511 Documents

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BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF 8 NORTH, LLC, FOR AN ORDER TO ESTABLISH AN APPROXIMATE 1,600-ACRE DRILLING AND SPACING UNIT FOR SECTIONS 9, 16 & N½ of 21, TOWNSHIP 10 NORTH, RANGE 59 WEST, 6TH P.M., AND AUTHORIZE THE DRILLING OF TWELVE HORIZONTAL WELLS WITHIN THE PROPOSED UNIT, FOR PRODUCTION FROM THE CODELL, FORT HAYS, CARLILE, AND NIOBRARA FORMATIONS, UNNAMED FIELD, WELD COUNTY, COLORADO	)	CAUSE NO. 535 DOCKET NO. 180600473 TYPE: Spacing

REQUEST FOR RECOMMENDATION OF
APPROVAL OF APPLICATION WITHOUT A HEARING

8 North, LLC ("8 North" or "Applicant"), by and through its undersigned attorneys, The Shanor Group LLC, hereby requests, pursuant to Rule 511.a. of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission, the Director to recommend approval of the verified amended application ("Application") filed herein without a hearing.

Applicant requests that the Application be approved based on: (1) the merits of the Application, and (2) the attached sworn written testimony with supporting exhibits which support the relief requested in the Application. There are no protests or applications presently pending against the Application.

WHEREFORE, Applicant requests the Application be approved without a hearing and on the merits of the Application and sworn testimony with supporting exhibits as provided for by Rule 511.a.

DATED this 21st day of May, 2018.

8 NORTH LLC

By: _____

Robert A. Willis
The Shanor Group LLC
600 Seventeenth Street, Suite 2800
Denver, CO 80202
(303) 995-5120

BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF 8 NORTH, LLC, FOR AN ORDER TO ESTABLISH AN APPROXIMATE 1,600-ACRE DRILLING AND SPACING UNIT FOR SECTIONS 9, 16 & N½ of 21, TOWNSHIP 10 NORTH, RANGE 59 WEST, 6TH P.M., AND AUTHORIZE THE DRILLING OF TWELVE HORIZONTAL WELLS WITHIN THE PROPOSED UNIT, FOR PRODUCTION FROM THE CODELL, FORT HAYS, CARLILE, AND NIOBRARA FORMATIONS, UNNAMED FIELD, WELD COUNTY, COLORADO	)	CAUSE NO. 535 DOCKET NO. 180600473 TYPE: Spacing

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Applicant requests that the Application be approved based on: (1) the merits of the Application, and (2) the attached sworn written testimony with supporting exhibits which support the relief requested in the Application. There are no protests or applications presently pending against the Application.

WHEREFORE, Applicant requests the Application be approved without a hearing and on the merits of the Application and sworn testimony with supporting exhibits as provided for by Rule 511.a.

DATED this 21st day of May, 2018.

8 NORTH LLC

By: _____

Robert A. Willis
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OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF 8 NORTH, LLC, FOR AN ORDER TO ESTABLISH AN APPROXIMATE 1,600-ACRE DRILLING AND SPACING UNIT FOR SECTIONS 9, 16 & N½ of 21, TOWNSHIP 10 NORTH, RANGE 59 WEST, 6TH P.M., AND AUTHORIZE THE DRILLING OF TWELVE HORIZONTAL WELLS WITHIN THE PROPOSED UNIT, FOR PRODUCTION FROM THE CODELL, FORT HAYS, CARLILE, AND NIOBRARA FORMATIONS, UNNAMED FIELD, WELD COUNTY, COLORADO	)	CAUSE NO. 535 DOCKET NO. 180600473 TYPE: Spacing

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Applicant requests that the Application be approved based on: (1) the merits of the Application, and (2) the attached sworn written testimony with supporting exhibits which support the relief requested in the Application. There are no protests or applications presently pending against the Application.

WHEREFORE, Applicant requests the Application be approved without a hearing and on the merits of the Application and sworn testimony with supporting exhibits as provided for by Rule 511.a.

DATED this 21st day of May, 2018.

