cream to off white rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20160-20190 DOLOMITE: mudstone, cream to off white rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20190-20220 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20220-20250 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20250-20280 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20280-20310 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20310-20340 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20340-20370 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20370-20400 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20400-20430 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20430-20460 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20460-20490 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20490-20520 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20520-20550 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20550-20580 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20580-20610 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20610-20640 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20640-20670 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20670-20700 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20700-20730 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20730-20760 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20760-20790 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20790-20820 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20820-20850 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20850-20880 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20880-20910 DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20910-20940: DOLOMITE: mudstone, cream to off white, rare tan, very fine grained, friable, microsucrosic texture, possible intercrystalline porosity, rare spotty brown oil stain, interbedded with SHALE: light blue to gray, firm, sub-blocky, earthy texture, trace nodular and disseminated pyrite, no visible porosity, trace light brown oil stain

20940-20970 CLAYSTONE: light cream to off white, rarely light tan to light grey, soft to firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, no visible oil stain; trace DOLOMITE: mudstone, off-white to tan, very fine grained, friable, microsucrosic texture, no visible porosity, rare spotty-even brown oil stain

20970-21000 CLAYSTONE: light cream to off white, rarely light tan to light grey, soft to firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, no visible oil stain; trace DOLOMITE: mudstone, off-white to tan, very fine grained, friable, microsucrosic texture, no visible porosity, rare spotty-even brown oil stain

21000- 21040 CLAYSTONE: light cream to off white, rarely light tan to light grey, soft to firm, sub-blocky, earthy texture, rare nodular and disseminated pyrite, no visible porosity, no visible oil stain; trace DOLOMITE: mudstone, off-white to tan, very fine grained, friable, microsucrosic texture, no visible porosity, rare spotty-even brown oil stain

Gyrodata, Incorporated
301 Thelma Drive #433
Casper, WY 82609

Office: 307/234-7241
Fax: 307/234-6309

DIRECTIONAL SURVEY CERTIFICATION

RE: Zavanna LLC. (Operator)

Angus 3-10-3TFH (Well Name & No.)

Gyrodata Job Number: RM0314GMS217

Run Date: 03/23/2014

Surveyor: Nathan Henderson

I, Joel Sulzen having personal knowledge of all of the facts, herby certify that the attached directional survey from the measured depth of 0 feet to a measured depth of 2293 feet is true and correct as determined from all available records.

Signature	Title	Company	Date
	Operations Manager	Gyrodata, Inc.	9/5/2014

State of **Wyoming)**

County of **Natrona)**

NOTARY PUBLIC
L. MACIAS
STATE OF WYOMING
COUNTY OF NATRONA
My Commission Expires Jan 18, 2016

On this 05th day of September, 2014, before me personally appeared Joel Sulzen to me known as the person described in and who executed the forgoing instrument and acknowledged that (s)he executed the same as his/her free act and deed.

SEAL: L Macias
Notary Public

01/18/2016
My Commission Expires

A Gyrodata Directional Survey

FINAL DEFINITIVE COPY

for

ZAVANNA, LLC.

Lease: Angus Well: 3-10-3TFH, 4.5" drill pipe
Location: Craigs Rig #4, Williams County, North Dakota

Job Number: RM0314GDM217

Run Date: 23 Mar 2014
Report Generated: 05 Sep 2014 11:25

Surveyor: Nathan Henderson, Cody Byers

Calculation Method: MINIMUM CURVATURE

Survey surface coordinates obtained from: Company Man
Survey Latitude: 48.110194 deg. N Longitude: 103.405797 deg. W

Azimuth Correction:

Gyro: Bearings are Relative to True North

Depth Reference: Rotary Table

Air Gap (RKB to Ground / RKB to MSL): 27.00

Vertical Section Calculated from Well Head Location

Closure Calculated from Well Head Location

Horizontal Coordinates Calculated from Well Head Location

A Gyrodata Directional Survey

Zavanna, LLC.
Lease: Angus Well: 3-10-3TFH, 4.5" drill pipe
Location: Craigs Rig #4, Williams County, North Dakota
Job Number: RM0314GDM217

MEASURED DEPTH feet	INCL deg.	AZIMUTH deg.	DOGLEG SEVERITY deg./ 100 ft.	VERTICAL DEPTH feet	CLOSURE DIST. feet	CLOSURE AZIMUTH deg.	HORIZONTAL COORDINATES feet
0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.00 N 0.00 E
0 - 2293 FT. RATE GYROSCOPIC MULTISHOT SURVEY RUN INSIDE 4-1/2" DRILL PIPE ALL MEASURED DEPTHS AND COORDINATES REFERENCED TO NABORS #92, R.K.B. OF 28 FT.							
123.00	0.36	244.44	0.29	123.00	0.4	244.4	0.17 S 0.35 W
223.00	0.28	231.56	0.11	223.00	0.9	241.1	0.45 S 0.82 W
323.00	0.15	219.75	0.14	323.00	1.3	237.2	0.71 S 1.10 W
423.00	0.07	208.68	0.08	423.00	1.5	234.6	0.86 S 1.21 W
523.00	0.09	199.54	0.02	523.00	1.6	232.0	0.99 S 1.27 W
623.00	0.05	278.82	0.09	623.00	1.7	231.7	1.06 S 1.34 W
723.00	0.03	334.40	0.04	723.00	1.7	233.6	1.03 S 1.39 W
823.00	0.09	44.31	0.08	823.00	1.6	234.9	0.95 S 1.35 W
923.00	0.13	75.83	0.07	923.00	1.5	233.9	0.86 S 1.18 W
1023.00	0.26	89.17	0.14	1023.00	1.2	225.5	0.83 S 0.85 W
1123.00	0.13	41.01	0.20	1123.00	0.9	216.3	0.74 S 0.54 W
1223.00	0.23	52.28	0.11	1222.99	0.6	210.3	0.53 S 0.31 W
1323.00	0.33	40.67	0.11	1322.99	0.2	169.6	0.19 S 0.04 E
1423.00	0.43	58.29	0.15	1422.99	0.6	67.6	0.22 N 0.54 E
1523.00	0.48	66.55	0.08	1522.99	1.4	64.8	0.59 N 1.25 E
1623.00	0.51	63.95	0.04	1622.98	2.2	64.9	0.95 N 2.03 E
1723.00	0.25	50.99	0.27	1722.98	2.9	63.7	1.28 N 2.60 E

A Gyrodata Directional Survey

Zavanna, LLC.
Lease: Angus Well: 3-10-3TFH, 4.5" drill pipe
Location: Craigs Rig #4, Williams County, North Dakota
Job Number: RM0314GDM217

MEASURED DEPTH feet	INCL deg.	AZIMUTH deg.	DOGLEG SEVERITY deg./ 100 ft.	VERTICAL DEPTH feet	CLOSURE DIST. feet	CLOSURE AZIMUTH deg.	HORIZONTAL COORDINATES feet	
1823.00	0.17	36.80	0.09	1822.98	3.2	61.7	1.54 N	2.86 E
1923.00	0.08	253.73	0.24	1922.98	3.3	60.4	1.64 N	2.88 E
2023.00	0.07	64.75	0.15	2022.98	3.3	60.2	1.64 N	2.87 E
2123.00	0.14	136.26	0.14	2122.98	3.4	62.3	1.58 N	3.01 E
2223.00	0.31	181.02	0.23	2222.98	3.3	68.4	1.22 N	3.09 E
2293.00	0.36	210.02	0.25	2292.98	3.1	74.2	0.84 N	2.97 E

Final Station Closure: Distance: 3.09 ft Az: 74.17 deg.

PATHFINDER
A Schlumberger Company
9251 E 104th Ave.
Commerce City, CO 80640
(303) 439-5500

Directional Survey Certification Form

Zavanna, LLC	Angus 3-10 #3TFH Original Hole	23-Sep-2014
Company	Well Name	Final report Date
14CCO0434	**ND, Williams County**	**33-105-03243**
PathFinder Job Number	County / State	API Number
N 48° 6' 36.69900" **N 48.11019417**	**W 103° 24' 19.54300"** **W 103.40579694**	**320 ft FNL & 1105 ft FWL** **Sec 3 Twn 153 N Rng 99 W**
Surface Latitude	Surface Logitude	Surface Section - Township - Range
NAD83 ND State Plane, N Zone, Ft	**Nabors 92**	**le: RKB @ 2385.00 ft / GL: 2358.00 ft MSL**
Datum & Coordinate System	Rig Contractor	Height Reference

Survey Depth	**2378.00**	to	**20987.00**
	Depth From		Depth To
	Measurement While Drilling		
	Type of Survey		
Survey Depth	**20987.00**	to	**21040.00**
	Depth From		Depth To
	Straight line projection to Bit/TD		
	Type of Survey		

Site Supervisors	**-**	**Tasha Rogers -**
	Directional Driller 1	MWD Surveyor 1
	-	
	Directional Driller 2	MWD Surveyor 2

The data submitted in this report conforms to the standards and procedures as set forth by Schlumberger. This report represents a true and correct directional wellbore survey based on original survey data obtained at the well site.

Matt VanderSchaaf — 9/23/2014

Matt VanderSchaaf — Date

PathFinder Well Planner II

Angus 3-10 #3TFH MWD+GYRO 0' to 21040' Definitive Survey Geodetic Report

(Def Survey)

Report Date:	September 24, 2014 - 09:18 AM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Zavanna, LLC	**Vertical Section Azimuth:**	178.803 ° (True North)
Field:	ND, Williams County (NAD 83 NZ) 2013	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Zavanna, LLC 3-153N-99W (Angus Pad) / Angus 3-10 #3TFH	**TVD Reference Datum:**	RKB
Well:	Angus 3-10 #3TFH	**TVD Reference Elevation:**	2385.000 ft above MSL
Borehole:	Original Hole	**Seabed / Ground Elevation:**	2358.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	8.295 °
Survey Name:	Angus 3-10 #3TFH MWD+GYRO 0' to 21040' Definitive	**Total Gravity Field Strength:**	1000.0320mgn (9.80665 Based)
Survey Date:	September 18, 2014	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	235.889 ° / 10111.394 ft / 6.646 / 0.893	**Total Magnetic Field Strength:**	56305.628 nT
Coordinate Reference System:	NAD83 North Dakota State Plane, Northern Zone, Feet	**Magnetic Dip Angle:**	72.993 °
Location Lat / Long:	N 48° 6' 36.69900", W 103° 24' 20.86900"	**Declination Date:**	September 18, 2014
Location Grid N/E Y/X:	N 418355.624 ft, E 1258796.868 ft	**Magnetic Declination Model:**	UNKNOWN
CRS Grid Convergence Angle:	-2.1623 °	**North Reference:**	True North
Grid Scale Factor:	0.99993594	**Grid Convergence Used:**	0.0000 °
Version / Patch:	2.8.551.0	**Total Corr Mag North->True North:**	8.2945 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ft)	Easting (ft)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
Last GYRO Survey	2293.00	0.36	210.02	2292.98	-0.81	0.87	3.04	0.25	418356.38	1258799.94	N 48 6 36.71	W 103 24 20.82
9 5/8" Casing Point	*2333.00*	*0.41*	*231.96*	*2332.98*	*-0.62*	*0.68*	*2.86*	*0.38*	*418356.19*	*1258799.75*	*N 48 6 36.71*	*W 103 24 20.83*
Begin SLB_MWD Survey	2378.00	0.52	249.05	2377.98	-0.45	0.51	2.55	0.38	418356.03	1258799.43	N 48 6 36.70	W 103 24 20.83
	2473.00	1.24	256.43	2472.97	-0.09	0.11	1.15	0.77	418355.69	1258798.02	N 48 6 36.70	W 103 24 20.85
	2568.00	1.34	248.42	2567.94	0.52	-0.54	-0.88	0.22	418355.12	1258795.97	N 48 6 36.69	W 103 24 20.88
	2663.00	1.70	249.63	2662.91	1.37	-1.44	-3.23	0.37	418354.31	1258793.58	N 48 6 36.68	W 103 24 20.92
	2759.00	2.29	245.95	2758.85	2.58	-2.71	-6.32	0.63	418353.15	1258790.45	N 48 6 36.67	W 103 24 20.96
	2854.00	2.12	244.40	2853.78	4.04	-4.24	-9.64	0.19	418351.75	1258787.08	N 48 6 36.66	W 103 24 21.01
	2948.00	0.28	219.99	2947.75	4.93	-5.17	-11.35	1.99	418350.89	1258785.33	N 48 6 36.65	W 103 24 21.04
	3043.00	0.86	199.48	3042.75	5.77	-6.02	-11.73	0.64	418350.05	1258784.92	N 48 6 36.64	W 103 24 21.04
	3138.00	1.27	177.05	3137.73	7.50	-7.75	-11.92	0.61	418348.33	1258784.67	N 48 6 36.62	W 103 24 21.04
	3232.00	1.99	194.72	3231.70	10.11	-10.37	-12.28	0.92	418345.73	1258784.21	N 48 6 36.60	W 103 24 21.05
	3326.00	1.70	207.54	3325.65	12.90	-13.18	-13.34	0.54	418342.95	1258783.04	N 48 6 36.57	W 103 24 21.07
	3421.00	1.56	213.42	3420.61	15.20	-15.51	-14.70	0.23	418340.68	1258781.60	N 48 6 36.55	W 103 24 21.09
	3516.00	1.62	216.71	3515.57	17.32	-17.66	-16.21	0.11	418338.59	1258780.00	N 48 6 36.52	W 103 24 21.11
	3612.00	1.85	221.18	3611.53	19.53	-19.92	-18.04	0.28	418336.40	1258778.09	N 48 6 36.50	W 103 24 21.13
	3711.00	1.68	227.46	3710.48	21.67	-22.10	-20.17	0.26	418334.30	1258775.88	N 48 6 36.48	W 103 24 21.17
	3799.00	1.54	216.44	3798.45	23.47	-23.93	-21.82	0.39	418332.54	1258774.16	N 48 6 36.46	W 103 24 21.19
	3892.00	1.61	229.09	3891.41	25.29	-25.79	-23.55	0.38	418330.74	1258772.36	N 48 6 36.44	W 103 24 21.22
	3986.00	1.28	222.09	3985.38	26.90	-27.43	-25.25	0.39	418329.16	1258770.60	N 48 6 36.43	W 103 24 21.24
	4080.00	1.18	210.79	4079.36	28.49	-29.05	-26.45	0.28	418327.60	1258769.34	N 48 6 36.41	W 103 24 21.26
	4175.00	0.86	195.55	4174.34	30.00	-30.58	-27.15	0.44	418326.10	1258768.59	N 48 6 36.40	W 103 24 21.27
	4270.00	0.63	354.45	4269.34	30.16	-30.74	-27.39	1.54	418325.94	1258768.34	N 48 6 36.40	W 103 24 21.27
	4364.00	0.57	194.46	4363.34	30.09	-30.67	-27.56	1.26	418326.02	1258768.18	N 48 6 36.40	W 103 24 21.28
	4456.00	0.66	174.85	4455.33	31.05	-31.64	-27.62	0.25	418325.05	1258768.07	N 48 6 36.39	W 103 24 21.28
	4552.00	0.49	157.02	4551.33	31.98	-32.56	-27.41	0.25	418324.12	1258768.25	N 48 6 36.38	W 103 24 21.27
	4650.00	0.32	130.59	4649.33	32.55	-33.13	-27.04	0.25	418323.54	1258768.60	N 48 6 36.37	W 103 24 21.27
	4746.00	0.08	184.85	4745.33	32.80	-33.37	-26.84	0.30	418323.30	1258768.79	N 48 6 36.37	W 103 24 21.26
	4839.00	0.20	31.96	4838.33	32.72	-33.29	-26.76	0.29	418323.37	1258768.87	N 48 6 36.37	W 103 24 21.26
	4934.00	0.31	67.55	4933.33	32.49	-33.05	-26.43	0.20	418323.60	1258769.21	N 48 6 36.37	W 103 24 21.26
	5029.00	0.25	64.53	5028.32	32.31	-32.86	-26.01	0.07	418323.77	1258769.64	N 48 6 36.37	W 103 24 21.25
	5123.00	0.29	99.61	5122.32	32.27	-32.82	-25.59	0.18	418323.80	1258770.06	N 48 6 36.38	W 103 24 21.25
	5218.00	0.42	35.51	5217.32	32.04	-32.57	-25.15	0.41	418324.02	1258770.51	N 48 6 36.38	W 103 24 21.24
	5311.00	0.17	310.84	5310.32	31.67	-32.21	-25.05	0.47	418324.39	1258770.62	N 48 6 36.38	W 103 24 21.24
	5405.00	0.22	47.20	5404.32	31.46	-31.99	-25.03	0.31	418324.60	1258770.65	N 48 6 36.38	W 103 24 21.24
	5499.00	0.28	77.54	5498.32	31.30	-31.82	-24.67	0.15	418324.76	1258771.01	N 48 6 36.39	W 103 24 21.23
	5592.00	1.10	107.53	5591.31	31.54	-32.04	-23.60	0.94	418324.50	1258772.07	N 48 6 36.38	W 103 24 21.22
	5687.00	1.55	89.61	5686.29	31.85	-32.31	-21.45	0.64	418324.15	1258774.22	N 48 6 36.38	W 103 24 21.19
	5782.00	1.67	82.81	5781.25	31.72	-32.12	-18.79	0.23	418324.23	1258776.88	N 48 6 36.38	W 103 24 21.15
	5877.00	1.96	84.08	5876.20	31.45	-31.78	-15.80	0.31	418324.46	1258779.88	N 48 6 36.39	W 103 24 21.10
	5972.00	2.00	83.65	5971.15	31.16	-31.43	-12.54	0.04	418324.69	1258783.15	N 48 6 36.39	W 103 24 21.05
	6067.00	2.08	75.51	6066.09	30.62	-30.82	-9.22	0.32	418325.18	1258786.49	N 48 6 36.39	W 103 24 21.00
	6160.00	2.07	72.30	6159.02	29.75	-29.88	-5.99	0.13	418325.99	1258789.76	N 48 6 36.40	W 103 24 20.96
	6256.00	1.67	66.06	6254.97	28.72	-28.79	-3.06	0.47	418326.97	1258792.72	N 48 6 36.41	W 103 24 20.91
	6349.00	1.34	61.45	6347.94	27.70	-27.72	-0.87	0.37	418327.95	1258794.95	N 48 6 36.43	W 103 24 20.88
	6444.00	1.18	72.61	6442.92	26.91	-26.90	1.04	0.31	418328.71	1258796.90	N 48 6 36.43	W 103 24 20.85
	6539.00	1.27	68.33	6537.90	26.27	-26.22	2.96	0.13	418329.32	1258798.84	N 48 6 36.44	W 103 24 20.83
	6634.00	1.21	53.69	6632.87	25.33	-25.24	4.74	0.34	418330.23	1258800.66	N 48 6 36.45	W 103 24 20.80
	6729.00	1.24	44.16	6727.85	24.03	-23.91	6.26	0.22	418331.50	1258802.22	N 48 6 36.46	W 103 24 20.78
	6823.00	1.10	50.48	6821.83	22.76	-22.61	7.67	0.20	418332.75	1258803.68	N 48 6 36.48	W 103 24 20.76
	6918.00	1.23	52.15	6916.81	21.59	-21.40	9.17	0.14	418333.89	1258805.23	N 48 6 36.49	W 103 24 20.73
	7012.00	0.97	44.12	7010.80	20.43	-20.21	10.52	0.32	418335.03	1258806.62	N 48 6 36.50	W 103 24 20.71
	7107.00	1.09	44.39	7105.78	19.23	-18.99	11.71	0.13	418336.21	1258807.86	N 48 6 36.51	W 103 24 20.70
	7202.00	1.10	29.79	7200.76	17.82	-17.55	12.80	0.29	418337.60	1258808.99	N 48 6 36.53	W 103 24 20.68
	7295.00	1.34	23.80	7293.74	16.07	-15.78	13.68	0.30	418339.34	1258809.94	N 48 6 36.54	W 103 24 20.67
	7391.00	1.59	31.28	7389.71	13.92	-13.61	14.83	0.33	418341.46	1258811.17	N 48 6 36.56	W 103 24 20.65
	7485.00	1.36	24.56	7483.68	11.81	-11.48	15.97	0.31	418343.55	1258812.39	N 48 6 36.59	W 103 24 20.63
	7580.00	1.00	33.87	7578.66	10.11	-9.76	16.90	0.43	418345.23	1258813.39	N 48 6 36.60	W 103 24 20.62
	7673.00	0.87	30.70	7671.65	8.85	-8.48	17.72	0.15	418346.48	1258814.25	N 48 6 36.62	W 103 24 20.61
	7768.00	0.87	15.45	7766.64	7.54	-7.16	18.28	0.24	418347.78	1258814.86	N 48 6 36.63	W 103 24 20.60
	7862.00	0.66	2.91	7860.63	6.32	-5.93	18.50	0.28	418349.00	1258815.13	N 48 6 36.64	W 103 24 20.60
	7957.00	0.59	2.84	7955.62	5.28	-4.90	18.55	0.08	418350.03	1258815.22	N 48 6 36.65	W 103 24 20.60
	8051.00	0.46	26.48	8049.62	4.47	-4.08	18.74	0.26	418350.84	1258815.44	N 48 6 36.66	W 103 24 20.59
	8146.00	0.29	14.87	8144.62	3.90	-3.50	18.97	0.19	418351.41	1258815.69	N 48 6 36.66	W 103 24 20.59
	8240.00	0.52	49.86	8238.61	3.40	-3.00	19.36	0.35	418351.90	1258816.10	N 48 6 36.67	W 103 24 20.58
	8335.00	0.63	53.18	8333.61	2.83	-2.41	20.11	0.12	418352.46	1258816.87	N 48 6 36.68	W 103 24 20.57
	8430.00	0.55	41.00	8428.60	2.18	-1.75	20.83	0.16	418353.09	1258817.61	N 48 6 36.68	W 103 24 20.56
	8523.00	0.48	30.13	8521.60	1.52	-1.08	21.31	0.13	418353.75	1258818.12	N 48 6 36.69	W 103 24 20.55
	8619.00	0.49	31.76	8617.60	0.83	-0.38	21.73	0.02	418354.43	1258818.57	N 48 6 36.70	W 103 24 20.55
	8713.00	0.35	42.18	8711.60	0.28	0.18	22.14	0.17	418354.97	1258819.00	N 48 6 36.70	W 103 24 20.54
	8807.00	0.52	50.28	8805.59	-0.19	0.67	22.66	0.19	418355.44	1258819.54	N 48 6 36.71	W 103 24 20.54
	8902.00	0.62	42.91	8900.59	-0.83	1.32	23.34	0.13	418356.06	1258820.24	N 48 6 36.71	W 103 24 20.53
	8998.00	0.25	304.35	8996.59	-1.32	1.82	23.52	0.73	418356.55	1258820.44	N 48 6 36.72	W 103 24 20.52
	9092.00	0.49	272.74	9090.58	-1.47	1.95	22.95	0.33	418356.71	1258819.88	N 48 6 36.72	W 103 24 20.53
	9187.00	0.49	273.57	9185.58	-1.53	1.99	22.14	0.01	418356.78	1258819.07	N 48 6 36.72	W 103 24 20.54