8 NORTH LLC

By: _____

Robert A. Willis
The Shanor Group LLC
600 Seventeenth Street, Suite 2800
Denver, CO 80202
(303) 995-5120

8N✶RTH

Cause No. 535
Docket No. 180600473

Rule 511 written submission in support of uncontested Application requesting an order establishing an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorizing the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

8 North, LLC

Sean Flanagan – Land Testimony
Cause No. 535, Docket No. 180600473

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 and 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Sean Flanagan and I am currently Landman for 8 North, LLC ("8 North). I graduated from Fort Lewis College with a Bachelor of Arts degree in Business Administration. I have over 11 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein. My resume/c.v. is attached to this submission. See Appendix.

In support of the Application, I am submitting two exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order: **(1)** amending Order No. 535-748 to establish an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, and **(2)** maintaining allocation of payment of proceeds for the Pawnee 16-13H well drilled within Section 16, Township 10 North, Range 59 West, 6th P.M., for production from the Niobrara Formation. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit L-1

Exhibit L-1 is an overhead map which shows the location of the Application Lands within Weld County, Colorado.

2. Exhibit L-2

Exhibit L-2 is a map that provides a closer view of the Application Lands and shows 8 North's leasehold positions in the Application Lands. 8 North owns substantial working interest / operating rights in these leases for the Codell, Fort Hays, Carlile, and Niobrara Formations.

Testimony

Extraction owns substantial leasehold interests underlying the Application Lands, which include working interests / operating rights for the Codell, Fort Hays, Carlile, and Niobrara Formations. As of the date of this testimony, 8 North has not received any notice of objection or protest to the Application.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

DATED this 16th day of May, 2018.

Sean Flanagan, Landman
8 North, LLC

VERIFICATION

STATE OF COLORADO)
) ss.
CITY & COUNTY OF DENVER)

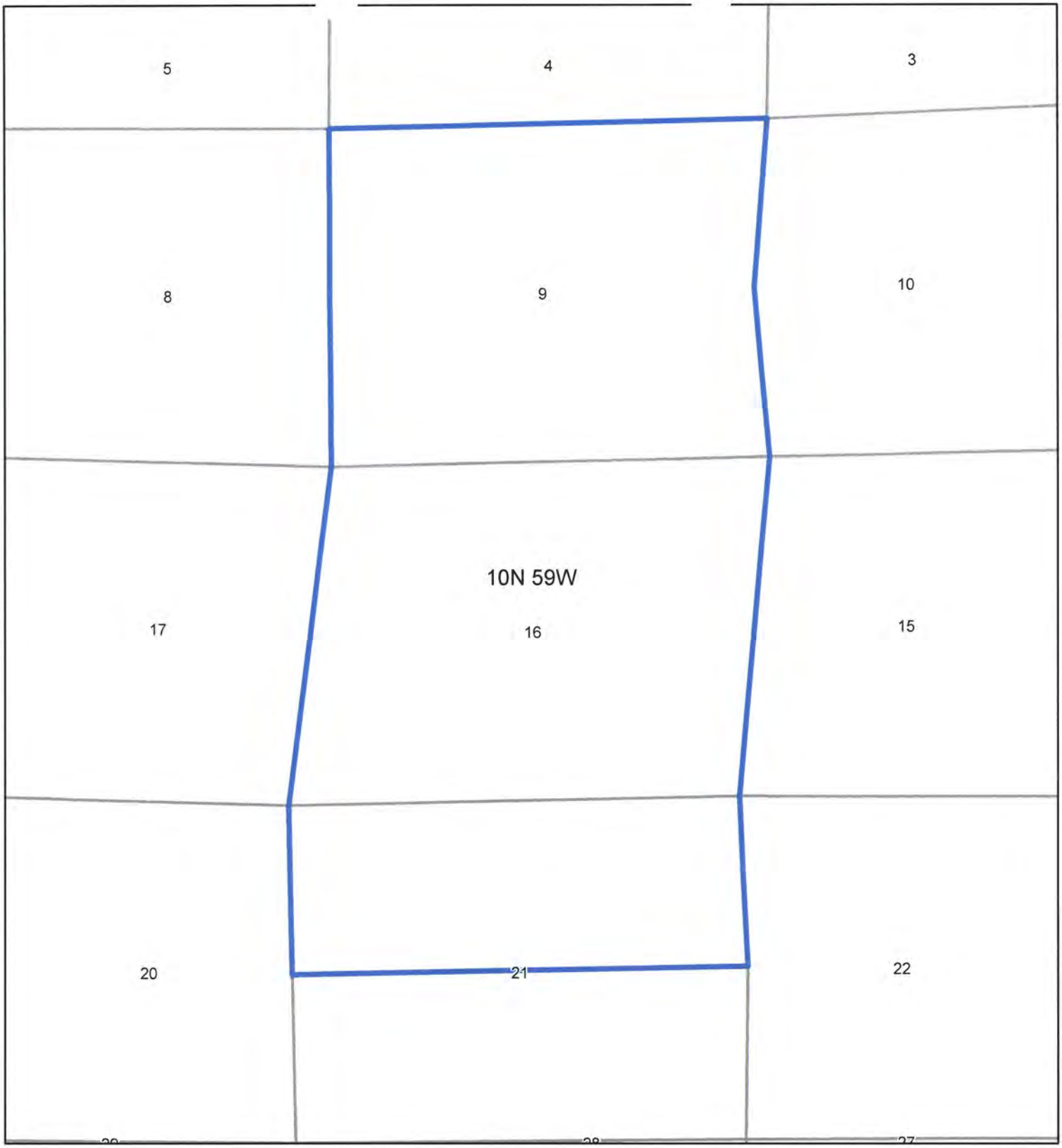
The foregoing instrument was subscribed and sworn to before me this 16th day of May, 2018, by Sean Flanagan, Landman for 8 North, LLC.