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ft)	Easting (ft)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	9282.00	0.53	263.76	9280.58	-1.53	1.97	21.31	0.10	418356.79	1258818.23	N 48 6 36.72	W 103 24 20.56
	9378.00	0.48	255.35	9376.57	-1.39	1.82	20.48	0.09	418356.67	1258817.40	N 48 6 36.72	W 103 24 20.57
	9471.00	0.20	265.75	9469.57	-1.30	1.71	19.94	0.30	418356.58	1258816.86	N 48 6 36.72	W 103 24 20.58
	9566.00	0.24	348.29	9564.57	-1.48	1.90	19.74	0.31	418356.77	1258816.66	N 48 6 36.72	W 103 24 20.58
	9658.00	0.25	338.38	9656.57	-1.86	2.27	19.63	0.05	418357.15	1258816.56	N 48 6 36.72	W 103 24 20.58
	9752.00	0.37	315.56	9750.57	-2.27	2.67	19.34	0.18	418357.56	1258816.29	N 48 6 36.73	W 103 24 20.58
	9846.00	0.42	331.10	9844.57	-2.79	3.19	18.96	0.13	418358.10	1258815.94	N 48 6 36.73	W 103 24 20.59
	9939.00	0.30	336.62	9937.56	-3.32	3.71	18.70	0.14	418358.63	1258815.69	N 48 6 36.74	W 103 24 20.59
	10034.00	0.19	333.29	10032.56	-3.69	4.08	18.53	0.11	418359.00	1258815.54	N 48 6 36.74	W 103 24 20.60
	10129.00	0.32	333.36	10127.56	-4.08	4.46	18.34	0.13	418359.39	1258815.36	N 48 6 36.74	W 103 24 20.60
	10225.00	0.43	307.18	10223.56	-4.54	4.92	17.94	0.21	418359.86	1258814.97	N 48 6 36.75	W 103 24 20.60
	10319.00	0.39	347.71	10317.56	-5.07	5.44	17.59	0.31	418360.40	1258814.64	N 48 6 36.75	W 103 24 20.61
	10414.00	0.33	342.70	10412.56	-5.65	6.02	17.44	0.08	418360.98	1258814.52	N 48 6 36.76	W 103 24 20.61
	10508.00	0.31	330.64	10506.56	-6.13	6.49	17.23	0.07	418361.46	1258814.33	N 48 6 36.76	W 103 24 20.62
	10602.00	0.60	320.65	10600.55	-6.74	7.09	16.80	0.32	418362.08	1258813.92	N 48 6 36.77	W 103 24 20.62
	10697.00	0.39	314.39	10695.55	-7.36	7.70	16.25	0.23	418362.71	1258813.40	N 48 6 36.78	W 103 24 20.63
	10740.00	0.47	324.81	10738.55	-7.61	7.95	16.04	0.25	418362.96	1258813.20	N 48 6 36.78	W 103 24 20.63
	10792.00	1.54	158.83	10790.54	-7.13	7.47	16.17	3.84	418362.48	1258813.31	N 48 6 36.77	W 103 24 20.63
	10824.00	6.43	153.07	10822.46	-5.11	5.47	17.14	15.30	418360.44	1258814.20	N 48 6 36.75	W 103 24 20.62
	10855.00	10.82	151.56	10853.10	-0.96	1.36	19.32	14.18	418356.26	1258816.22	N 48 6 36.71	W 103 24 20.58
	10884.00	14.71	153.84	10881.38	4.80	-4.34	22.24	13.52	418350.45	1258818.92	N 48 6 36.66	W 103 24 20.54
	10915.00	18.28	157.26	10911.10	12.89	-12.36	25.85	11.93	418342.30	1258822.23	N 48 6 36.58	W 103 24 20.49
	10948.00	21.96	153.02	10942.08	23.27	-22.63	30.65	11.99	418331.85	1258826.64	N 48 6 36.48	W 103 24 20.42
	10979.00	25.84	151.38	10970.41	34.49	-33.73	36.52	12.70	418320.54	1258832.09	N 48 6 36.37	W 103 24 20.33
	11011.00	29.23	149.86	10998.79	47.52	-46.62	43.79	10.82	418307.39	1258838.86	N 48 6 36.24	W 103 24 20.22
	11043.00	30.75	149.25	11026.50	61.47	-60.40	51.89	4.84	418293.31	1258846.44	N 48 6 36.10	W 103 24 20.10
	11075.00	34.20	148.85	11053.49	76.39	-75.14	60.73	10.80	418278.26	1258854.72	N 48 6 35.96	W 103 24 19.97
	11107.00	37.90	149.36	11079.36	92.74	-91.29	70.40	11.60	418261.74	1258863.76	N 48 6 35.80	W 103 24 19.83
	11138.00	39.52	150.22	11103.55	109.70	-108.05	80.15	5.51	418244.64	1258872.88	N 48 6 35.63	W 103 24 19.69
	11170.00	42.12	153.65	11127.77	128.36	-126.51	89.97	10.73	418225.82	1258882.00	N 48 6 35.45	W 103 24 19.54
	11201.00	45.63	156.72	11150.11	148.04	-146.01	98.97	13.24	418206.00	1258890.25	N 48 6 35.26	W 103 24 19.41
	11233.00	49.49	157.52	11171.70	169.99	-167.76	108.14	12.20	418183.91	1258898.60	N 48 6 35.04	W 103 24 19.28
	11264.00	54.01	157.51	11190.89	192.66	-190.25	117.45	14.58	418161.09	1258907.05	N 48 6 34.82	W 103 24 19.14
	11296.00	57.19	159.45	11208.97	217.42	-214.81	127.13	11.12	418136.18	1258915.79	N 48 6 34.58	W 103 24 19.00
	11327.00	59.92	163.23	11225.14	242.64	-239.86	135.57	13.63	418110.83	1258923.29	N 48 6 34.33	W 103 24 18.87
	11359.00	63.28	166.73	11240.36	269.97	-267.05	142.85	14.24	418083.40	1258929.53	N 48 6 34.06	W 103 24 18.76
	11391.00	67.15	169.45	11253.78	298.51	-295.47	148.84	14.34	418054.77	1258934.44	N 48 6 33.78	W 103 24 18.68
	11422.00	68.62	169.81	11265.45	326.86	-323.71	154.00	4.86	418026.35	1258938.54	N 48 6 33.50	W 103 24 18.60
	11453.00	71.87	171.31	11275.93	355.73	-352.49	158.79	11.43	417997.42	1258942.23	N 48 6 33.22	W 103 24 18.53
	11485.00	74.49	174.70	11285.19	386.20	-382.89	162.51	13.03	417966.90	1258944.80	N 48 6 32.92	W 103 24 18.47
	11517.00	78.41	177.08	11292.68	417.26	-413.91	164.73	14.22	417935.82	1258945.86	N 48 6 32.61	W 103 24 18.44
	11548.00	82.98	179.12	11297.70	447.84	-444.47	165.74	16.11	417905.24	1258945.71	N 48 6 32.31	W 103 24 18.43
	11587.00	88.90	179.86	11300.46	486.72	-483.36	166.09	15.30	417866.38	1258944.59	N 48 6 31.93	W 103 24 18.42
7" Casing Point	*11634.00*	*89.06*	*180.60*	*11301.29*	*533.70*	*-530.35*	*165.90*	*1.61*	*417819.43*	*1258942.63*	*N 48 6 31.47*	*W 103 24 18.42*
	11668.00	89.18	181.13	11301.82	567.67	-564.34	165.39	1.61	417785.48	1258940.83	N 48 6 31.13	W 103 24 18.43
	11760.00	87.87	180.66	11304.19	659.58	-656.30	163.95	1.51	417693.65	1258935.93	N 48 6 30.22	W 103 24 18.45
	11851.00	89.00	178.90	11306.67	750.53	-747.26	164.30	2.31	417602.75	1258932.84	N 48 6 29.32	W 103 24 18.45
	11943.00	89.38	177.34	11307.96	842.51	-839.20	167.32	1.74	417510.77	1258932.39	N 48 6 28.42	W 103 24 18.40
	12034.00	91.30	177.06	11307.42	933.47	-930.08	171.76	2.14	417419.79	1258933.40	N 48 6 27.52	W 103 24 18.34
	12124.00	92.37	178.48	11304.53	1023.40	-1019.96	175.26	1.97	417329.84	1258933.51	N 48 6 26.63	W 103 24 18.29
	12215.00	91.00	179.23	11301.86	1114.36	-1110.90	177.07	1.72	417238.90	1258931.89	N 48 6 25.74	W 103 24 18.26
	12306.00	89.31	181.56	11301.61	1205.31	-1201.89	176.44	3.15	417148.01	1258927.83	N 48 6 24.84	W 103 24 18.27
	12399.00	89.35	180.88	11302.70	1298.22	-1294.86	174.46	0.73	417055.18	1258922.34	N 48 6 23.92	W 103 24 18.30
	12496.00	90.17	180.31	11303.11	1395.17	-1391.86	173.46	1.03	416958.30	1258917.68	N 48 6 22.96	W 103 24 18.31
	12591.00	89.52	181.58	11303.36	1490.11	-1486.84	171.89	1.49	416863.45	1258912.53	N 48 6 22.03	W 103 24 18.34
	12687.00	89.73	182.86	11303.99	1585.93	-1582.76	168.18	1.35	416767.74	1258905.20	N 48 6 21.08	W 103 24 18.39
	12781.00	90.52	182.93	11303.80	1679.69	-1676.64	163.43	0.84	416674.12	1258896.92	N 48 6 20.15	W 103 24 18.46
	12876.00	88.87	183.80	11304.31	1774.38	-1771.47	157.86	1.96	416579.57	1258887.77	N 48 6 19.22	W 103 24 18.54
	12971.00	89.76	184.30	11305.45	1868.98	-1866.23	151.15	1.08	416485.14	1258877.49	N 48 6 18.28	W 103 24 18.64
	13067.00	88.69	184.11	11306.74	1964.54	-1961.96	144.11	1.13	416389.75	1258866.84	N 48 6 17.34	W 103 24 18.75
	13162.00	87.46	184.53	11309.93	2059.05	-2056.63	136.96	1.37	416295.42	1258856.13	N 48 6 16.40	W 103 24 18.85
	13257.00	86.98	182.87	11314.54	2153.58	-2151.32	130.83	1.82	416201.04	1258846.43	N 48 6 15.47	W 103 24 18.94
	13352.00	88.90	181.38	11317.96	2248.36	-2246.19	127.30	2.56	416106.38	1258839.33	N 48 6 14.53	W 103 24 18.99
	13447.00	89.21	181.22	11319.52	2343.25	-2341.15	125.14	0.37	416011.57	1258833.59	N 48 6 13.60	W 103 24 19.03
	13542.00	90.86	181.18	11319.47	2438.17	-2436.12	123.16	1.74	415916.74	1258828.02	N 48 6 12.66	W 103 24 19.05
	13638.00	89.79	180.54	11318.92	2534.10	-2532.11	121.72	1.29	415820.89	1258822.97	N 48 6 11.71	W 103 24 19.08
	13734.00	89.04	180.61	11319.90	2630.05	-2628.10	120.76	0.79	415725.01	1258818.38	N 48 6 10.76	W 103 24 19.09
	13831.00	90.21	181.67	11320.54	2726.96	-2725.08	118.84	1.62	415628.18	1258812.80	N 48 6 9.81	W 103 24 19.12
	13925.00	90.52	181.64	11319.95	2820.85	-2819.03	116.13	0.33	415534.40	1258806.55	N 48 6 8.88	W 103 24 19.16
	14021.00	90.76	180.22	11318.88	2916.77	-2915.01	114.57	1.49	415438.55	1258801.37	N 48 6 7.93	W 103 24 19.18
	14117.00	89.90	179.64	11318.34	3012.75	-3011.01	114.68	1.08	415342.62	1258797.86	N 48 6 6.99	W 103 24 19.18
	14213.00	89.48	179.18	11318.85	3108.74	-3107.00	115.66	0.65	415246.67	1258795.22	N 48 6 6.04	W 103 24 19.16
	14308.00	89.73	178.57	11319.51	3203.74	-3201.98	117.53	0.69	415151.69	1258793.50	N 48 6 5.10	W 103 24 19.14
	14402.00	89.69	177.41	11319.99	3297.73	-3295.92	120.82	1.24	415057.70	1258793.25	N 48 6 4.17	W 103 24 19.09
	14498.00	90.24	178.32	11320.05	3393.71	-3391.85	124.40	1.11	414961.71	1258793.20	N 48 6 3.23	W 103 24 19.04
	14594.00	89.97	177.95	11319.87	3489.71	-3487.80	127.52	0.49	414865.72	1258792.70	N 48 6 2.28	W 103 24 18.99
	14689.00	90.86	177.59	11319.19	3584.69	-3582.73	131.22	1.01	414770.73	1258792.82	N 48 6 1.34	W 103 24 18.94
	14784.00	90.69	178.90	11317.91	3679.67	-3677.67	134.13	1.40	414675.75	1258792.14	N 48 6 0.41	W 103 24 18.89
	14881.00	90.58	179.11	11316.83	3776.66	-3774.65	135.81	0.23	414578.78	1258790.17	N 48 5 59.45	W 103 24 18.87
	14976.00	89.76	178.80	11316.55	3871.66	-3869.63	137.55	0.93	414483.80	1258788.32	N 48 5 58.51	W 103 24 18.84
	15071.00	90.41	177.80	11316.41	3966.66	-3964.59	140.37	1.26	414388.81	1258787.55	N 48 5 57.58	W 103 24 18.80
	15167.00	89.90	177.74	11316.15	4062.64	-4060.52	144.10	0.54	414292.82	1258787.67	N 48 5 56.63	W 103 24 18.75
	15262.00	89.93	178.69	11316.29	4157.64	-4155.47	147.06	1.00	414197.83	1258787.04	N 48 5 55.69	W 103 24 18.70
	15358.00	89.52	177.26	11316.75	4253.62	-4251.41	150.46	1.56	414101.84	1258786.81	N 48 5 54.74	W 103 24 18.65
	15453.00	89.14	177.37	11317.86	4348.58	-4346.29	154.91	0.41	414006.86	1258787.68	N 48 5 53.81	W 103 24 18.59
	15549.00	90.03	177.55	11318.55	4444.55	-4442.20	159.17	0.95	413910.87	1258788.32	N 48 5 52.86	W 103 24 18.52
	15644.00	90.48	177.10	11318.12	4539.52	-4537.09	163.61	0.66	413815.88	1258789.17	N 48 5 51.93	W 103 24 18.46
	15739.00	90.82	176.26	11317.04	4634.45	-4631.92	169.11	0.96	413720.91	1258791.10	N 48 5 50.99	W 103 24 18.38
	15835.00	89.90	178.21	11316.44	4730.40	-4727.81	173.75	2.25	413624.93	1258792.11	N 48 5 50.04	W 103 24 18.31
	15930.00	88.18	179.05	11318.03	4825.38	-4822.76	176.02	2.02	413529.97	1258790.80	N 48 5 49.11	W 103 24 18.28
	16025.00	89.97	179.54	11319.57	4920.36	-4917.74	177.19	1.95	413435.02	1258788.38	N 48 5 48.17	W 103 24 18.26
	16120.00	89.93	179.87	11319.65	5015.35	-5012.74	177.68	0.35	413340.08	1258785.29	N 48 5 47.23	W 103 24 18.25
	16215.00	89.55	180.69	11320.08	5110.32	-5107.73	177.21	0.95	413245.17	1258781.24	N 48 5 46.29	W 103 24 18.26
	16310.00	88.63	179.62	11321.59	5205.28	-5202.72	176.96	1.49	413150.27	1258777.40	N 48 5 45.36	W 103 24 18.26
	16406.00	89.49	178.48	11323.17	5301.26	-5298.69	178.55	1.48	413054.31	1258775.37	N 48 5 44.41	W 103 24 18.24
	16502.00	89.52	178.49	11324.00	5397.26	-5394.65	181.09	0.04	412958.33	1258774.29	N 48 5 43.46	W 103 24 18.20
	16598.00	90.82	178.81	11323.71	5493.25	-5490.62	183.35	1.40	412862.35	1258772.93	N 48 5 42.52	W 103 24 18.17
	16694.00	91.17	178.89	11322.05	5589.24	-5586.59	185.27	0.37	412766.38	1258771.23	N 48 5 41.57	W 103 24 18.14
	16789.00	91.65	178.82	11319.72	5684.21	-5681.54	187.17	0.51	412671.43	1258769.54	N 48 5 40.63	W 103 24 18.11
	16885.00	90.89	178.90	11317.59	5780.19	-5777.50	189.09	0.79	412575.48	1258767.84	N 48 5 39.68	W 103 24 18.08
	16979.00	89.79	179.91	11317.03	5874.18	-5871.49	190.06	1.59	412481.52	1258765.27	N 48 5 38.76	W 103 24 18.07
	17075.00	89.04	179.53	11318.01	5970.16	-5967.48	190.53	0.88	412385.59	1258762.11	N 48 5 37.81	W 103 24 18.06
	17170.00	87.49	179.57	11320.88	6065.10	-6062.43	191.27	1.63	412290.68	1258759.27	N 48 5 36.87	W 103 24 18.05
	17264.00	89.42	179.62	11323.41	6159.06	-6156.39	191.93	2.05	412196.77	1258756.38	N 48 5 35.95	W 103 24 18.04
	17360.00	89.52	179.07	11324.30	6255.05	-6252.38	193.03	0.58	412100.81	1258753.86	N 48 5 35.00	W 103 24 18.03
	17455.00	90.48	178.71	11324.30	6350.05	-6347.36	194.87	1.08	412005.84	1258752.11	N 48 5 34.06	W 103 24 18.00
	17551.00	89.69	179.39	11324.16	6446.04	-6443.35	196.46	1.09	411909.87	1258750.08	N 48 5 33.11	W 103 24 17.98
	17646.00	90.82	180.18	11323.73	6541.03	-6538.34	196.80	1.45	411814.93	1258746.84	N 48 5 32.18	W 103 24 17.97
	17741.00	90.14	179.48	11322.93	6636.01	-6633.34	197.08	1.03	411720.00	1258743.54	N 48 5 31.24	W 103 24 17.97