Witness my hand and official seal.

My Commission expires: 01/25/22

Notary Public

HALEY ZEPESKI
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20184004172
MY COMMISSION EXPIRES JAN 25, 2022



8 NORTH

EXHIBIT L-1

T10N R59W Sec: 9

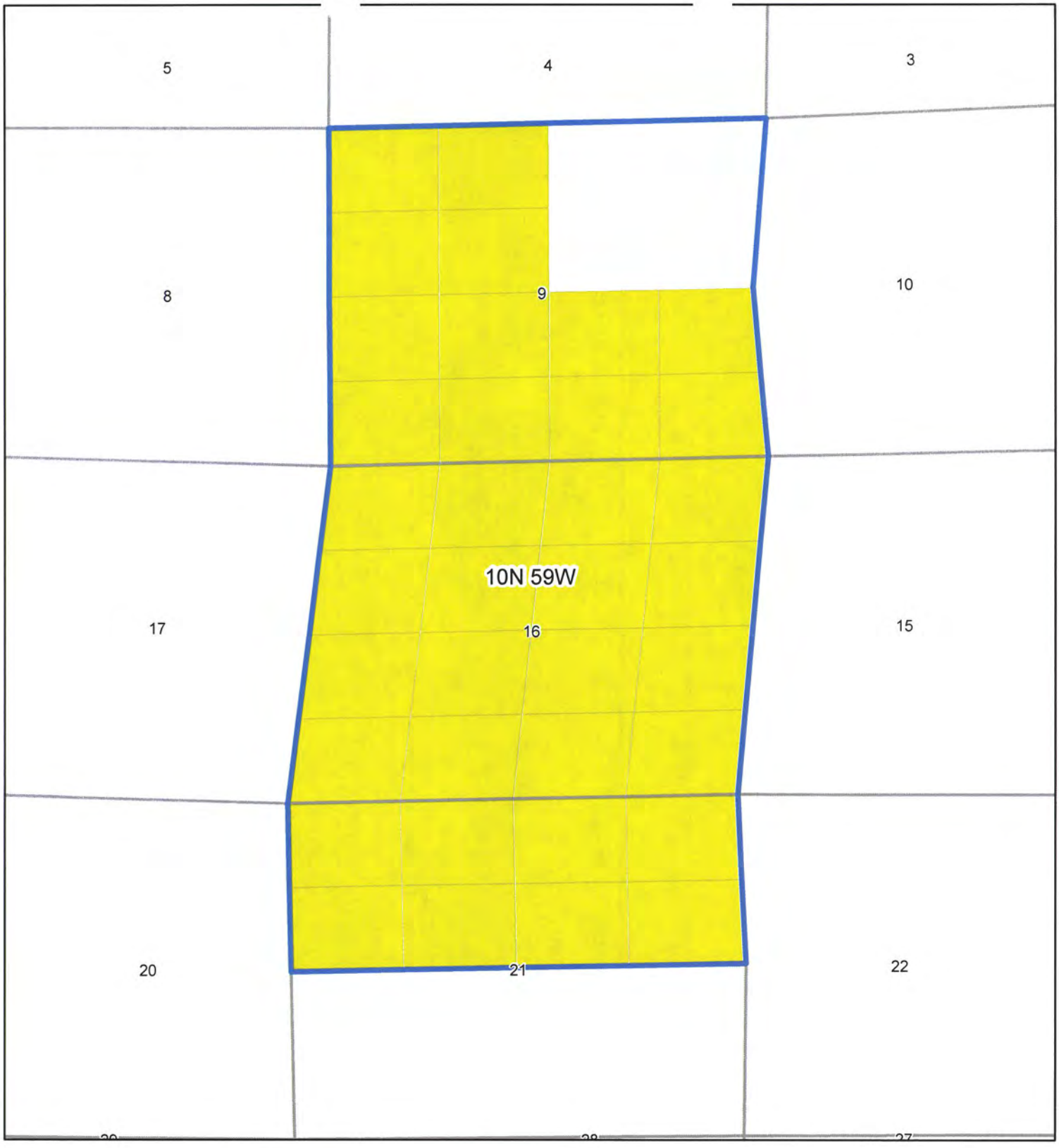
Scale:1:24,000	PRJ:GCS NAD83
Date: 5/21/2018	Author: ECP

Legend

Proposed Spacing Unit

1 inch = 2,000 feet

0 500 1,000 2,000 3,000 4,000 Feet



8 NORTH

EXHIBIT L-2

T10N R59W Sec: 9

Scale:1:24,000	PRJ:GCS NAD83
Date: 5/21/2018	Author: ECP

Legend

Proposed Spacing Unit

XOG Leasehold

1 inch = 2,000 feet

0 500 1,000 2,000 3,000 4,000 Feet

8 North, LLC

Alicia Branch – Geologic Testimony
Cause No. 535, Docket No. 180600473

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 and 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Alicia Branch and I am currently employed as Geologist for 8 North, LLC ("8 North"). I received a Bachelor of Science degree in Petroleum Geology from the University of Oklahoma in 2005, and Master of Science degree in Geology from the University of Oklahoma in 2007. I have over 12 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein. My resume/c.v. is attached to this submission. See Appendix.

In support of the Application, I am submitting nine exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order: **(1)** amending Order No. 535-748 to establish an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, and **(2)** maintaining allocation of payment of proceeds for the Pawnee 16-13H well drilled within Section 16, Township 10 North, Range 59 West, 6th P.M., for production from the Niobrara Formation. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit G-1. Offset Well Locations

Exhibit G-1 shows well locations in the vicinity of the Application Lands. These wells have been drilled on (or very near) the Application lands, all of which are producing out of the Codell and/or Niobrara Formations. The geological cross-section (Exhibit G-9) is designated as W-E on this map.

2. Exhibit G-2. Codell Structure Map

Exhibit G-2 is a subsea true vertical depth structure map constructed on the top of the Codell Formation. The regional dip for the Codell Formation underlying the Application Lands is approximately 0.27 degree up-dip to the east/northeast or approximately 24 feet per mile.

3. Exhibit G-3. Niobrara Structure Map

Exhibit G-3 is a subsea true vertical depth structure map constructed on the top of the Niobrara Formation. The regional dip for the Niobrara Formation underlying the Application Lands is approximately 0.28 degree up-dip to the east approximately 27 feet per mile.