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (ft)	Easting (ft)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	17836.00	90.14	179.75	11322.71	6731.00	-6728.33	197.72	0.29	411625.05	1258740.59	N 48 5 30.30	W 103 24 17.96
	17931.00	90.82	179.40	11321.91	6825.98	-6823.33	198.42	0.82	411530.10	1258737.71	N 48 5 29.36	W 103 24 17.95
	18027.00	90.69	179.56	11320.64	6921.97	-6919.32	199.29	0.23	411434.16	1258734.96	N 48 5 28.42	W 103 24 17.93
	18123.00	90.89	178.95	11319.32	7017.96	-7015.30	200.54	0.67	411338.20	1258732.58	N 48 5 27.47	W 103 24 17.92
	18219.00	90.41	180.41	11318.23	7113.94	-7111.29	201.08	1.60	411242.27	1258729.49	N 48 5 26.52	W 103 24 17.91
	18315.00	88.56	180.30	11319.09	7209.89	-7207.28	200.49	1.93	411146.38	1258725.28	N 48 5 25.58	W 103 24 17.92
	18411.00	88.70	179.93	11321.39	7305.84	-7303.25	200.30	0.41	411050.49	1258721.47	N 48 5 24.63	W 103 24 17.92
	18507.00	88.46	179.37	11323.78	7401.80	-7399.22	200.88	0.63	410954.57	1258718.44	N 48 5 23.68	W 103 24 17.91
	18603.00	89.62	179.01	11325.39	7497.78	-7495.19	202.24	1.27	410858.62	1258716.17	N 48 5 22.73	W 103 24 17.89
	18699.00	90.89	179.87	11324.96	7593.77	-7591.18	203.17	1.60	410762.67	1258713.48	N 48 5 21.79	W 103 24 17.88
	18795.00	91.06	180.20	11323.32	7689.74	-7687.17	203.10	0.39	410666.76	1258709.79	N 48 5 20.84	W 103 24 17.88
	18892.00	91.48	180.41	11321.17	7786.68	-7784.15	202.59	0.47	410569.88	1258705.62	N 48 5 19.88	W 103 24 17.89
	18987.00	90.58	180.81	11319.46	7881.61	-7879.12	201.58	1.03	410475.01	1258701.03	N 48 5 18.95	W 103 24 17.90
	19083.00	89.48	182.52	11319.41	7977.49	-7975.08	198.79	2.12	410379.24	1258694.62	N 48 5 18.00	W 103 24 17.94
	19179.00	89.79	180.70	11320.01	8073.37	-8071.03	196.09	1.93	410283.46	1258688.30	N 48 5 17.05	W 103 24 17.98
	19274.00	88.56	181.52	11321.37	8168.28	-8166.00	194.25	1.56	410188.63	1258682.88	N 48 5 16.11	W 103 24 18.01
	19371.00	88.46	181.23	11323.90	8265.15	-8262.94	191.92	0.32	410091.85	1258676.90	N 48 5 15.16	W 103 24 18.04
	19467.00	89.66	180.81	11325.48	8361.06	-8358.91	190.21	1.32	409996.02	1258671.57	N 48 5 14.21	W 103 24 18.07
	19562.00	89.93	181.00	11325.82	8456.00	-8453.90	188.70	0.35	409901.17	1258666.48	N 48 5 13.27	W 103 24 18.09
	19657.00	90.76	180.41	11325.25	8550.94	-8548.89	187.53	1.07	409806.29	1258661.72	N 48 5 12.34	W 103 24 18.11
	19753.00	90.93	180.36	11323.84	8646.89	-8644.88	186.88	0.18	409710.41	1258657.45	N 48 5 11.39	W 103 24 18.12
	19848.00	90.41	180.24	11322.73	8741.85	-8739.87	186.38	0.56	409615.51	1258653.37	N 48 5 10.45	W 103 24 18.12
	19943.00	90.86	179.87	11321.68	8836.83	-8834.86	186.29	0.61	409520.59	1258649.70	N 48 5 9.51	W 103 24 18.13
	20039.00	90.34	179.12	11320.68	8932.81	-8930.85	187.14	0.94	409424.64	1258646.92	N 48 5 8.57	W 103 24 18.11
	20135.00	90.48	178.85	11319.99	9028.81	-9026.83	188.84	0.32	409328.67	1258644.99	N 48 5 7.62	W 103 24 18.09
	20231.00	89.17	180.36	11320.27	9124.79	-9122.83	189.50	2.08	409232.73	1258642.03	N 48 5 6.67	W 103 24 18.08
	20327.00	89.28	179.52	11321.57	9220.77	-9218.82	189.60	0.88	409136.81	1258638.51	N 48 5 5.72	W 103 24 18.08
	20423.00	89.42	178.90	11322.66	9316.76	-9314.80	190.92	0.66	409040.85	1258636.21	N 48 5 4.78	W 103 24 18.06
	20519.00	90.14	180.08	11323.04	9412.75	-9410.79	191.77	1.44	408944.90	1258633.44	N 48 5 3.83	W 103 24 18.04
	20614.00	89.62	179.38	11323.24	9507.73	-9505.79	192.22	0.92	408849.96	1258630.31	N 48 5 2.89	W 103 24 18.04
	20710.00	90.31	179.82	11323.29	9603.72	-9601.79	192.89	0.85	408754.01	1258627.35	N 48 5 1.95	W 103 24 18.03
	20805.00	89.62	178.85	11323.35	9698.72	-9696.78	193.98	1.25	408659.05	1258624.86	N 48 5 1.01	W 103 24 18.01
	20900.00	89.93	178.29	11323.72	9793.72	-9791.75	196.35	0.68	408564.06	1258623.64	N 48 5 0.07	W 103 24 17.98
Last SLB_MWD Survey	20987.00	89.18	177.42	11324.40	9880.70	-9878.69	199.60	1.32	408477.07	1258623.61	N 48 4 59.21	W 103 24 17.93
Projection to Bit	21040.00	89.18	177.42	11325.16	9933.68	-9931.63	201.99	0.01	408424.08	1258624.00	N 48 4 58.69	W 103 24 17.89

Survey Type: Def Survey

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	23.000	1/98.425	30.000	30.000	SLB_NSG+MSHOT-Depth Only	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040' Definitive
	1	23.000	27.000	Act Stns	30.000	30.000	SLB_NSG+MSHOT-Depth Only	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040' Definitive
	1	27.000	2293.000	Act Stns	30.000	30.000	SLB_NSG+MSHOT	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040'
	1	2293.000	10792.000	Act Stns	30.000	30.000	SLB_MWD-STD	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040'
	1	10792.000	11587.000	Act Stns	30.000	30.000	SLB_MWD+DMAG	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040'
	1	11587.000	20987.000	Act Stns	30.000	30.000	SLB_MWD-STD	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040'
	1	20987.000	21040.000	Act Stns	30.000	30.000	SLB_BLIND+TREND	Original Hole / Angus 3-10 #3TFH MWD+GYRO 0' to 21040'

SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)

JAN 2014
RECEIVED
ND OIL & GAS DIVISION

Well File No.
26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

☑ Notice of Intent	Approximate Start Date: **February 1, 2014**	☐ Drilling Prognosis	☐ Spill Report
☐ Report of Work Done	Date Work Completed:	☐ Redrilling or Repair	☐ Shooting
☐ Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03.	Approximate Start Date:	☐ Casing or Liner	☐ Acidizing
		☐ Plug Well	☐ Fracture Treatment
		☐ Supplemental History	☐ Change Production Method
		☐ Temporarily Abandon	☐ Reclamation
		☑ Other **Suspension of Drilling**	

Well Name and Number					
Angus 3-10 3TFH					
Footages	Qtr-Qtr	Section	Township	Range	
320 F N L 1105 F W L	**LOT4**	**3**	**153 N**	**99 W**	
Field	Pool	County			
Long Creek	**Bakken**	**WILLIAMS**			

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s)			
Craig's Roustabout Service, Inc.			
Address	City	State	Zip Code
5245 142nd Dr. NW	**Williston**	**ND**	**58801**

DETAILS OF WORK

Zavanna, LLC. requests permission for suspension of drilling for up to 90 days for the referenced well under NDAC 43-02-03-55. Zavanna intends to drill the surface hole with fresh water based drilling mud and set surface casing with a small drilling rig and move off within 3 to 5 days. The casing will be set at a depth as per the approved APD. No saltwater will be used in the drilling and cementing operations of the surface casing. Once the surface casing is cemented, a plug or mechanical seal will be placed at the top of the casing to prevent any foreign matter from getting into the well. A rig capable of drilling to TD will move onto the location within 90 days to complete the drilling of the well as per the approved APD. The undersigned states that this request for suspension of drilling operations in accordance with Subsection 4 of Section 43-02-03-55 of the NDAC, is requested in order to take advantage of the cost savings and time savings of using an initial rig that is smaller than the rig necessary to drill a well to total depth but is not intended to alter or extend the terms and conditions of, or suspend any obligation under, any oil and gas lease with acreage in or under the spacing or drilling unit for the above-referenced well. Zavanna understands NDAC 43-02-03-31 requirements regarding confidentiality pertaining to this permit. The cuttings pit will be fenced immediately after construction if the well pad is located in a pasture (NDAC 43-02-03-19 & 19.1). Zavanna will plug and abandon the well and reclaim the wellsite if the well is not drilled by the larger rotary rig within 90 days after spudding the well with the smaller drilling rig. Zavanna will notify NDIC Inspector with spud date.

NOTIFY NDIC INSPECTOR JESSICA GILKEY AT 701-770-7340 WITH SPUD + TD INFO.

Company		Telephone Number
Zavanna, LLC		**(303) 595-8004**
Address		
1200 17th St., Ste 1100		
City	State	Zip Code
Denver	**CO**	**80202**
Signature	Printed Name	
	Jean Arnold	
Title	Date	
Sr. Prod. Tech.	**January 8, 2014**	
Email Address		
jarnold@zavanna.com		

FOR STATE USE ONLY

☐ Received	☒ Approved
Date: 1/30/14	
By: Alice D. Webber	
Title: Engineering Technician	

TH

SUNDRY NOTICES AND REPORTS ON WELLS - FORM 4

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 5749 (09-2006)

RECEIVED
SEP 2013
ND OIL & GAS DIVISION

Well File No. 26684

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

- [ ] Notice of Intent — Approximate Start Date
- [x] Report of Work Done — Date Work Completed: October 1, 2013
- [ ] Notice of Intent to Begin a Workover Project that may Qualify for a Tax Exemption Pursuant to NDCC Section 57-51.1-03. — Approximate Start Date

- [ ] Drilling Prognosis
- [ ] Redrilling or Repair
- [ ] Casing or Liner
- [ ] Plug Well
- [ ] Supplemental History
- [ ] Temporarily Abandon
- [x] Other OHL Request
- [ ] Spill Report
- [ ] Shooting
- [ ] Acidizing
- [ ] Fracture Treatment
- [ ] Change Production Method
- [ ] Reclamation

Well Name and Number: Angus 3-10 3TFH

Footages	Qtr-Qtr	Section	Township	Range
320 F N L 1105 F W L	NWNW	3	153 N	99 W

Field	Pool	County
	BAKKEN	WILLIAMS

24-HOUR PRODUCTION RATE

Before		After	
Oil	Bbls	Oil	Bbls
Water	Bbls	Water	Bbls
Gas	MCF	Gas	MCF

Name of Contractor(s)

Address	City	State	Zip Code

DETAILS OF WORK

Zavanna, LLC requests a waiver to Rule 43-02-03-31 regarding open hole logging. Open hole logs have been run on the Brogger 21-4 well operated by LL & E (Sec. 4-153N-R99W, 660' FNL & 1980' FWL, NDIC File #(11455). This well was logged 5-14-85. The Brogger 21-4 is approximately 4400' W of the Angus pad wells, and provides adequate geological control. Zavanna will run a gamma ray log from TD to surface and a cement bond log on the production casing.

Company	Telephone Number
Zavanna, LLC	(303) 595-8004

Address		
1200 17th St., Ste 1100		
City: Denver	State: CO	Zip Code: 80202

Signature	Printed Name
Jean Arnold	Jean Arnold
Title: Sr. Prod. Tech.	Date: September 9, 2013

Email Address: jarnold@zavanna.com

FOR STATE USE ONLY

- [ ] Received
- [x] Approved

Date: 10-8-2013

By

Title: Richard A. Suggs Geologist

26684
TH

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director
Department of Mineral Resources
Lynn D. Helms - Director
North Dakota Industrial Commission
www.dmr.nd.gov/oilgas

JEAN ARNOLD
ZAVANNA, LLC
1200 17TH STREET, SUITE 2000
DENVER, CO 80202 USA

Date: **10/14/2013**

RE: CORES AND SAMPLES

Well Name: **ANGUS 3-10 3TFH** Well File No.: **26684**
Location: **LOT4 3-153-99** County: WILLIAMS
Permit Type: **Development - HORIZONTAL**
Field: **LONG CREEK** Target Horizon: THREE FORKS

Dear JEAN ARNOLD:

North Dakota Century Code (NDCC) Section 38-08-04 provides for the preservation of cores and samples and their shipment to the State Geologist when requested. The following is required on the above referenced well:

1) All cores, core chips and samples must be submitted to the State Geologist as provided for the NDCC Section 38-08-04 and North Dakota Administrative Code 43-02-03-38.1.

2) Samples shall include all cuttings from:

Base of the Last Charles Salt

Samples of cuttings shall be taken at 30' maximum intervals through all vertical, build and horizontal sections. Samples must be washed, dried, packed in sample envelopes in correct order with labels showing operator, well name, location and depth, and forwarded in standard boxes to the State Geologist within 30 days of the completion of drilling operations.

3) Cores: ALL CORES cut shall be preserved in correct order, properly boxed, and forwarded to the State Geologist within 90 days of completion of drilling operations. Any extension of time must have written approval from the State Geologist.

4) All cores, core chips, and samples must be shipped, prepaid, to the State Geologist at the following address:

ND Geological Survey Core Library
Campus Road and Cornell
Grand Forks, ND 58202

5) NDCC Section 38-08-16 allows for a civil penalty for any violation of Chapter 38 08 not to exceed $12,500 for each offense, and each day's violation is a separate offense.

Sincerely

Richard A. Suggs
Geologist

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director

Department of Mineral Resources

Lynn D. Helms - Director

North Dakota Industrial Commission

www.oilgas.nd.gov

October 8, 2013

Jean Arnold
Sr. Prod. Tech.
ZAVANNA, LLC
1200 17th Street, Ste. 1100
Denver, CO 80202

RE: HORIZONTAL WELL
ANGUS 3-10 3TFH
LOT4 Section 3-153N-99W
Williams County
Well File # 26684

Dear Jean:

Pursuant to Commission Order No. 21219, approval to drill the above captioned well is hereby given. The approval is granted on the condition that all portions of the well bore not isolated by cement, be no closer than the 200' setback from the north & south boundaries and 500' setback from the east & west boundaries within the 1280 acre spacing unit consisting of Sections 3 & 10 T153N R99W .

PERMIT STIPULATIONS: ZAVANNA LLC must contact NDIC Field Inspector Jessica Gilkey at 701-770-7340 prior to location construction.

Drilling pit
NDAC 43-02-03-19.4 states that "a pit may be utilized to bury drill cuttings and solids generated during well drilling and completion operations, providing the pit can be constructed, used and reclaimed in a manner that will prevent pollution of the land surface and freshwaters. Reserve and circulation of mud system through earthen pits are prohibited. All pits shall be inspected by an authorized representative of the director prior to lining and use. Drill cuttings and solids must be stabilized in a manner approved by the director prior to placement in a cuttings pit."

Form 1 Changes & Hard Lines
Any changes, shortening of casing point or lengthening at Total Depth must have prior approval by the NDIC. The proposed directional plan is at a legal location. Based on the azimuth of the proposed lateral the maximum legal coordinate from the well head is: 10030' south.

Location Construction Commencement (Three Day Waiting Period)
Operators shall not commence operations on a drill site until the 3rd business day following publication of the approved drilling permit on the NDIC - OGD Daily Activity Report. If circumstances require operations to commence before the 3rd business day following publication on the Daily Activity Report, the waiting period may be waived by the Director. Application for a waiver must be by sworn affidavit providing the information necessary to evaluate the extenuating circumstances, the factors of NDAC 43-02-03-16.2 (1), (a)-(f), and any other information that would allow the Director to conclude that in the event another owner seeks revocation of the drilling permit, the applicant should retain the permit.

Permit Fee & Notification

Payment was received in the amount of $100 via credit card. It is requested that notification be given immediately upon the spudding of the well. This information should be relayed to the Oil & Gas Division, Bismarck, via telephone. The following information must be included: Well name, legal location, permit number, drilling contractor, company representative, date and time of spudding. Office hours are 8:00 a.m. to 12:00 p.m. and 1:00 p.m. to 5:00 p.m. Central Time. Our telephone number is (701) 328-8020, leave a message if after hours or on the weekend.

Survey Requirements for Horizontal, Horizontal Re-entry, and Directional Wells

NDAC Section 43-02-03-25 (Deviation Tests and Directional Surveys) states in part (that) the survey contractor shall file a certified copy of all surveys with the director free of charge within thirty days of completion. Surveys must be submitted as one electronic copy, or in a form approved by the director. However, the director may require the directional survey to be filed immediately after completion if the survey is needed to conduct the operation of the director's office in a timely manner. Certified surveys must be submitted via email in one adobe document, with a certification cover page to certsurvey@nd.gov.
Survey points shall be of such frequency to accurately determine the entire location of the well bore.
Specifically, the Horizontal and Directional well survey frequency is 100 feet in the vertical, 30 feet in the curve (or when sliding) and 90 feet in the lateral.

Confidential status

Your request for confidential status of all information furnished to the Director, or his representatives, is hereby granted. Such information, except production runs, shall remain confidential for six months commencing on the date the well is spud.

Confidential status notwithstanding, the Director and his representatives shall have access to all well records wherever located. Your company personnel, or any person performing work for your company shall permit the Director and his representatives to come upon any lease, property, well, or drilling rig operated or controlled by them, complying with all safety rules, and to inspect the records and operation of such wells and to have access at all times to any and all records of wells. The Commission's field personnel periodically inspect producing and drilling wells. Any information regarding such wells shall be made available to them at any time upon request. The information so obtained by the field personnel shall be maintained in strict confidence and shall be available only to the Commission and its staff.

Surface casing cement

Tail cement utilized on surface casing must have a minimum compressive strength of 500 psi within 12 hours, and tail cement utilized on production casing must have a minimum compressive strength of 500 psi before drilling the plug or initiating tests.

Logs

NDAC Section 43-02-03-31 requires the running of (1) a suite of open hole logs from which formation tops and porosity zones can be determined, (2) a Gamma Ray Log run from total depth to ground level elevation of the well bore, and (3) a log from which the presence and quality of cement can be determined (Standard CBL or Ultrasonic cement evaluation log) in every well in which production or intermediate casing has been set, this log must be run prior to completing the well. All logs run must be submitted free of charge, as one digital TIFF (tagged image file format) copy and one digital LAS (log ASCII) formatted copy. Digital logs may be submitted on a standard CD, DVD, or attached to an email sent to digitallogs@nd.gov Thank you for your cooperation.

Sincerely,

Nathaniel Erbele
Petroleum Resource Specialist

APPLICATION FOR PERMIT TO DRILL HORIZONTAL WELL - FORM 1H

INDUSTRIAL COMMISSION OF NORTH DAKOTA
OIL AND GAS DIVISION
600 EAST BOULEVARD DEPT 405
BISMARCK, ND 58505-0840
SFN 54269 (08-2005)

PLEASE READ INSTRUCTIONS BEFORE FILLING OUT FORM.
PLEASE SUBMIT THE ORIGINAL AND ONE COPY.

Type of Work	Type of Well	Approximate Date Work Will Start	Confidential Status
New Location	**Oil & Gas**	**10 / 1 / 2013**	**Yes**

Operator	Telephone Number
ZAVANNA, LLC	**303-595-8004**

Address	City	State	Zip Code
1200 17th Street, Ste. 1100	**Denver**	**CO**	**80202**

☑ Notice has been provided to the owner of any permanently occupied dwelling within 1,320 feet.

☑ This well is not located within five hundred feet of an occupied dwelling.

WELL INFORMATION **(If more than one lateral proposed, enter data for additional laterals on page 2)**

Well Name	Well Number
ANGUS	**3-10 3TFH**

Surface Footages	Qtr-Qtr	Section	Township	Range	County
320 F **N** L **1105** F **W** L	**LOT4**	**3**	**153 N**	**99 W**	**Williams**
Longstring Casing Point Footages	Qtr-Qtr	Section	Township	Range	County
782 F **N** L **1226** F **W** L	**LOT4**	**3**	**153 N**	**99 W**	**Williams**
Longstring Casing Point Coordinates From Well Head	Azimuth	Longstring Total Depth			
462 S From WH **121 E** From WH	**165 º**	**11575** Feet MD	**11302** Feet TVD		
Bottom Hole Footages From Nearest Section Line	Qtr-Qtr	Section	Township	Range	County
250 F **S** L **1313** F **W** L	**SWSE**	**10**	**153 N**	**99 W**	**Williams**
Bottom Hole Coordinates From Well Head	KOP Lateral 1	Azimuth Lateral 1	Estimated Total Depth Lateral 1		
9980 S From WH **208 E** From WH	**10825** Feet MD	**180 º**	**21101** Feet MD	**11292** Feet TVD	

Latitude of Well Head	Longitude of Well Head	NAD Reference	Description of (Subject to NDIC Approval)
48 ° 06 ' 36.70 "	**-103 ° 24 ' 20.87 "**	**NAD83**	**Spacing Unit: Sections 3 & 10 T153N R99W**

Ground Elevation	Acres in Spacing/Drilling Unit	Spacing/Drilling Unit Setback Requirement	Industrial Commission Order
2356 Feet Above S.L.	**1280**	**200** Feet N/S **500** Feet E/W	**21219**

North Line of Spacing/Drilling Unit	South Line of Spacing/Drilling Unit	East Line of Spacing/Drilling Unit	West Line of Spacing/Drilling Unit
5273 Feet	**5276** Feet	**10549** Feet	**10551** Feet

Objective Horizons	Pierre Shale Top
Three Forks B1	**2211**

Proposed	Size	Weight	Depth	Cement Volume	
Surface Casing	**9 - 5/8 "**	**36** Lb./Ft.	**2311** Feet	**653** Sacks	**NOTE: Surface hole must be drilled with fresh water and surface casing must be cemented back to surface.**

Proposed	Size	Weight(s)	Longstring Total Depth		Cement Volume	Cement Top	Top Dakota Sand
Longstring Casing	**7 - 0 "**	**29/32** Lb./Ft.	**11575** Feet MD	**11302** Feet TVD	**699** Sacks	**4839** Feet	**5772** Feet

Base Last Charles Salt (If Applicable)	
9649 Feet	**NOTE: Intermediate or longstring casing string must be cemented above the top Dakota Group Sand.**

Proposed Logs
GR/CBL FM4 OHL waiver submitted via e-mail with APD attachments

Drilling Mud Type (Vertical Hole - Below Surface Casing)	Drilling Mud Type (Lateral)
Invert	**Brine**

Survey Type in Vertical Portion of Well	Survey Frequency: Build Section	Survey Frequency: Lateral	Survey Contractor
MWD Every 100 Feet	**30** Feet	**90** Feet	**PathFinder**

NOTE: A Gamma Ray log must be run to ground surface and a CBL must be run on intermediate or longstring casing string if set.

Surveys are required at least every 30 feet in the build section and every 90 feet in the lateral section of a horizontal well. Measurement inaccuracies are not considered when determining compliance with the spacing/drilling unit boundary setback requirement except in the following scenarios: 1) When the angle between the well bore and the respective boundary is 10 degrees or less; or 2) If Industry standard methods and equipment are not utilized. Consult the applicable field order for exceptions.

If measurement inaccuracies are required to be considered, a 2° MWD measurement inaccuracy will be applied to the horizontal portion of the well bore. This measurement inaccuracy is applied to the well bore from KOP to TD.

REQUIRED ATTACHMENTS: Certified surveyor's plat, horizontal section plat, estimated geological tops, proposed mud/cementing plan, directional plot/plan, $100 fee.

See Page 2 for Comments section and signature block.

COMMENTS, ADDITIONAL INFORMATION, AND/OR LIST OF ATTACHMENTS

Lateral 2

KOP Lateral 2 Feet MD	Azimuth Lateral 2 °	Estimated Total Depth Lateral 2 Feet MD	Feet TVD	KOP Coordinates From Well Head From WH	From WH
Formation Entry Point Coordinates From Well Head From WH	From WH	Bottom Hole Coordinates From Well Head From WH	From WH		
KOP Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County
Bottom Hole Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County

Lateral 3

KOP Lateral 3 Feet MD	Azimuth Lateral 3 °	Estimated Total Depth Lateral 3 Feet MD	Feet TVD	KOP Coordinates From Well Head From WH	From WH
Formation Entry Point Coordinates From Well Head From WH	From WH	Bottom Hole Coordinates From Well Head From WH	From WH		
KOP Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County
Bottom Hole Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County

Lateral 4

KOP Lateral 4 Feet MD	Azimuth Lateral 4 °	Estimated Total Depth Lateral 4 Feet MD	Feet TVD	KOP Coordinates From Well Head From WH	From WH
Formation Entry Point Coordinates From Well Head From WH	From WH	Bottom Hole Coordinates From Well Head From WH	From WH		
KOP Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County
Bottom Hole Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County

Lateral 5

KOP Lateral 5 Feet MD	Azimuth Lateral 5 °	Estimated Total Depth Lateral 5 Feet MD	Feet TVD	KOP Coordinates From Well Head From WH	From WH
Formation Entry Point Coordinates From Well Head From WH	From WH	Bottom Hole Coordinates From Well Head From WH	From WH		
KOP Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County
Bottom Hole Footages From Nearest Section Line F L	F L	Qtr-Qtr	Section	Township N	Range W	County

I hereby swear or affirm the information provided is true, complete and correct as determined from all available records.	Date 9 / 16 / 2013
ePermit	Printed Name Jean Arnold	Title Sr. Prod. Tech.

FOR STATE USE ONLY

Permit and File Number 26684	API Number 33 - 105 - 03243
Field LONG CREEK	
Pool BAKKEN	Permit Type DEVELOPMENT

FOR STATE USE ONLY

Date Approved 10 / 8 / 2013
By Nathaniel Erbele
Title Petroleum Resource Specialist

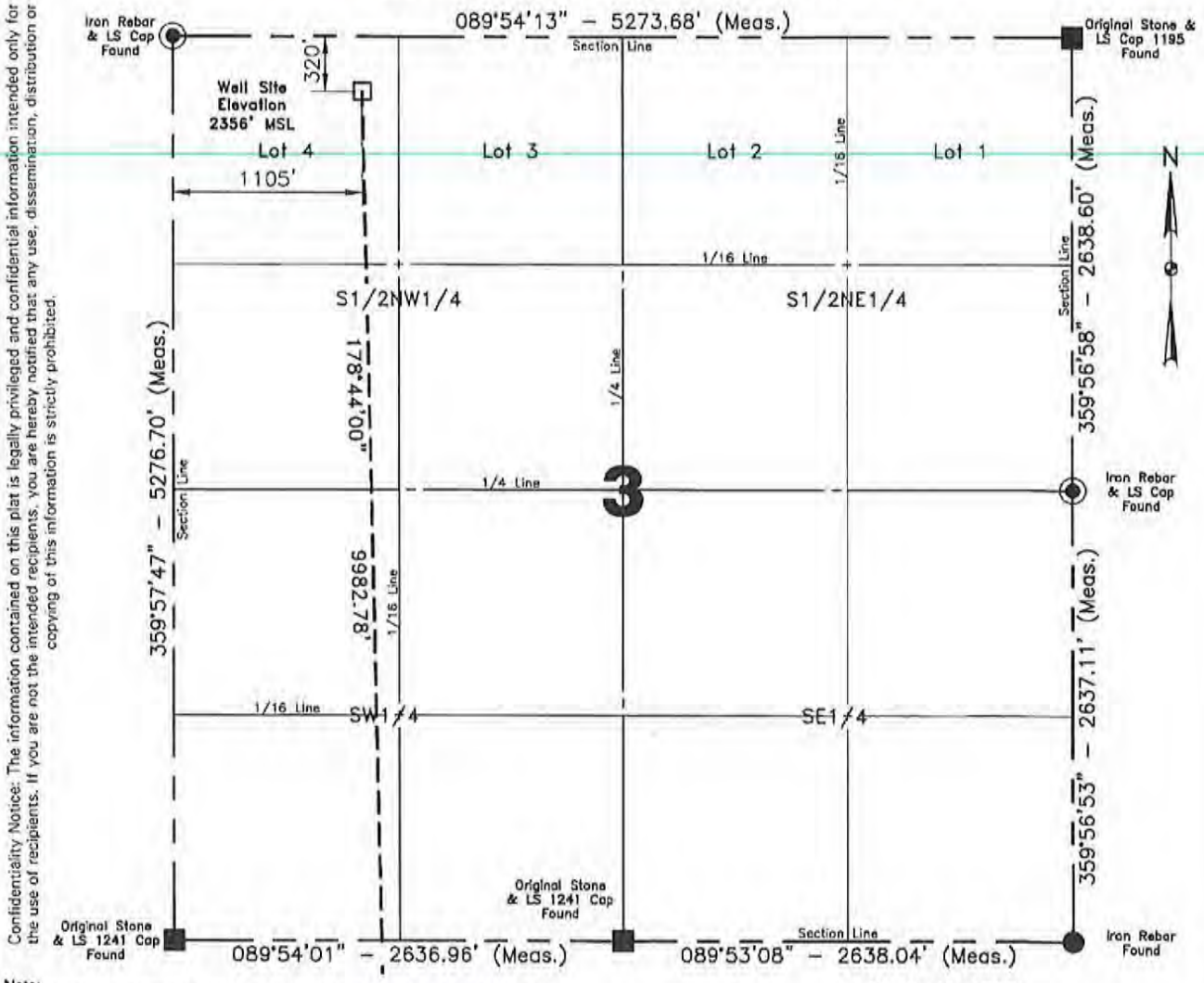
WELL LOCATION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site – Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH all well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°09'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Scale 1"=1000'

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

Andy Staloch — Surveyed By
07/01/2013 — Date

RICK LEACH
REGISTERED
LAND
SURVEYOR
L.S. 3496
NORTH DAKOTA

Vertical Control Datum Used
North American Vertical Datum 1988 (NAVD 88)
Based on elevation derived from OPUS Solution on GPS*NGS Willow (Brass Cap) Located a distance of 7929.06' on an azimuth of 272°05'04" from the NW corner of Section 3 T.153N., R.99W., 5th P.M. being at 2486.62' Elevation MSL.

Project No. 8713245
Book 0-139 Pg. 57-63 Staking

Professional Consulting Engineers and Surveyors
Registered in
North Dakota, South Dakota
Montana, Wyoming & Minnesota
Tele-Fax No. 701-572-2019
Bus. Phone No. 701-572-6352
820 East Broadway, Suite 1
Williston, North Dakota 58801-6126
Certificate of Authorization #C-061

Revised: 08/28/2013

KLJ

Geologic Prognosis for Stockyard Creek Prospect

Location: NW NW Sec 3-153-99

Long Creek Field

Well Name: Angus 3-10 3TFH

Control Well: ZAVANNA Nelson 3-10 1H, NE NE 3-153-99

Spacing Unit: Sections 3 & 10, T153N R99W

	Control Well				Prognosis for Proposed Well							
	Depth	Interval Thickness	Subsea	Prog to Control	Depth	Interval Thickness	Subsea	Drill Top	Subsea	Delta Prog	Delta Control	Notes
KB	**2378**				**2385**							GR = 2356'
Pierre Sh	2204	2727	174	0	2211	2727	174					Pad = 2358
Greenhorn	4931	403	-2553	0	4938	401	**-2553**					Sub = 27'
Mowry	5334	434	-2956	2	5339	432	-2954					**KB = 2385'**
Dakota	5768	270	-3390	3	5772	269	-3387					Surface Casing: 2311'
Lakota	6038	214	-3660	5	6040	213	-3655					
Swift	6252	468	-3874	5	6254	466	-3869					
Rierdon	6720	198	-4342	7	6720	197	-4335					
Piper lime	6918	286	-4540	8	6917	285	-4532					
Dunham	7204	64	-4826	9	7202	64	-4817					No Dunham salt
Saude	7268	267	-4890	10	7265	266	-4880					
Pine salt	7535	85	-5157	11	7531	85	-5146					SALT: 7531-7616
Spearfish	7620	49	-5242	11	7616	49	-5231					
Minnekahta	7669	69	-5291	11	7665	69	-5280					
Opeche salt	7738	48	-5360	12	7733	48	-5348					SALT: 7733-7781
B/ Opeche salt	7786	234	-5408	12	7781	233	-5396					
Minnelusa	8020	200	-5642	13	8014	199	-5629					
Tyler	8220	558	-5842	14	8213	556	-5828					
Kibbey lime	8778	144	-6400	16	8769	143	-6384					
Charles	8922	740	-6544	16	8913	737	-6528					SALT: 8913-9649
Base Last Salt	9662	49	-7284	20	9649	49	-7264					
Ratcliffe	9711	93	-7333	20	9698	93	-7313					
Midale	9804	74	-7426	20	9791	74	-7406					
Mission Canyon	9878	73	-7500	20	9865	73	-7480					
Bluell	9951	521	-7573	21	9937	519	-7552					KOP: 10,825'
Lodgepole	10472	752	-8094	23	10456	749	-8071					Directional Drlg. Plan
Bakken	11224	19	-8846	26	11205	19	**-8820**					
Middle Member *	11243	40	-8865	26	11224	40	-8839					
Lower Shale *	11283	22	-8905	26	11264	22	-8879					
Three Forks *	11305	50	-8927	26	11286	50	-8901					
TD (est)	11355		-8977		11335		-8950					**MDTD 21,101'**

* used Brogger 21-4-1, NE NW 4 153 99 for deep control

Isopachs	Control Well					Prog	Delta Thickness		
Kgh-Mb		6293				6267	0.995868	-26	"thinner" for proposed well

Prognosis: **flat to control well at Bakken**

Surface Location:	**NW NW Sec 3 (320' FNL 1105' FWL)**	
Target:	Three Forks	
Initial Depth for Hz target:	11,302' (-8917') TVD	97' below upper Bakken shale
End of Lateral:	drill updip 10' to 11,292 (-8907') TVD	
Target for EOL:	**SW SE Sec 10 (250' FSL 1320' FWL)**	

NDIC rule 'Heel' and 'Toe' setbacks are 200' from North or South lease line for "Stand Up" spacing unit.

Plan for EOL MDTD with 50' additional setback buffer from closest lease line (250' from lease line).

Prepared 8/30/2013 (JNM)

Zavanna, LLC

Angus 3-10 3TFH Three Forks
Section 3 (NWNW), T153N, R99W
Williams County, North Dakota Haul cuttings to IHD (JMAC)

Casing Program

Type	Hole Size	Casing Size	Weight	Grade	Connection	Depth Top	Depth Bottom
Surface	13 1/2"	9 5/8"	36#	J55	LTC	0	2311
Intermediate	8 3/4"	7"	29#	HCP110	LTC	0	7102
	8 3/4"	7"	32#	HCP110	LTC	7102	11575
Liner	6"	4 1/2"	11.6#	P110	BTC	10725	21101

Cement Program Estimated volumes

Surface Casing
Casing setting depth >= 100' into Pierre Shale
Cement to Surface (35% or greater excess based on water losses)
300 feet of tail cement above the shoe

TOC @ 4839'

Depth	Lead	Tail
	466 sacks	**187** sacks = 653
0-2311	Control Set C + 1% CaCl2 + 1% OGC -60 + 1% SMS + 1/4#/sx Polyflake	0:1:0 G + 2% CaCl2 + 1/4#/sx Polyflake

Intermediate Casing
Top of cement targeted to be 500' above Mowry
Excess over gauge hole +/- 50%
Tail cement 500' above the top of the Charles Salt

Depth	Lead	Tail
	295 sacks	**404** sacks = 699
4839-11575	1:1:6 Poz:Type III:Gel + 10% NaCl + 0.5% CFL-4 +0.5% LTR + 0.4% FMC + 0.4% CDF-4P + 1/4 #/sk Polyflake + 1.5 #/sk PS Flake	Thermal 35 + .8% CFR-2 + .65% CFL-4 + .5% LTR + 25% NaCl (BWOW) + .4% CDF-4P + 1/4 #/sk Polyflake + 1.5 #/sk PS Flake

Mud Program

Interval	Mud Type	MudWeight lbs/gal	Viscosity sec/qt	Fluid Loss cc
0-2311	fresh water	8.4-9	28-32	as needed
2311-11575	invert	9.5-10.5	40-50	15-20
11575- TD	brine	9.5-10	28-32	as needed

Zavanna Proposed Liner/Completion
Angus 3-10 3TFH

Completion Equipment Details:

Wellhead – 10,000 psi rated.

Surface Casing: 9 5/8" 36# J-55 set to a depth below surface aquifers **2,311** ft. (Pb =3520 psi, Pc=2020 psi).

Intermediate Casing: 7" 29# P-110 LT&C casing (Pb: 11,220 psi, Pc :8510 psi) run to just above the salt intervals (surface to **7,102** ft); and 7" 32# P-110 LT&C (Pb: 12,460 psi, Pc: 10,760 psi) from above the salt intervals to the horizontal in the Middle Bakken interval (**7,102** to **11,575** ft).

Uncemented Liner: 4½" 11.6# P-110 BTC (Pb:10,690 psi, Pc=7560 psi) set from above KOP to the end of the lateral (**10,725** to **21,101** ft).

Liner hanger plan to set at approximately 100' above KOP at **10,725'** (in the upper Lodgepole Fm).

A Polished Bore Receptacle is run above the liner hangar.

The completion method is Plug and Perf; with one sliding sleeve in the toe stage.

Plan for **35** swell packers. Plan spacing is **272'** per stage.

Two 10,000 psi frac valves are set on the wellhead; typically both are 7-1/16" bore valves with the upper valve being remotely hydraulically operated.

Stimulation:

Slickwater hydraulic fracture treatments, will be performed through intermediate casing string.

Typical rates are 40 to 70 bpm; with average wellhead treating pressures of 6800 to 7800 psi.

Pressure Rating: The wellhead and intermediate casing string are pressure tested per state testing requirements at 9500 psi. The ending pressure after 30 minutes (provided, per state regulations, that it is no less than 5% below the initial test pressure) is then set at the maximum fracture treating pressure. Pop-off valves are set no more than 100 psi below this pressure; with pump kick-outs staggered over a 300 psi interval below the pop-off setpoint.

Per state requirements a flow line is run from the surface casing valve (connected to the surface-intermediate casing annulus) to a flowback tank. An electronic pressure gauge is mounted on this line and the pressure data continuously displayed and recorded throughout pumping operations.

Zavanna, LLC

Rev 0

PATHFINDER — A Schlumberger Company

WELL	FIELD	STRUCTURE
Angus 3-10 #3TFH	ND, Williams County	3-153N-99W

Magnetic Parameters				Surface Location					Miscellaneous		
Model: BGGM 2013	Dip: 73.040°	Date: September 05, 2013	Lat: N 48 6 36.699	Northing: 418355.62 lFOOT	Grid Conv: -2.162°	Slot: Angus 3-10 #3TFH	TVD Ref: RKB(2385ft above MSL)
	Mag Dec: 8.363°	FS: 56453.2nT	Lon: W 103 24 20.699	Easting: 1258796.87 lFOOT	Scale Fact: 0.99993894	Plan: R0 mdv 5Sept13	Srvy Date: September 05, 2013

NAD83 North Dakota State Plane, Northern Zone, International Foot

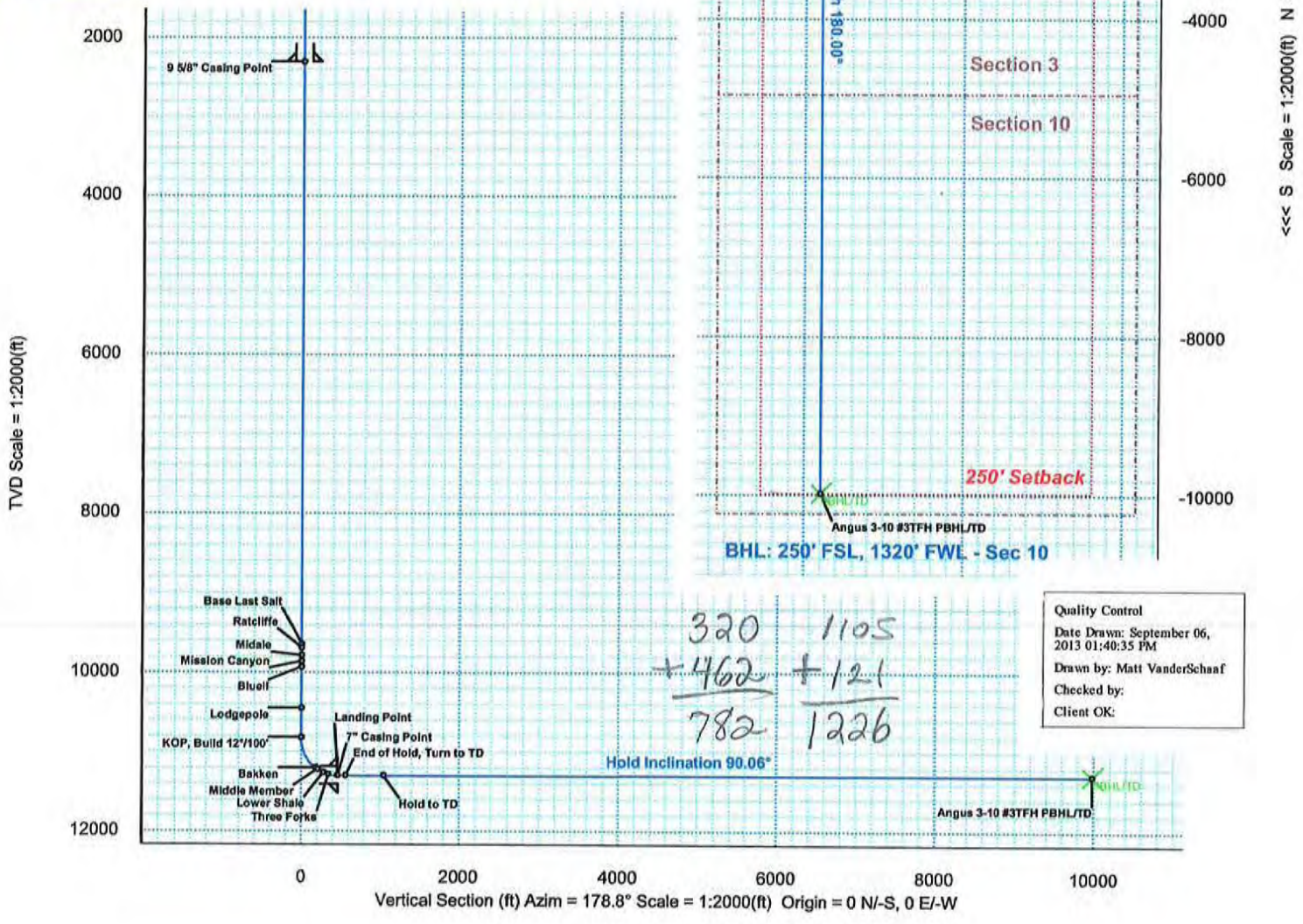
Proposal

Critical Points

Critical Point	MD	INCL	AZIM	TVD	VSEC	N(+)/S(-)	E(+)/W(-)	DLS
Surface	0.00	0.00	165.35	0.00	0.00	0.00	0.00	
9 5/8" Casing Point	2311.00	0.00	165.35	2311.00	0.00	0.00	0.00	0.00
Base Last Salt	9649.00	0.00	165.35	9649.00	0.00	0.00	0.00	0.00
Ratcliffe	9698.00	0.00	165.35	9698.00	0.00	0.00	0.00	0.00
Midale	9791.00	0.00	165.35	9791.00	0.00	0.00	0.00	0.00
Mission Canyon	9865.00	0.00	165.35	9865.00	0.00	0.00	0.00	0.00
Bluell	9937.00	0.00	165.35	9937.00	0.00	0.00	0.00	0.00
Lodgepole	10456.00	0.00	165.35	10456.00	0.00	0.00	0.00	0.00
KOP, Build 12°/100'	10824.54	0.00	165.35	10824.54	0.00	0.00	0.00	0.00
Bakken	11264.78	52.83	165.35	11205.00	183.80	-182.84	47.80	12.00
Middle Member	11297.75	56.79	165.35	11224.00	210.00	-208.90	54.61	12.00
Lower Shale	11382.75	66.99	165.35	11264.00	282.81	-281.34	73.54	12.00
Three Forks	11450.57	75.12	165.35	11286.00	345.14	-343.34	89.75	12.00
Landing Point	11574.54	90.00	165.35	11302.00	464.36	-461.94	120.76	12.00
7" Casing Point	11574.64	90.00	165.35	11302.00	464.46	-462.04	120.78	0.00
End of Hold, Turn to TD	11674.54	90.00	165.35	11302.00	561.62	-558.69	146.05	0.00
Hold to TD	12162.81	90.06	180.00	11301.74	1045.78	-1041.66	208.14	3.00
Angus3-10 #3TFH PBHL/TD	21100.77	90.06	180.00	11292.00	9981.79	-9979.61	208.45	0.00

True North
Tot Corr (M->T 8.3630°)
Mag Dec (8.363°)
Grid Conv (-2.162°)

<<< W Scale = 1:2000(ft) E >>>



320 | 1105
+462 | +121
782 | 1226

Quality Control
Date Drawn: September 06, 2013 01:40:35 PM
Drawn by: Matt VanderSchaaf
Checked by:
Client OK:

ZAVANNA

Angus 3-10 #3TFH R0 mdv 5Sept13 Proposal Geodetic Report

PATHFINDER
A Schlumberger Company

(Def Plan)

Report Date:	September 06, 2013 - 01:39 PM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:	Zavanna, LLC	**Vertical Section Azimuth:**	176.803 ° (True North)
Field:	ND, Williams County (NAD 83 NZ) 2013	**Vertical Section Origin:**	0.000 ft, 0.000 ft
Structure / Slot:	Zavanna, LLC 3-153N-99W (Angus Pad) / Angus 3-10 #3TFH	**TVD Reference Datum:**	RKB
Well:	Angus 3-10 #3TFH	**TVD Reference Elevation:**	2385.000 ft above MSL
Borehole:	Original Hole	**Seabed / Ground Elevation:**	2358.000 ft above MSL
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	8.369 °
Survey Name:	Angus 3-10 #3TFH R0 mdv 5Sept13	**Total Gravity Field Strength:**	1000.0127mgn (9.80665 Based)
Survey Date:	September 05, 2013	**Total Magnetic Field Strength:**	56453.231 nT
Tort / AHD / DDI / ERD Ratio:	104.648 ° / 10003.689 ft / 6.291 / 0.865	**Magnetic Dip Angle:**	73.040 °
Coordinate Reference System:	NAD83 North Dakota State Plane, Northern Zone, International Feet	**Declination Date:**	September 05, 2013
Location Lat / Long:	N 48° 6' 36.69900", W 103° 24' 20.86900"	**Magnetic Declination Model:**	BGGM 2013
Location Grid N/E Y/X:	N 418355.824 IFOOT, E 1258796.868 IFOOT	**North Reference:**	True North
CRS Grid Convergence Angle:	-2.1623 °	**Grid Convergence Used:**	0.0000 °
Grid Scale Factor:	0.99993594	**Total Corr Mag North->True North:**	8.3630 °
		Local Coord Referenced To:	Well Head

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (IFOOT)	Easting (IFOOT)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
Surface	0.00	0.00	165.35	0.00	0.00	0.00	0.00	N/A	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	100.00	0.00	165.35	100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	200.00	0.00	165.35	200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	300.00	0.00	165.35	300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	400.00	0.00	165.35	400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	500.00	0.00	165.35	500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	600.00	0.00	165.35	600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	700.00	0.00	165.35	700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	800.00	0.00	165.35	800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	900.00	0.00	165.35	900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1000.00	0.00	165.35	1000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1100.00	0.00	165.35	1100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1200.00	0.00	165.35	1200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1300.00	0.00	165.35	1300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1400.00	0.00	165.35	1400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1500.00	0.00	165.35	1500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1600.00	0.00	165.35	1600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1700.00	0.00	165.35	1700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1800.00	0.00	165.35	1800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	1900.00	0.00	165.35	1900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2000.00	0.00	165.35	2000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2100.00	0.00	165.35	2100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2200.00	0.00	165.35	2200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2300.00	0.00	165.35	2300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
9 5/8" Casing Point	*2311.00*	*0.00*	*165.35*	*2311.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	2400.00	0.00	165.35	2400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2500.00	0.00	165.35	2500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2600.00	0.00	165.35	2600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2700.00	0.00	165.35	2700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2800.00	0.00	165.35	2800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	2900.00	0.00	165.35	2900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3000.00	0.00	165.35	3000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3100.00	0.00	165.35	3100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3200.00	0.00	165.35	3200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3300.00	0.00	165.35	3300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3400.00	0.00	165.35	3400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3500.00	0.00	165.35	3500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3600.00	0.00	165.35	3600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3700.00	0.00	165.35	3700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3800.00	0.00	165.35	3800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	3900.00	0.00	165.35	3900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4000.00	0.00	165.35	4000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4100.00	0.00	165.35	4100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4200.00	0.00	165.35	4200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4300.00	0.00	165.35	4300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4400.00	0.00	165.35	4400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4500.00	0.00	165.35	4500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4600.00	0.00	165.35	4600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4700.00	0.00	165.35	4700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4800.00	0.00	165.35	4800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	4900.00	0.00	165.35	4900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5000.00	0.00	165.35	5000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5100.00	0.00	165.35	5100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5200.00	0.00	165.35	5200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5300.00	0.00	165.35	5300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5400.00	0.00	165.35	5400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5500.00	0.00	165.35	5500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5600.00	0.00	165.35	5600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5700.00	0.00	165.35	5700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5800.00	0.00	165.35	5800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	5900.00	0.00	165.35	5900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6000.00	0.00	165.35	6000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6100.00	0.00	165.35	6100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6200.00	0.00	165.35	6200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (IFOOT)	Easting (IFOOT)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	6300.00	0.00	165.35	6300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6400.00	0.00	165.35	6400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6500.00	0.00	165.35	6500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6600.00	0.00	165.35	6600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6700.00	0.00	165.35	6700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6800.00	0.00	165.35	6800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	6900.00	0.00	165.35	6900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7000.00	0.00	165.35	7000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7100.00	0.00	165.35	7100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7200.00	0.00	165.35	7200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7300.00	0.00	165.35	7300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7400.00	0.00	165.35	7400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7500.00	0.00	165.35	7500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7600.00	0.00	165.35	7600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7700.00	0.00	165.35	7700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7800.00	0.00	165.35	7800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	7900.00	0.00	165.35	7900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8000.00	0.00	165.35	8000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8100.00	0.00	165.35	8100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8200.00	0.00	165.35	8200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8300.00	0.00	165.35	8300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8400.00	0.00	165.35	8400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8500.00	0.00	165.35	8500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8600.00	0.00	165.35	8600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8700.00	0.00	165.35	8700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8800.00	0.00	165.35	8800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	8900.00	0.00	165.35	8900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9000.00	0.00	165.35	9000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9100.00	0.00	165.35	9100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9200.00	0.00	165.35	9200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9300.00	0.00	165.35	9300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9400.00	0.00	165.35	9400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9500.00	0.00	165.35	9500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	9600.00	0.00	165.35	9600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
Base Last Salt	*9649.00*	*0.00*	*165.35*	*9649.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
Ratcliffe	*9698.00*	*0.00*	*165.35*	*9698.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	9700.00	0.00	165.35	9700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
Midale	*9791.00*	*0.00*	*165.35*	*9791.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	9800.00	0.00	165.35	9800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
Mission Canyon	*9865.00*	*0.00*	*165.35*	*9865.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	9900.00	0.00	165.35	9900.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
Bluell	*9937.00*	*0.00*	*165.35*	*9937.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	10000.00	0.00	165.35	10000.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10100.00	0.00	165.35	10100.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10200.00	0.00	165.35	10200.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10300.00	0.00	165.35	10300.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10400.00	0.00	165.35	10400.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
Lodgepole	*10456.00*	*0.00*	*165.35*	*10456.00*	*0.00*	*0.00*	*0.00*	*0.00*	*418355.62*	*1258796.87*	*N 48 6 36.70*	*W 103 24 20.87*
	10500.00	0.00	165.35	10500.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10600.00	0.00	165.35	10600.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10700.00	0.00	165.35	10700.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10800.00	0.00	165.35	10800.00	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
KOP, Build 12°/100'	10824.54	0.00	165.35	10824.54	0.00	0.00	0.00	0.00	418355.62	1258796.87	N 48 6 36.70	W 103 24 20.87
	10900.00	9.06	165.35	10899.69	5.79	-5.76	1.50	12.00	418349.81	1258798.15	N 48 6 36.64	W 103 24 20.85
	11000.00	21.06	165.35	10996.08	31.00	-30.84	8.06	12.00	418324.50	1258803.76	N 48 6 36.39	W 103 24 20.75
	11100.00	33.06	165.35	11084.97	75.16	-74.77	19.55	12.00	418280.18	1258813.58	N 48 6 35.96	W 103 24 20.58
	11200.00	45.06	165.35	11162.48	136.33	-135.61	35.45	12.00	418218.78	1258827.18	N 48 6 35.36	W 103 24 20.35
Bakken	*11264.78*	*52.83*	*165.35*	*11205.00*	*183.80*	*-182.84*	*47.80*	*12.00*	*418171.13*	*1258837.73*	*N 48 6 34.89*	*W 103 24 20.16*
Middle Member	*11297.75*	*56.79*	*165.35*	*11224.00*	*210.00*	*-208.90*	*54.61*	*12.00*	*418144.82*	*1258843.55*	*N 48 6 34.64*	*W 103 24 20.06*
	11300.00	57.06	165.35	11225.23	211.83	-210.72	55.09	12.00	418142.99	1258843.96	N 48 6 34.62	W 103 24 20.06
Lower Shale	*11382.75*	*66.99*	*165.35*	*11264.00*	*282.81*	*-281.34*	*73.54*	*12.00*	*418071.73*	*1258859.74*	*N 48 6 33.92*	*W 103 24 19.79*
	11400.00	69.06	165.35	11270.46	298.37	-296.81	77.59	12.00	418056.11	1258863.20	N 48 6 33.77	W 103 24 19.73
Three Forks	*11450.57*	*75.12*	*165.35*	*11286.00*	*345.14*	*-343.34*	*89.75*	*12.00*	*418009.16*	*1258873.60*	*N 48 6 33.31*	*W 103 24 19.55*
	11500.00	81.06	165.35	11296.20	392.16	-390.12	101.98	12.00	417961.96	1258884.05	N 48 6 32.85	W 103 24 19.37
Landing Point	11574.54	90.00	165.35	11302.00	464.36	-461.94	120.76	12.00	417889.48	1258900.10	N 48 6 32.14	W 103 24 19.09
7" Casing Point	*11574.64*	*90.00*	*165.35*	*11302.00*	*464.46*	*-462.04*	*120.78*	*0.00*	*417889.39*	*1258900.13*	*N 48 6 32.14*	*W 103 24 19.09*
	11600.00	90.00	165.35	11302.00	489.12	-486.57	127.20	0.00	417864.63	1258905.61	N 48 6 31.90	W 103 24 18.99
End of Hold, Turn to TD	11674.54	90.00	165.35	11302.00	561.62	-558.69	146.05	0.00	417791.86	1258921.73	N 48 6 31.19	W 103 24 18.72
	11700.00	90.00	166.11	11302.00	586.42	-583.37	152.32	3.00	417766.96	1258927.06	N 48 6 30.94	W 103 24 18.62
	11800.00	90.02	169.11	11301.99	684.51	-681.03	173.77	3.00	417668.57	1258944.81	N 48 6 29.98	W 103 24 18.31
	11900.00	90.03	172.11	11301.95	783.48	-779.68	190.08	3.00	417569.38	1258957.38	N 48 6 29.00	W 103 24 18.07
	12000.00	90.04	175.11	11301.89	883.05	-879.04	201.20	3.00	417469.67	1258964.75	N 48 6 28.02	W 103 24 17.90
	12100.00	90.05	178.11	11301.80	982.97	-978.86	207.11	3.00	417369.71	1258966.88	N 48 6 27.04	W 103 24 17.82
Hold to TD	12162.81	90.06	180.00	11301.74	1045.78	-1041.66	208.14	3.00	417306.92	1258965.55	N 48 6 26.42	W 103 24 17.80
	12200.00	90.06	180.00	11301.70	1082.96	-1078.85	208.14	0.00	417269.76	1258964.15	N 48 6 26.05	W 103 24 17.80
	12300.00	90.06	180.00	11301.59	1182.94	-1178.85	208.15	0.00	417169.84	1258960.38	N 48 6 25.07	W 103 24 17.80
	12400.00	90.06	180.00	11301.48	1282.91	-1278.85	208.15	0.00	417069.92	1258956.61	N 48 6 24.08	W 103 24 17.80
	12500.00	90.06	180.00	11301.37	1382.89	-1378.85	208.15	0.00	416969.99	1258952.84	N 48 6 23.09	W 103 24 17.80
	12600.00	90.06	180.00	11301.26	1482.87	-1478.85	208.16	0.00	416870.07	1258949.07	N 48 6 22.11	W 103 24 17.80
	12700.00	90.06	180.00	11301.15	1582.85	-1578.85	208.16	0.00	416770.15	1258945.30	N 48 6 21.12	W 103 24 17.80
	12800.00	90.06	180.00	11301.04	1682.83	-1678.85	208.16	0.00	416670.23	1258941.53	N 48 6 20.13	W 103 24 17.80
	12900.00	90.06	180.00	11300.93	1782.81	-1778.85	208.17	0.00	416570.30	1258937.76	N 48 6 19.14	W 103 24 17.80
	13000.00	90.06	180.00	11300.83	1882.78	-1878.85	208.17	0.00	416470.38	1258933.99	N 48 6 18.16	W 103 24 17.80
	13100.00	90.06	180.00	11300.72	1982.76	-1978.85	208.17	0.00	416370.46	1258930.22	N 48 6 17.17	W 103 24 17.80
	13200.00	90.06	180.00	11300.61	2082.74	-2078.85	208.18	0.00	416270.54	1258926.45	N 48 6 16.18	W 103 24 17.80
	13300.00	90.06	180.00	11300.50	2182.72	-2178.85	208.18	0.00	416170.61	1258922.68	N 48 6 15.20	W 103 24 17.80
	13400.00	90.06	180.00	11300.39	2282.70	-2278.85	208.18	0.00	416070.69	1258918.91	N 48 6 14.21	W 103 24 17.80

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (IFOOT)	Easting (IFOOT)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	13500.00	90.06	180.00	11300.28	2382.68	-2378.85	208.19	0.00	415970.77	1258915.15	N 48 6 13.22	W 103 24 17.80
	13600.00	90.06	180.00	11300.17	2482.65	-2478.85	208.19	0.00	415870.85	1258911.38	N 48 6 12.24	W 103 24 17.80
	13700.00	90.06	180.00	11300.06	2582.63	-2578.85	208.19	0.00	415770.92	1258907.61	N 48 6 11.25	W 103 24 17.80
	13800.00	90.06	180.00	11299.95	2682.61	-2678.85	208.20	0.00	415671.00	1258903.84	N 48 6 10.26	W 103 24 17.80
	13900.00	90.06	180.00	11299.84	2782.59	-2778.85	208.20	0.00	415571.08	1258900.07	N 48 6 9.28	W 103 24 17.80
	14000.00	90.06	180.00	11299.74	2882.57	-2878.85	208.21	0.00	415471.16	1258896.30	N 48 6 8.29	W 103 24 17.80
	14100.00	90.06	180.00	11299.63	2982.54	-2978.85	208.21	0.00	415371.23	1258892.53	N 48 6 7.30	W 103 24 17.80
	14200.00	90.06	180.00	11299.52	3082.52	-3078.85	208.21	0.00	415271.31	1258888.76	N 48 6 6.32	W 103 24 17.80
	14300.00	90.06	180.00	11299.41	3182.50	-3178.85	208.22	0.00	415171.39	1258884.99	N 48 6 5.33	W 103 24 17.80
	14400.00	90.06	180.00	11299.30	3282.48	-3278.85	208.22	0.00	415071.47	1258881.22	N 48 6 4.34	W 103 24 17.80
	14500.00	90.06	180.00	11299.19	3382.46	-3378.85	208.22	0.00	414971.54	1258877.45	N 48 6 3.36	W 103 24 17.80
	14600.00	90.06	180.00	11299.08	3482.44	-3478.85	208.23	0.00	414871.62	1258873.68	N 48 6 2.37	W 103 24 17.80
	14700.00	90.06	180.00	11298.97	3582.41	-3578.85	208.23	0.00	414771.70	1258869.91	N 48 6 1.38	W 103 24 17.80
	14800.00	90.06	180.00	11298.86	3682.39	-3678.85	208.23	0.00	414671.78	1258866.14	N 48 6 0.40	W 103 24 17.80
	14900.00	90.06	180.00	11298.76	3782.37	-3778.85	208.24	0.00	414571.85	1258862.38	N 48 5 59.41	W 103 24 17.80
	15000.00	90.06	180.00	11298.65	3882.35	-3878.85	208.24	0.00	414471.93	1258858.61	N 48 5 58.42	W 103 24 17.80
	15100.00	90.06	180.00	11298.54	3982.33	-3978.85	208.24	0.00	414372.01	1258854.84	N 48 5 57.43	W 103 24 17.80
	15200.00	90.06	180.00	11298.43	4082.30	-4078.85	208.25	0.00	414272.09	1258851.07	N 48 5 56.45	W 103 24 17.80
	15300.00	90.06	180.00	11298.32	4182.28	-4178.85	208.25	0.00	414172.16	1258847.30	N 48 5 55.46	W 103 24 17.80
	15400.00	90.06	180.00	11298.21	4282.26	-4278.85	208.25	0.00	414072.24	1258843.53	N 48 5 54.47	W 103 24 17.80
	15500.00	90.06	180.00	11298.10	4382.24	-4378.84	208.26	0.00	413972.32	1258839.76	N 48 5 53.49	W 103 24 17.80
	15600.00	90.06	180.00	11297.99	4482.22	-4478.84	208.26	0.00	413872.40	1258835.99	N 48 5 52.50	W 103 24 17.80
	15700.00	90.06	180.00	11297.88	4582.20	-4578.84	208.27	0.00	413772.48	1258832.22	N 48 5 51.51	W 103 24 17.80
	15800.00	90.06	180.00	11297.77	4682.17	-4678.84	208.27	0.00	413672.55	1258828.45	N 48 5 50.53	W 103 24 17.80
	15900.00	90.06	180.00	11297.67	4782.15	-4778.84	208.27	0.00	413572.63	1258824.68	N 48 5 49.54	W 103 24 17.80
	16000.00	90.06	180.00	11297.56	4882.13	-4878.84	208.28	0.00	413472.71	1258820.91	N 48 5 48.55	W 103 24 17.80
	16100.00	90.06	180.00	11297.45	4982.11	-4978.84	208.28	0.00	413372.79	1258817.14	N 48 5 47.57	W 103 24 17.80
	16200.00	90.06	180.00	11297.34	5082.09	-5078.84	208.28	0.00	413272.86	1258813.37	N 48 5 46.58	W 103 24 17.80
	16300.00	90.06	180.00	11297.23	5182.06	-5178.84	208.29	0.00	413172.94	1258809.61	N 48 5 45.59	W 103 24 17.80
	16400.00	90.06	180.00	11297.12	5282.04	-5278.84	208.29	0.00	413073.02	1258805.84	N 48 5 44.61	W 103 24 17.80
	16500.00	90.06	180.00	11297.01	5382.02	-5378.84	208.29	0.00	412973.10	1258802.07	N 48 5 43.62	W 103 24 17.80
	16600.00	90.06	180.00	11296.90	5482.00	-5478.84	208.30	0.00	412873.17	1258798.30	N 48 5 42.63	W 103 24 17.80
	16700.00	90.06	180.00	11296.79	5581.98	-5578.84	208.30	0.00	412773.25	1258794.53	N 48 5 41.65	W 103 24 17.80
	16800.00	90.06	180.00	11296.69	5681.96	-5678.84	208.30	0.00	412673.33	1258790.76	N 48 5 40.66	W 103 24 17.80
	16900.00	90.06	180.00	11296.58	5781.93	-5778.84	208.31	0.00	412573.41	1258786.99	N 48 5 39.67	W 103 24 17.80
	17000.00	90.06	180.00	11296.47	5881.91	-5878.84	208.31	0.00	412473.48	1258783.22	N 48 5 38.68	W 103 24 17.80
	17100.00	90.06	180.00	11296.36	5981.89	-5978.84	208.31	0.00	412373.56	1258779.45	N 48 5 37.70	W 103 24 17.80
	17200.00	90.06	180.00	11296.25	6081.87	-6078.84	208.32	0.00	412273.64	1258775.68	N 48 5 36.71	W 103 24 17.80
	17300.00	90.06	180.00	11296.14	6181.85	-6178.84	208.32	0.00	412173.72	1258771.91	N 48 5 35.72	W 103 24 17.80
	17400.00	90.06	180.00	11296.03	6281.83	-6278.84	208.32	0.00	412073.79	1258768.14	N 48 5 34.74	W 103 24 17.80
	17500.00	90.06	180.00	11295.92	6381.80	-6378.84	208.33	0.00	411973.87	1258764.37	N 48 5 33.75	W 103 24 17.80
	17600.00	90.06	180.00	11295.81	6481.78	-6478.84	208.33	0.00	411873.95	1258760.60	N 48 5 32.76	W 103 24 17.80
	17700.00	90.06	180.00	11295.70	6581.76	-6578.84	208.34	0.00	411774.03	1258756.84	N 48 5 31.78	W 103 24 17.80
	17800.00	90.06	180.00	11295.60	6681.74	-6678.84	208.34	0.00	411674.10	1258753.07	N 48 5 30.79	W 103 24 17.80
	17900.00	90.06	180.00	11295.49	6781.72	-6778.84	208.34	0.00	411574.18	1258749.30	N 48 5 29.80	W 103 24 17.80
	18000.00	90.06	180.00	11295.38	6881.69	-6878.84	208.35	0.00	411474.26	1258745.53	N 48 5 28.82	W 103 24 17.80
	18100.00	90.06	180.00	11295.27	6981.67	-6978.84	208.35	0.00	411374.34	1258741.76	N 48 5 27.83	W 103 24 17.80
	18200.00	90.06	180.00	11295.16	7081.65	-7078.84	208.35	0.00	411274.41	1258737.99	N 48 5 26.84	W 103 24 17.80
	18300.00	90.06	180.00	11295.05	7181.63	-7178.84	208.36	0.00	411174.49	1258734.22	N 48 5 25.86	W 103 24 17.80
	18400.00	90.06	180.00	11294.94	7281.61	-7278.84	208.36	0.00	411074.57	1258730.45	N 48 5 24.87	W 103 24 17.80
	18500.00	90.06	180.00	11294.83	7381.59	-7378.84	208.36	0.00	410974.65	1258726.68	N 48 5 23.88	W 103 24 17.80
	18600.00	90.06	180.00	11294.72	7481.56	-7478.84	208.37	0.00	410874.72	1258722.91	N 48 5 22.90	W 103 24 17.80
	18700.00	90.06	180.00	11294.62	7581.54	-7578.84	208.37	0.00	410774.80	1258719.14	N 48 5 21.91	W 103 24 17.80
	18800.00	90.06	180.00	11294.51	7681.52	-7678.84	208.37	0.00	410674.88	1258715.37	N 48 5 20.92	W 103 24 17.80
	18900.00	90.06	180.00	11294.40	7781.50	-7778.84	208.38	0.00	410574.96	1258711.60	N 48 5 19.93	W 103 24 17.80
	19000.00	90.06	180.00	11294.29	7881.48	-7878.84	208.38	0.00	410475.03	1258707.83	N 48 5 18.95	W 103 24 17.80
	19100.00	90.06	180.00	11294.18	7981.45	-7978.84	208.38	0.00	410375.11	1258704.07	N 48 5 17.96	W 103 24 17.80
	19200.00	90.06	180.00	11294.07	8081.43	-8078.84	208.39	0.00	410275.19	1258700.30	N 48 5 16.97	W 103 24 17.80
	19300.00	90.06	180.00	11293.96	8181.41	-8178.84	208.39	0.00	410175.27	1258696.53	N 48 5 15.99	W 103 24 17.80
	19400.00	90.06	180.00	11293.85	8281.39	-8278.84	208.39	0.00	410075.34	1258692.76	N 48 5 15.00	W 103 24 17.80
	19500.00	90.06	180.00	11293.74	8381.37	-8378.84	208.40	0.00	409975.42	1258688.99	N 48 5 14.01	W 103 24 17.80
	19600.00	90.06	180.00	11293.64	8481.35	-8478.84	208.40	0.00	409875.50	1258685.22	N 48 5 13.03	W 103 24 17.80
	19700.00	90.06	180.00	11293.53	8581.32	-8578.84	208.41	0.00	409775.58	1258681.45	N 48 5 12.04	W 103 24 17.80
	19800.00	90.06	180.00	11293.42	8681.30	-8678.84	208.41	0.00	409675.65	1258677.68	N 48 5 11.05	W 103 24 17.80
	19900.00	90.06	180.00	11293.31	8781.28	-8778.84	208.41	0.00	409575.73	1258673.91	N 48 5 10.07	W 103 24 17.80
	20000.00	90.06	180.00	11293.20	8881.26	-8878.84	208.42	0.00	409475.81	1258670.14	N 48 5 9.08	W 103 24 17.80
	20100.00	90.06	180.00	11293.09	8981.24	-8978.84	208.42	0.00	409375.89	1258666.37	N 48 5 8.09	W 103 24 17.80
	20200.00	90.06	180.00	11292.98	9081.21	-9078.84	208.42	0.00	409275.96	1258662.60	N 48 5 7.11	W 103 24 17.80
	20300.00	90.06	180.00	11292.87	9181.19	-9178.84	208.43	0.00	409176.04	1258658.83	N 48 5 6.12	W 103 24 17.80
	20400.00	90.06	180.00	11292.76	9281.17	-9278.84	208.43	0.00	409076.12	1258655.06	N 48 5 5.13	W 103 24 17.80
	20500.00	90.06	180.00	11292.65	9381.15	-9378.84	208.43	0.00	408976.20	1258651.30	N 48 5 4.15	W 103 24 17.80
	20600.00	90.06	180.00	11292.55	9481.13	-9478.84	208.44	0.00	408876.27	1258647.53	N 48 5 3.16	W 103 24 17.80
	20700.00	90.06	180.00	11292.44	9581.11	-9578.84	208.44	0.00	408776.35	1258643.76	N 48 5 2.17	W 103 24 17.80
	20800.00	90.06	180.00	11292.33	9681.08	-9678.84	208.44	0.00	408676.43	1258639.99	N 48 5 1.19	W 103 24 17.80
	20900.00	90.06	180.00	11292.22	9781.06	-9778.84	208.45	0.00	408576.51	1258636.22	N 48 5 0.20	W 103 24 17.80
	21000.00	90.06	180.00	11292.11	9881.04	-9878.84	208.45	0.00	408476.58	1258632.45	N 48 4 59.21	W 103 24 17.80
	21100.00	90.06	180.00	11292.00	9981.02	-9978.84	208.45	0.00	408376.66	1258628.68	N 48 4 58.22	W 103 24 17.80
Angus 3-10 #3TFH PBHL/TD	21100.77	90.06	180.00	11292.00	9981.79	-9979.61	208.45	0.00	408375.89	1258628.65	N 48 4 58.22	W 103 24 17.80

Survey Type: Def Plan

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey

Comments	MD (ft)	Incl (°)	Azim True (°)	TVD (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (°/100ft)	Northing (IFOOT)	Easting (IFOOT)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
		0.000	27.000		1/100.000	30.000	30.000	SLB_CNSG+DPIPE-Depth Only		Original Hole / Angus 3-10 #3TFH R0 mdv 5Sept13		
		27.000	2311.000		1/100.000	30.000	30.000	SLB_CNSG+DPIPE		Original Hole / Angus 3-10 #3TFH R0 mdv 5Sept13		
		2311.000	21100.770		1/100.000	30.000	30.000	SLB_MWD-STD		Original Hole / Angus 3-10 #3TFH R0 mdv 5Sept13		

PATHFINDER
A Schlumberger Company

ZAVANNA

Angus 3-10 #3TFH R0 mdv 5Sept13 Anti-Collision Summary Report

Analysis Date-24hr Time:	September 05, 2013 - 15:18	**Analysis Method:**	3D Least Distance
Client:	Zavanna, LLC	**Reference Trajectory:**	Angus 3-10 #3TFH R0 mdv 5Sept13 (Def Plan)
Field:	ND, Williams County (NAD 83 NZ) 2013	**Depth Interval:**	Every 10.00 Measured Depth (ft)
Structure:	Zavanna, LLC 3-153N-99W (Angus Pad)	**Rule Set:**	D&M AntiCollision Standard S002 v5 1/5 2
Slot:	Angus 3-10 #3TFH	**Min Pts:**	All local minima indicated
Well:	Angus 3-10 #3TFH		
Borehole:	Original Hole		

Offset Trajectories Summary

Offset Selection Criteria
Wellhead distance scan: Not performed!
Selection filters: Definitive Surveys - Definitive Plans - Definitive surveys exclude definitive plans
- All Non-Def Surveys when no Def-Survey is set in a borehole - All Non-Def Plans when no Def-Plan is set in a borehole

Offset Trajectory	Separation			Allow	Sep.	Controlling	Reference Trajectory		Risk Level			Alert	Status
	Ct-Ct (ft)	MAS (ft)	EOU (ft)	Dev. (ft)	Fact.	Rule	MD (ft)	TVD (ft)	Alert	Minor	Major		
Angus 3-10 #5H R0 mdv 5Sept13 (Def Plan)													Warning Alert
	30.00	24.50	27.50	5.50	N/A	MAS = 7.47 (m)	0.00	0.00	CtCt<=15m<15.00			Enter Alert	
	30.00	29.78	9.31	0.22	1.51	OSF 1.50	2310.00	2310.00				MinPt-CtCt	
	30.00	29.82	9.29	0.18	1.51	OSF 1.50	2320.00	2320.00				MinPts	
	98.11	31.31	76.40	66.80	4.98	OSF 1.50	3270.00	3270.00	OSF>5.00			Exit Alert	
	564.10	171.34	449.04	392.76	4.99	OSF 1.50	13060.00	11299.76	OSF<5.00			Enter Alert	
	563.85	541.90	201.75	21.95	1.56	OSF 1.50	21100.00	11292.00				MinPt-CtCt	
	563.85	541.95	201.72	21.90	1.56	OSF 1.50	21100.77	11292.00				MinPts	
Angus 34-27 #2H R0 mdv 5Sept13 (Def Plan)													Warning Alert
	30.00	24.50	27.50	5.50	N/A	MAS = 7.47 (m)	0.00	0.00	CtCt<=15m<15.00			Enter Alert	
	30.00	29.78	9.31	0.22	1.51	OSF 1.50	2310.00	2310.00				MinPt-CtCt	
	30.00	29.82	9.29	0.18	1.51	OSF 1.50	2320.00	2320.00				MinPts	
	97.64	31.15	76.04	66.49	4.98	OSF 1.50	3210.00	3210.00	OSF>5.00			Exit Alert	
	520.04	78.46	466.90	441.58	10.22	OSF 1.50	10770.00	10770.00				MINPT-O-EOU	
	520.10	78.53	466.92	441.57	10.21	OSF 1.50	10780.00	10780.00				MinPt-O-ADP	
	520.91	78.84	467.52	442.07	10.19	OSF 1.50	10824.54	10824.54				MinPt-O-SF	
	10148.05	84.63	10090.79	10063.42	185.29	OSF 1.50	21100.77	11292.00				TD	
Angus 3-10 #1H R0 mdv 5Sept13 (Def Plan)													Warning Alert
	59.99	32.81	57.49	27.18	N/A	MAS = 10.00 (m)	0.00	0.00				Surface	
	59.99	32.81	45.94	27.18	4.98	MAS = 10.00 (m)	1490.00	1490.00	OSF<5.00			Enter Alert	
	59.99	32.81	39.31	27.18	3.18	MAS = 10.00 (m)	2310.00	2310.00				MinPts	
	60.00	32.81	39.28	27.19	3.16	MAS = 10.00 (m)	2320.00	2320.00				MINPT-O-EOU	
	60.09	32.81	39.33	27.28	3.15	MAS = 10.00 (m)	2340.00	2340.00				MinPt-O-SF	
	95.42	32.81	74.30	62.61	4.99	MAS = 10.00 (m)	2890.00	2890.00	OSF>5.00			Exit Alert	
	432.92	74.00	382.75	358.91	9.03	OSF 1.50	10770.00	10770.00				MinPts	
	433.43	74.18	383.14	359.24	9.02	OSF 1.50	10810.00	10810.00				MinPt-O-SF	
	722.97	218.68	576.35	504.29	5.00	OSF 1.50	15220.00	11298.41	OSF<5.00			Enter Alert	
	722.97	532.13	367.38	190.83	2.04	OSF 1.50	21100.77	11292.00				MinPts	
Angus 34-27 #4TFH R0 mdv 5Sept13 (Def Plan)													Warning Alert
	59.99	32.81	57.49	27.18	N/A	MAS = 10.00 (m)	0.00	0.00				Surface	
	59.99	32.81	45.94	27.18	4.98	MAS = 10.00 (m)	1490.00	1490.00	OSF<5.00			Enter Alert	
	59.99	32.81	39.31	27.18	3.18	MAS = 10.00 (m)	2310.00	2310.00				MinPts	
	60.00	32.81	39.28	27.19	3.16	MAS = 10.00 (m)	2320.00	2320.00				MINPT-O-EOU	
	60.09	32.81	39.33	27.28	3.15	MAS = 10.00 (m)	2340.00	2340.00				MinPt-O-SF	
	94.74	32.81	73.65	61.94	4.98	MAS = 10.00 (m)	2870.00	2870.00	OSF>5.00			Exit Alert	
	10264.27	98.02	10168.09	10156.25	160.99	OSF 1.50	21100.77	11292.00				TD	
Angus 3-10 #7H R0 mdv 5Sept13 (Def Plan)													Warning Alert
	89.99	32.81	87.49	57.18	N/A	MAS = 10.00 (m)	0.00	0.00				Surface	
	89.99	32.81	69.95	57.18	4.99	MAS = 10.00 (m)	2230.00	2230.00	OSF<5.00			Enter Alert	
	89.99	32.81	69.30	57.18	4.81	MAS = 10.00 (m)	2310.00	2310.00				MinPts	
	90.00	32.81	69.28	57.19	4.80	MAS = 10.00 (m)	2320.00	2320.00				MINPT-O-EOU	
	90.17	32.81	69.39	57.36	4.80	MAS = 10.00 (m)	2350.00	2350.00				MinPt-O-SF	
	93.95	32.81	73.07	61.14	4.98	MAS = 10.00 (m)	2490.00	2490.00	OSF>5.00			Exit Alert	
	1483.65	91.15	1422.25	1392.71	25.07	OSF 1.50	11040.00	11032.76				MinPt-O-SF	
	1321.58	398.58	1055.03	923.00	5.00	OSF 1.50	18420.00	11294.92	OSF<5.00			Enter Alert	
	1321.50	542.35	959.10	779.15	3.66	OSF 1.50	21100.00	11292.00				MinPt-CtCt	
	1321.50	542.39	959.07	779.11	3.66	OSF 1.50	21100.77	11292.00				MinPts	

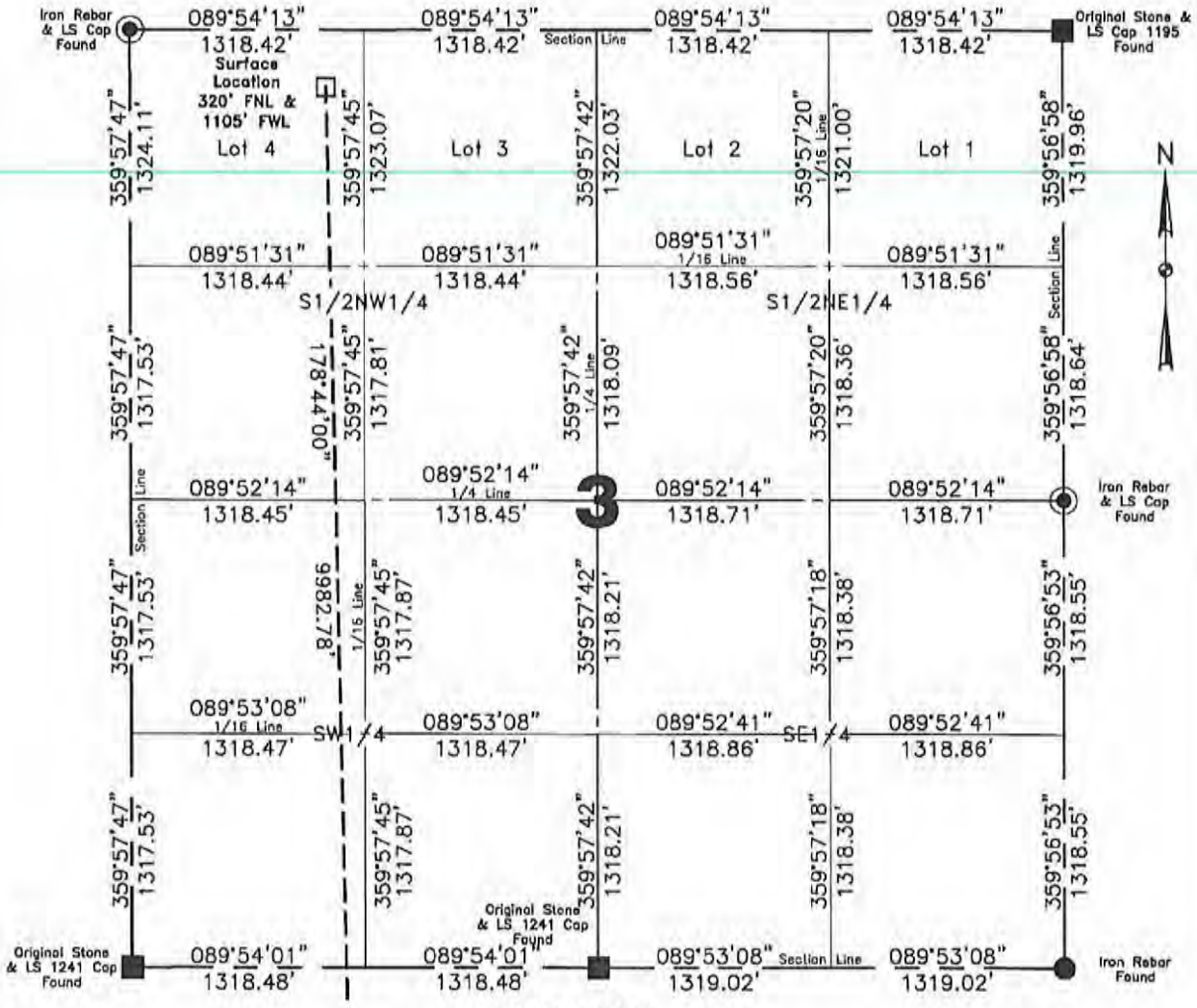
HORIZONTAL SECTION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site – Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



Scale 1"=1000'

Confidentiality Notice
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED LAND SURVEYOR
L.S. 3496
8/29/13
NORTH DAKOTA

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°09'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Surveyed By	Field Book
A. Staloch	O-139
Computed & Drawn By	Project No.
A. Nielsen	8713245

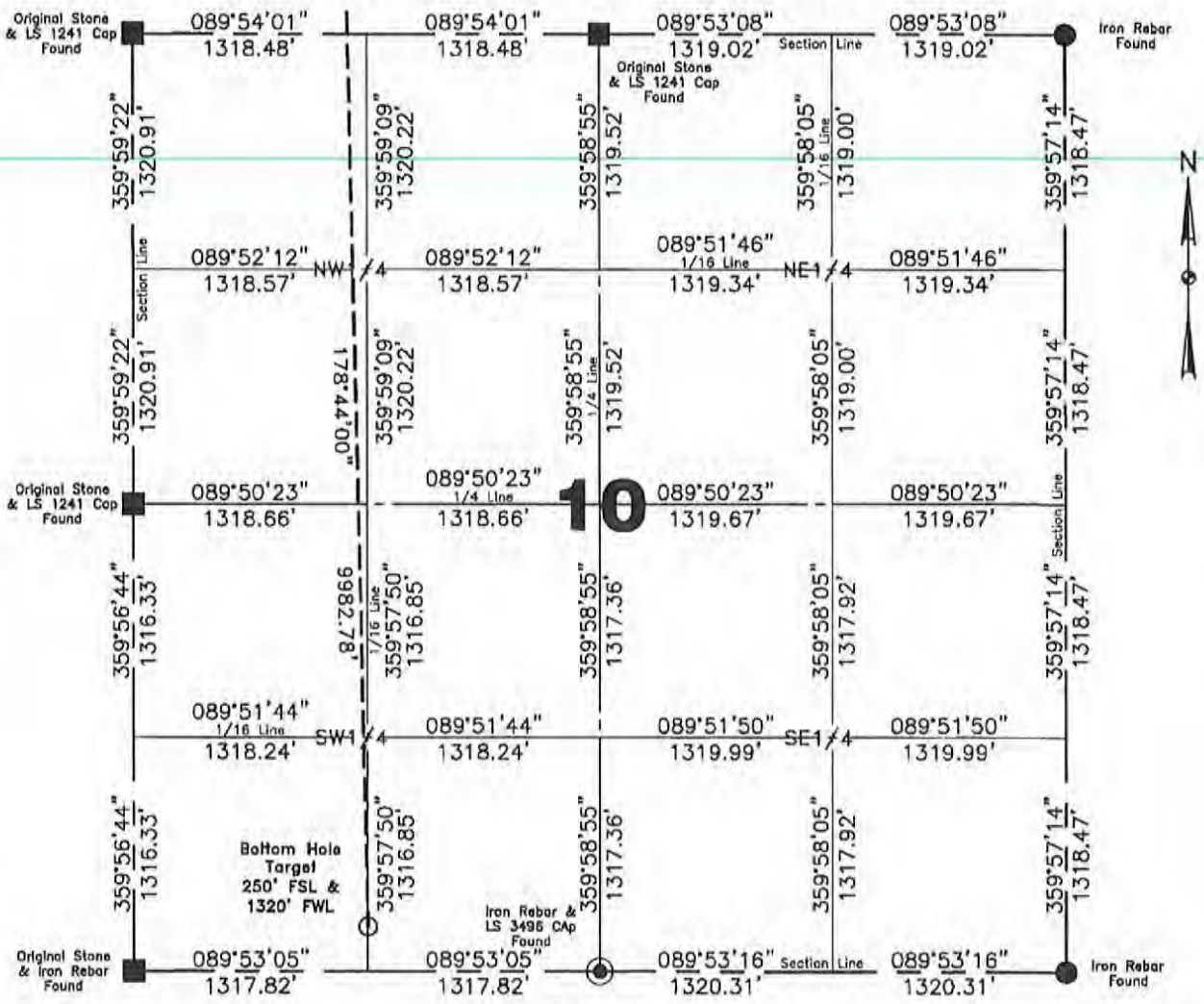
Revised:08/28/2013

KLJ

Aug 28, 2013 - 8:23 PM - J:\oilfield\Zavanna\8713245\CADD\8713245BAS01.dwg

HORIZONTAL SECTION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202
Angus 3-10 #3TFH
320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site – Robert J. Lynch
Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD–83(2011)]



Scale 1"=1000'

Confidentiality Notice:
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED
LAND
SURVEYOR
L.S. 3496
NORTH DAKOTA

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #3TFH oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°09'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Surveyed By	Field Book
A. Staloch	0–139
Computed & Drawn By	Project No.
A. Nielsen	8713245

Revised:08/28/2013

KLJ

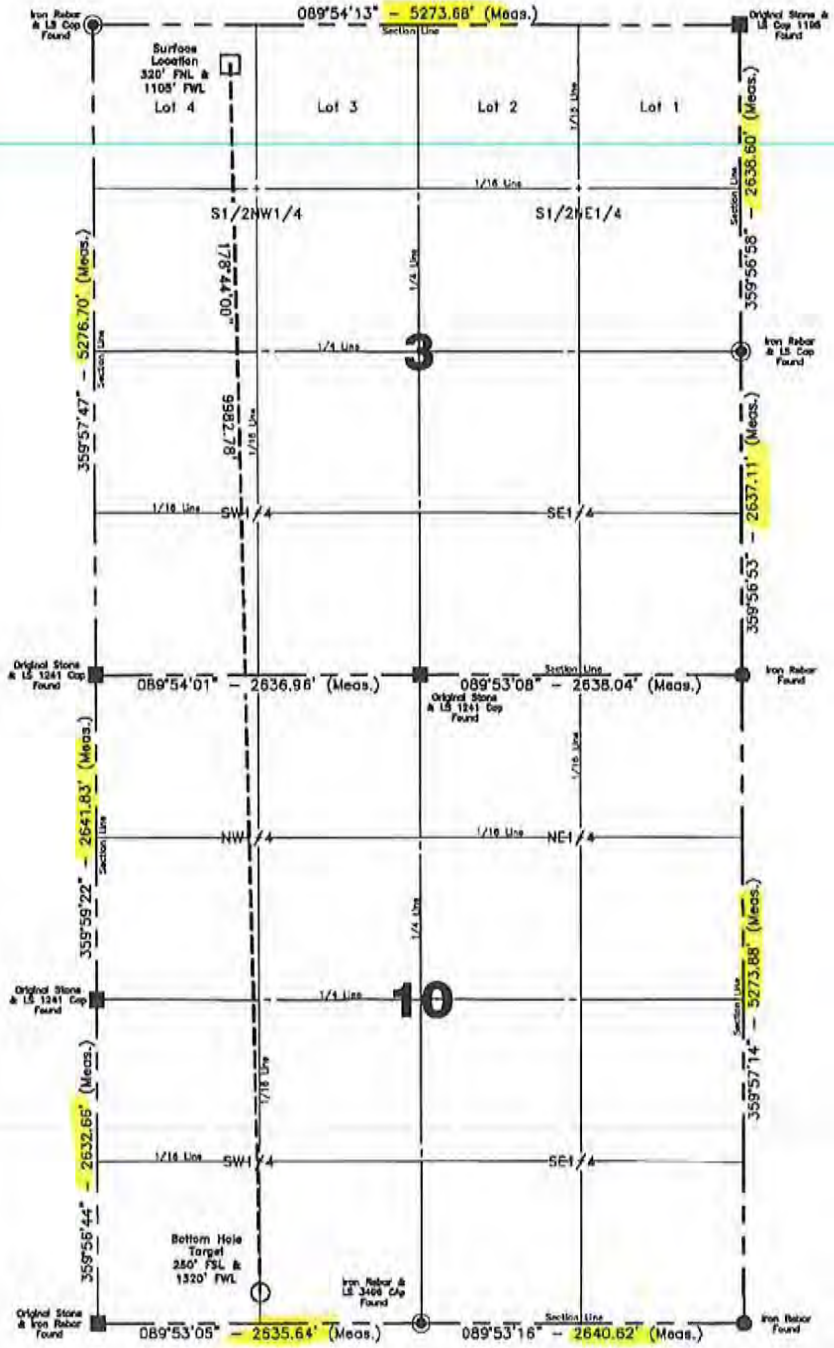
BOTTOM HOLE LOCATION PLAT

Zavanna, LLC
1200 17th Street, Ste 1100 Denver, CO 80202

Angus 3-10 #3TFH

320 feet from the north line and 1105 feet from the west line (surface location)
Section 3, T. 153 N., R. 99 W., 5th P.M.
250 feet from the south line and 1320 feet from the west line (bottom hole location)
Section 10, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota
Surface owner @ well site – Robert J. Lynch

Latitude 48°06'36.699" North; Longitude 103°24'20.869" West (surface location)
Latitude 48°04'58.217" North; Longitude 103°24'17.799" West (bottom hole location)
[Derived from OPUS Solution NAD-83(2011)]



I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED LAND SURVEYOR
L.S. 3496
8/29/13
NORTH DAKOTA

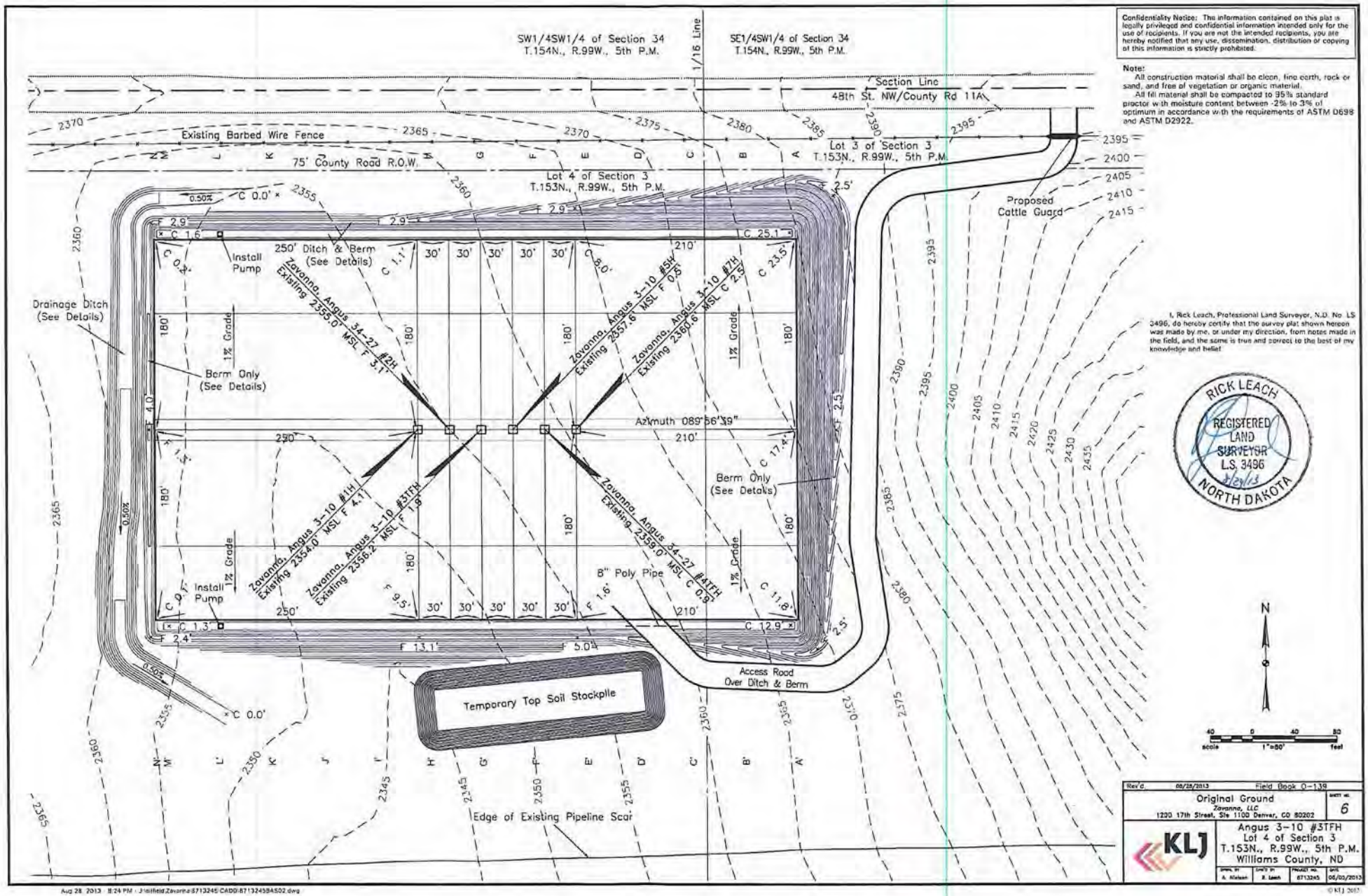
Confidentiality Notice:
The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

Note:
All corners shown on this plat were found in the field during Zavanna, LLC, Angus 3-10 #1H oil well survey on July 1, 2013. Distances to all others are calculated. The azimuths shown on this plat are grid, based upon Geodetic North derived from GPS measurements at the center of the project origin located at Triangulation Station MED HILL, T. 153 N., R. 99 W., 5th P.M. Latitude 48°09'14.721" North; Longitude 103°29'59.850" West. Azimuths represent the calculated value from the central meridian using the forward bearing. The well location shown hereon is not an as-built location.

Computed & Drawn By	Surveyed By	Approved By	Scale	Date
A. Nielsen	A. Staloch	R. Leach	1"=1500'	08/05/2013
Field Book	**Material**	**Revised**	**Project No.**	**Drawing No.**
O-139	B.H. Layout	08/28/2013	8713245	4

KLJ

Aug 28, 2013 - 8:23 PM - J:\oilfield\Zavanna\8713245\CADD\8713245BAS01.dwg



Confidentiality Notice: The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

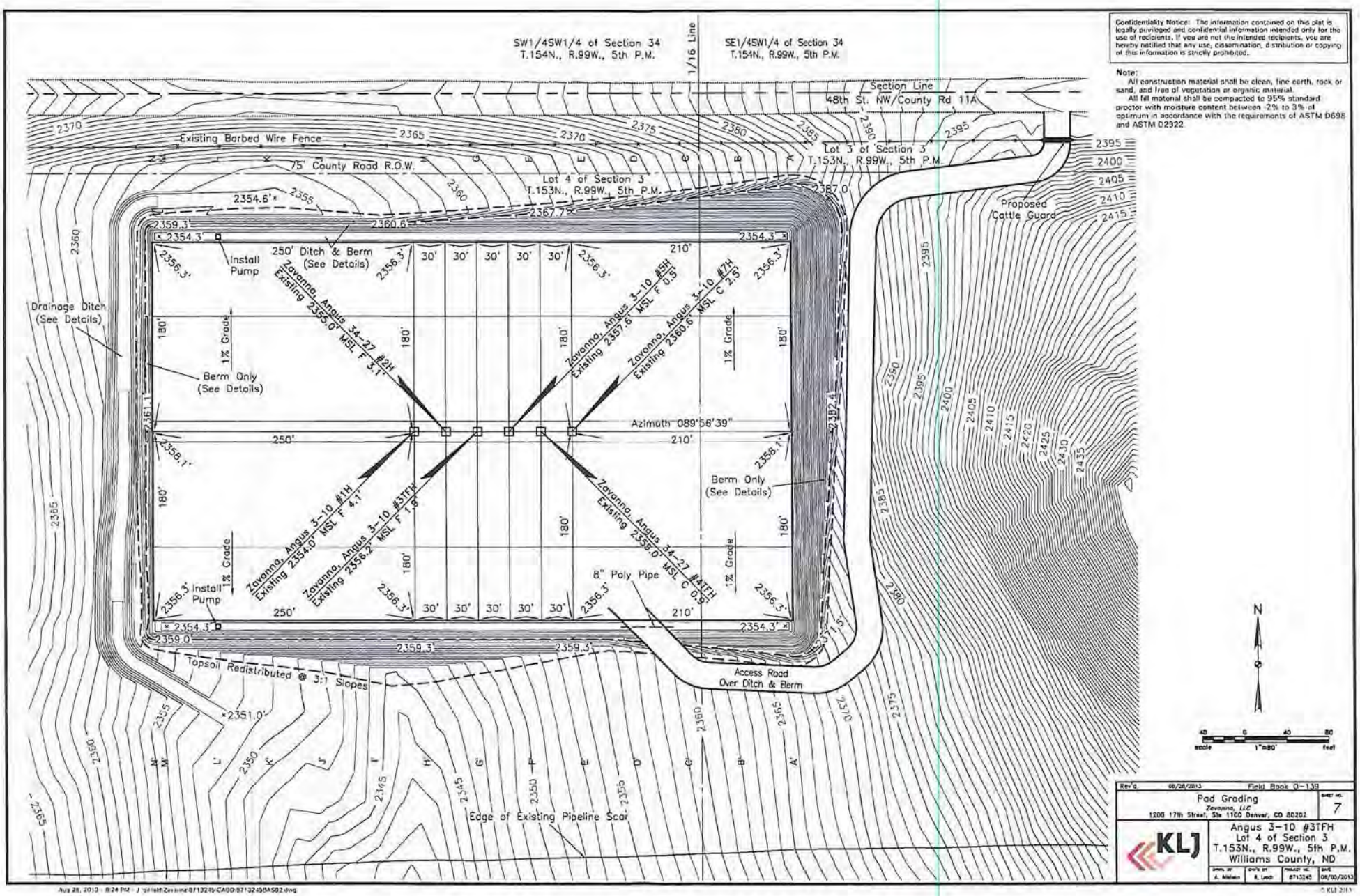
Note:
All construction material shall be clean, fine earth, rock or sand, and free of vegetation or organic material.
All fill material shall be compacted to 95% standard proctor with moisture content between -2% to 3% of optimum in accordance with the requirements of ASTM D698 and ASTM D2922.

I, Rick Leach, Professional Land Surveyor, N.D. No. LS 3496, do hereby certify that the survey plat shown hereon was made by me, or under my direction, from notes made in the field, and the same is true and correct to the best of my knowledge and belief.

RICK LEACH
REGISTERED
LAND
SURVEYOR
L.S. 3496
8/29/13
NORTH DAKOTA

Rev'd. 08/28/2013	Field Book O-139	
Original Ground Zavanna, LLC 1200 17th Street, Ste 1100 Denver, CO 80202		Sheet no. 6
KLJ	Angus 3-10 #3TFH Lot 4 of Section 3 T.153N., R.99W., 5th P.M. Williams County, ND	
Drawn by: A. Nielsen	Chk'd by: R. Leach	Project no. 8713245
Date: 08/02/2013		

Aug 28, 2013 - 8:24 PM - J:\fieldfeld\Zavanna\8713245\CADD\8713245BAS02.dwg



Confidentiality Notice: The information contained on this plat is legally privileged and confidential information intended only for the use of recipients. If you are not the intended recipients, you are hereby notified that any use, dissemination, distribution or copying of this information is strictly prohibited.

Note:
All construction material shall be clean, fine earth, rock or sand, and free of vegetation or organic material.
All fill material shall be compacted to 95% standard proctor with moisture content between -2% to 3% of optimum in accordance with the requirements of ASTM D698 and ASTM D2922.

Rev'd. 08/28/2013 Field Book Q-139

Pad Grading
Zavanna, LLC
1200 17th Street, Ste 1700 Denver, CO 80202

Sheet No. 7

KLJ

Angus 3-10 #3TFH
Lot 4 of Section 3
T.153N., R.99W., 5th P.M.
Williams County, ND

Drawn By: A. Nielsen | Check By: R. Lesh | Project No.: 871-3245 | Date: 08/20/2013

Aug 28, 2013 - 8:24 PM - J:\projfiles\Zavanna\871-3245\CADD\871-3245BAS02.dwg

Zavanna, LLC

Angus 3-10 #1H, Angus 34-27 #2H, Angus 3-10 #3TFH, Angus 3-10 #5H, Angus 34-27 #4TFH & Angus 3-10 #7H

Section 3, T. 153 N., R. 99 W., 5th P.M.
Williams County, North Dakota

Angus 3-10 #1H	2354.0' MSL
Angus 34-27 #2H	2355.0' MSL
Angus 3-10 #3TFH	2356.2' MSL
Angus 3-10 #5H	2357.6' MSL
Angus 34-27 #4TFH	2359.0' MSL
Angus 3-10 #7H	2360.6' MSL
Well Pad Elevation @ Crown	2358.1' MSL

Excavation	38,050 C.Y.
Plus Pit	0 C.Y.
	38,050 C.Y.
Embankment Plus	24,440 C.Y.
Shrinkage (+30%)	7,330 C.Y.
	31,770 C.Y.
Stockpile Pit	0 C.Y.
Stockpile Top Soil (6")	5,630 C.Y.
Production Rehabilitation	0 C.Y.
Road Embankment & Stockpile from Pad	640 C.Y.

Disturbed Area From Pad	6.98 Acres
Disturbed Area From Top Soil Redistribution & Temporary Stockpiles	1.97 Acres
Total Disturbed Area	8.95 Acres

Note:

All cut end slopes are designed at 1 1/2:1 slopes
& all fill end slopes are designed at 1 1/2:1 slopes

Angus 3-10 #1H	Angus 34-27 #2H	Angus 3-10 #3TFH	Angus 3-10 #5H	Angus 34-27 #4TFH	Angus 3-10 #7H
320' FNL 1045' FWL	320' FNL 1075' FWL	320' FNL 1105' FWL	320' FNL 1135' FWL	320' FNL 1165' FWL	320' FNL 1195' FWL

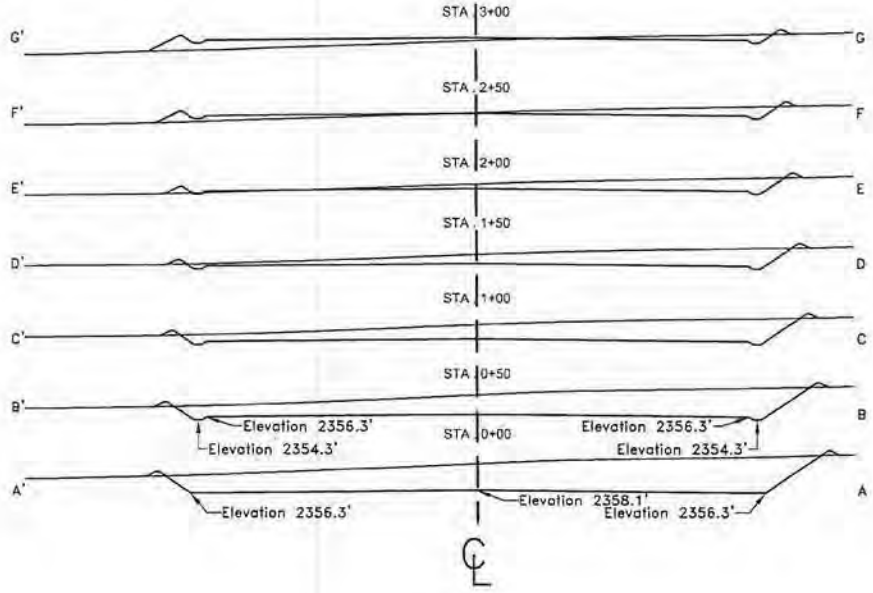
Note:
All construction material shall be clean, fine earth, rock or sand, and free of vegetation or organic material.
All fill material shall be compacted to 95% standard proctor with moisture content between -2% to 3% of optimum in accordance with the requirements of ASTM D698 and ASTM D2922.

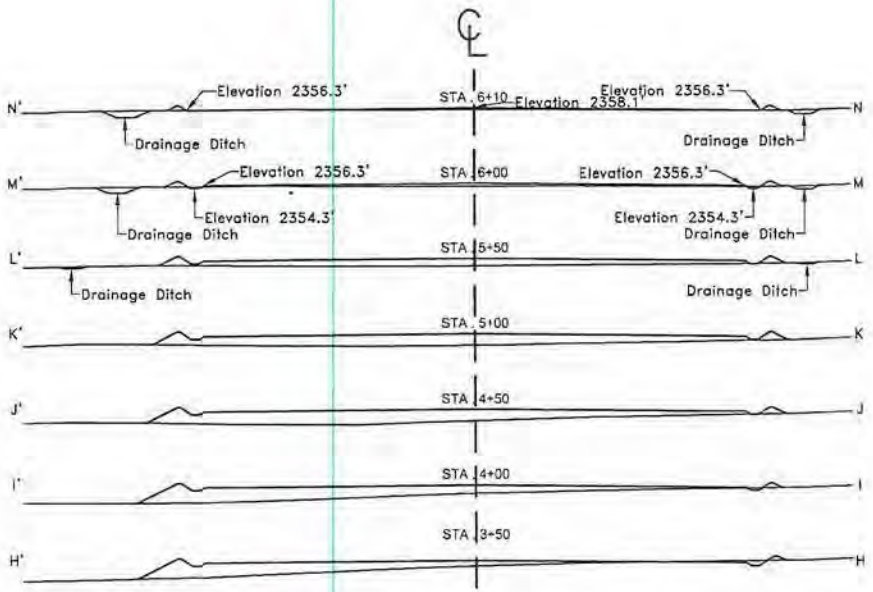
Rev'd.	08/28/2013	Field Book 0-139	
Quantities Zavanna, LLC 1300 17th Street, Ste 1100 Denver, CO 80202			SHEET NO. 5
KLJ	Angus 3-10 #3TFH Lot 4 of Section 3 T.153N., R.99W., 5th P.M. Williams County, ND		
DRWN BY A. Nielsen	CHK'D BY S. Lewis	PROJECT NO. 8713245	DATE 08/05/2013

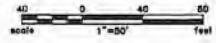
Aug 28, 2013 - 8:23 PM - J:\Wilfield Zavanna\8713245 CADD\8713245BAS02.dwg

Angus 3-10 #1H, Angus 34-27 #2H, Angus 3-10 #3TFH, Angus 3-10 #5H, Angus 34-27 #4TFH & Angus 3-10 #7H

Cross Sections



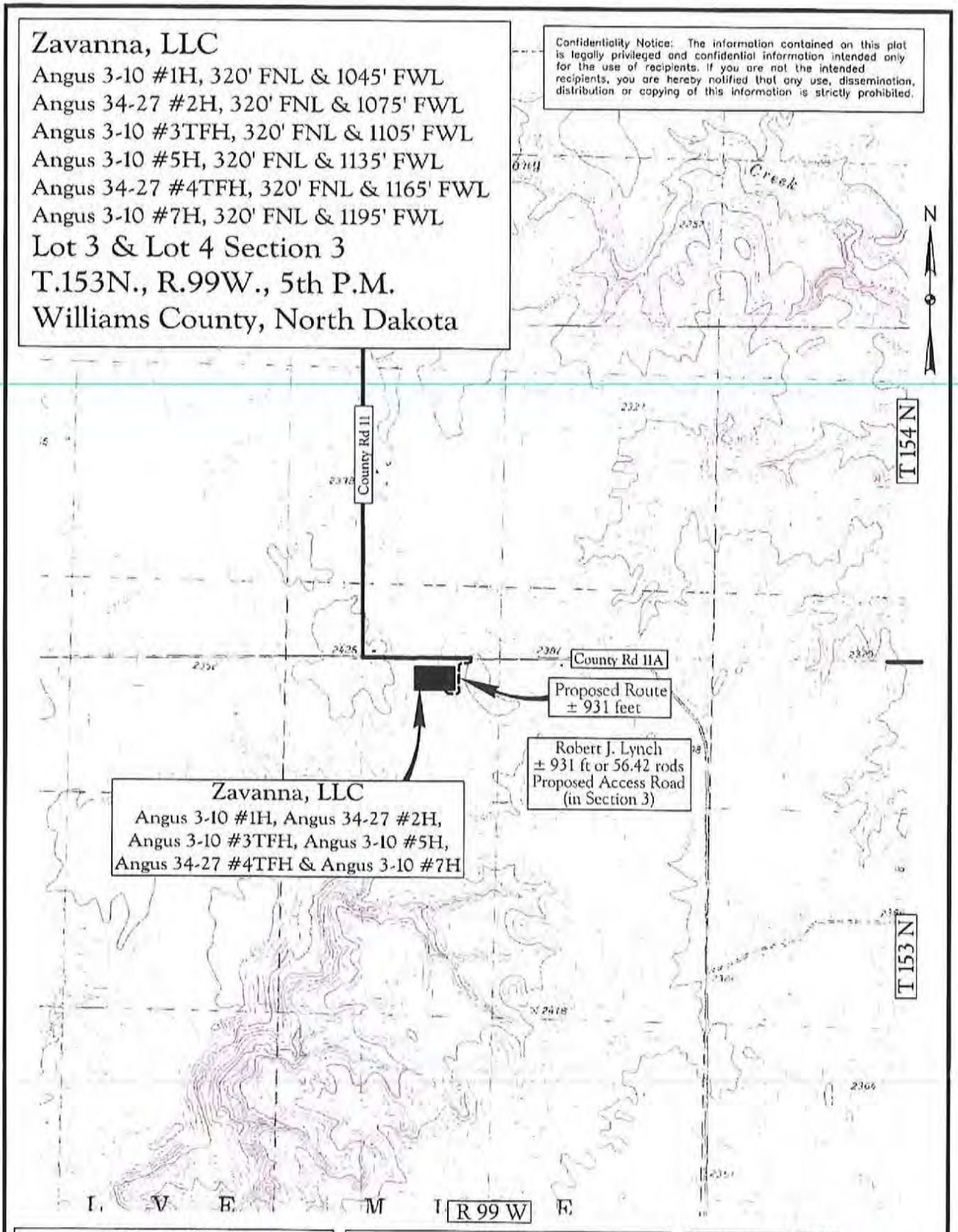




Rev'd.	08/28/2013	Field Book O-139	
Cross Sections Zavanna, LLC 1200 17th Street, Ste 1100 Denver, CO 80202			SHEET NO. 8
KLJ	Angus 3-10 #3TFH Lot 4 of Section 3 T.153N., R.99W., 5th P.M. Williams County, ND		
DRWN. BY A. Nelsen	CHK'D BY R. Lesch	PROJECT NO. 8713245	DATE 08/05/2013

Zavanna, LLC

Angus 3-10 #1H, 320' FNL & 1045' FWL
Angus 34-27 #2H, 320' FNL & 1075' FWL
Angus 3-10 #3TFH, 320' FNL & 1105' FWL
Angus 3-10 #5H, 320' FNL & 1135' FWL
Angus 34-27 #4TFH, 320' FNL & 1165' FWL
Angus 3-10 #7H, 320' FNL & 1195' FWL
Lot 3 & Lot 4 Section 3
T.153N., R.99W., 5th P.M.
Williams County, North Dakota



Map "B"
Quad Access Route

Legend
Existing Roads
Proposed Roads

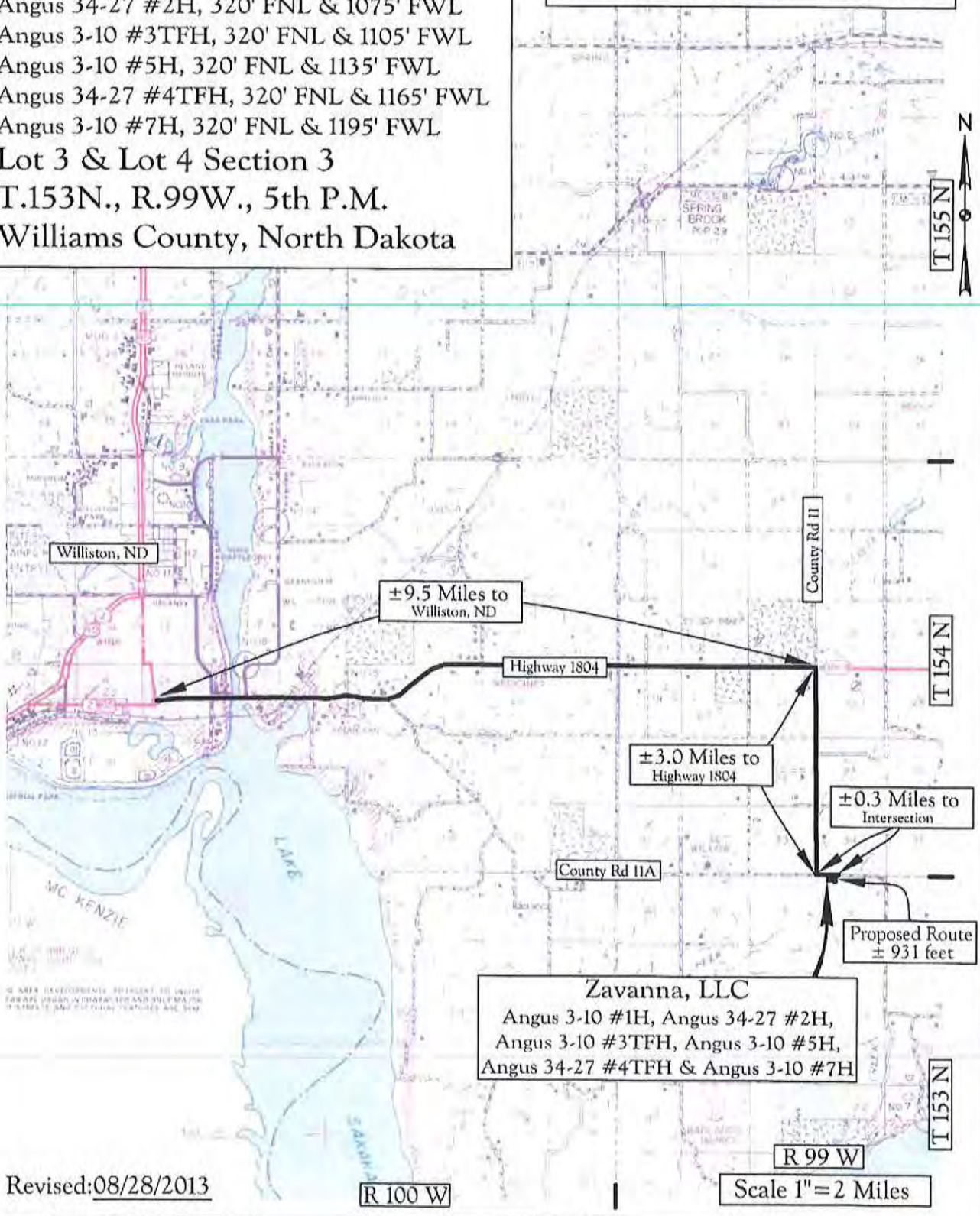
Scale 1"=2000'

KLJ

Aug 28, 2013 - 8:24 PM - J:\oilfield\Zavanna\8713245\CADD\8713245LOC01.dwg

Zavanna, LLC

Angus 3-10 #1H, 320' FNL & 1045' FWL
Angus 34-27 #2H, 320' FNL & 1075' FWL
Angus 3-10 #3TFH, 320' FNL & 1105' FWL
Angus 3-10 #5H, 320' FNL & 1135' FWL
Angus 34-27 #4TFH, 320' FNL & 1165' FWL
Angus 3-10 #7H, 320' FNL & 1195' FWL
Lot 3 & Lot 4 Section 3
T.153N., R.99W., 5th P.M.
Williams County, North Dakota



Revised:08/28/2013

Map "A"
County Access Route

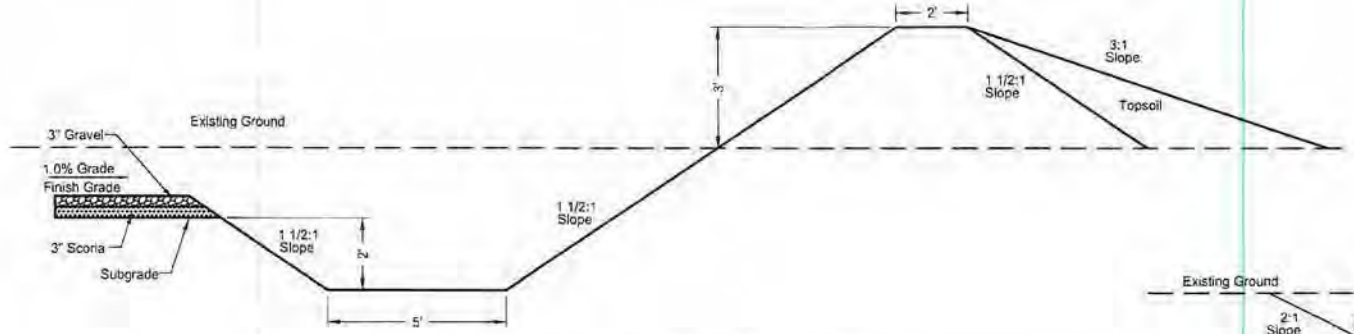
Legend
Existing Roads
Proposed Roads

KLJ

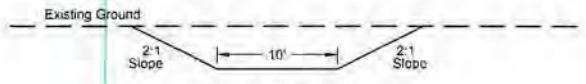
Aug 28, 2013 - 8:24 PM - J:\oilfield\Zavanna\8713245\CADD\8713245LOC01.dwg

Angus 3-10 #1H, Angus 34-27 #2H, Angus 3-10 #3TFH, Angus 3-10 #5H, Angus 34-27 #4TFH & Angus 3-10 #7H

Details



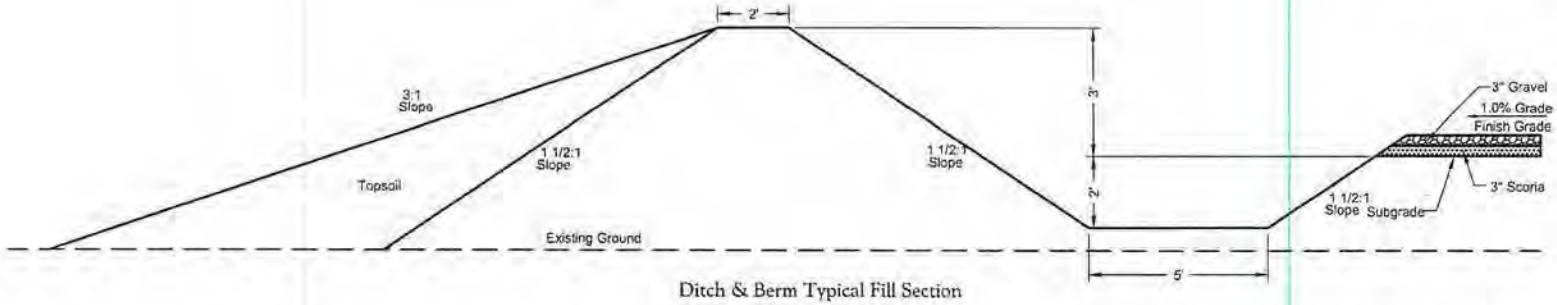
Ditch & Berm Typical Cut Section



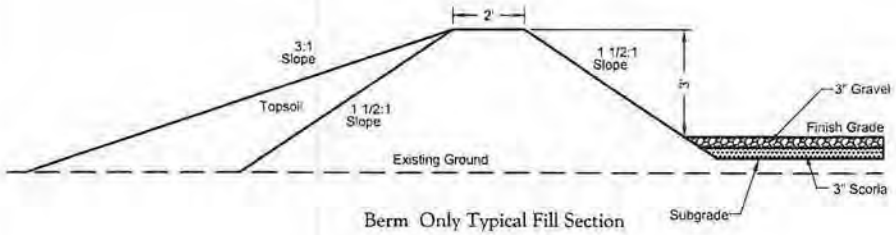
Drainage Ditch Section

Note:
All construction material shall be clean, fine earth, rock or sand, and free of vegetation or organic material.
All fill material shall be compacted to 95% standard proctor with moisture content between -2% to 3% of optimum in accordance with the requirements of ASTM D698 and ASTM D2922.

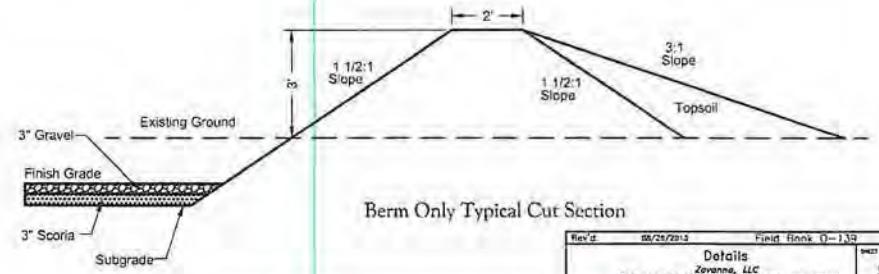
Note:
Topsoil redistributed around pad at a 3:1 slope from the top of the berm



Ditch & Berm Typical Fill Section



Berm Only Typical Fill Section



Berm Only Typical Cut Section

Rev'd	08/29/2013	Field Book 0--139	
Details Zavanna, LLC 1200 17th Street, Ste 1100 Denver, CO 80202			SHEET NO. 9
KLJ	Angus 3-10 #3TFH Lot 4 of Section 3 T.153N., R.99W., 5th P.M. Williams County, ND		
DRWN. BY A. Nielsen	CHK'D. BY E. Lasch	PROJECT NO. 8713245	DATE 08/05/2013