4. Exhibit G-4. Codell Isopach Map

Exhibit G-4 is an isopach map of the total thickness of the Codell Formation. Total thickness of the Codell Formation underlying the Application lands ranges from 15 to 17 feet.

5. Exhibit G-5. Niobrara Isopach Map

Exhibit G-5 is an isopach map of the total thickness of the Niobrara Formation. The total thickness of the Niobrara Formation underlying the Application Lands ranges from 295 to 300 feet.

6. Exhibit G-6. Fort Hays Isopach Map

Exhibit G-6 is an isopach map of the total thickness of the Fort Hays Formation in the vicinity of the Application Lands. The thickness of the Fort Hays Formation underlying the Application ranges from 20 to 22 feet.

7. Exhibit G-7. Carlile Isopach Map

Exhibit G-7 is an isopach map of the total thickness of the Carlile Formation in the vicinity of the Application Lands. The exhibit indicates the Carlile Formation varies between 37 and 45 feet in thickness in this area of the DJ Basin and underlies the entirety of the Application Lands. The thickness of the Carlile Formation underlying the Application ranges from 42 to 54 feet.

8. Exhibit G-8. Type Log

Exhibit G-8 shows a vertical well log through the Codell, Niobrara, Fort Hays, and Carlile Formations on (or very near) the Application Lands. The well log is from Chalk Bluffs 36-13H Pilot, located in the NWSW T10N-R60W S36. Niobrara A, B and C chalks, the Codell Sandstone, the Fort Hays Limestone, and the Carlile Marl are present in the well and should be encountered underlying the Application Lands. The type log illustrates that the Codell Formation underlying the Application Lands will likely consist of a sandstone and the Niobrara Formation under the Application Lands will consist of an alternating sequence of chalks and marls. The log also shows that the Fort Hays underlying the Applications Lands will consist of limestone, and the Carlile Formation will consist of marl.

9. Exhibit G-9. Correlation Cross-Section

Exhibit G-9 shows a shows a stratigraphic cross section, flattened on the top of the Niobrara A Marl, across the proposed drilling and spacing unit. This cross section represents the vertical distribution of the Codell sandstone and the chalk benches within the Niobrara, commonly referred to as the A, B, C and D Chalks, as well as the Fort Hayes member and Carlile marl. The cross section shows that the Codell sandstone and the A, B and C chalk benches of the Niobrara Formation are present in potentially productive thicknesses under the proposed drilling and spacing unit.

Conclusions

The Codell and Niobrara Formations were deposited in the Western Interior Seaway during Cretaceous time. This seaway was vast in extent and covered much of present day North America from the Gulf of Mexico north to the Arctic.

These rocks were deposited as shallow water sediments and underlie most of the DJ Basin in parts of northeastern Colorado, southeastern Wyoming and southwestern Nebraska. The Codell and Niobrara Formations exist under the entirety of the Application Lands and are a common source of hydrocarbon production.

The Codell Formation is a shallow marine tight-sandstone reservoir. Permeability of the reservoir as characterized by published data ranges between 0.05-0.005 md and this is offered as characterization for the Codell reservoir under the Application Lands.

The Niobrara formation is both a hydrocarbon source rock and a reservoir. Permeability of the reservoir, as characterized by published data, is less than 0.001 md and this is offered as characterization for the Niobrara reservoir under the Application Lands.

The Fort Hays Formation is composed of limestone and lies between the Codell and Niobrara Formations and is an uneconomic target for drilling today. The Carlile Formation is a clay-rich shale underlying the Codell Formation and is not a target due to high water saturation. The Fort Hays and Carlile Formations underlie the entirety of the Application Lands in varying thicknesses. Both Fort Hays and Carlile Formations may be encountered during drilling and, thus, are included in the spacing application.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

DATED this 16th day of May, 2018.

Alicia Branch, Geologist
8 North, LLC

VERIFICATION

STATE OF COLORADO)
) ss.
CITY & COUNTY OF DENVER)

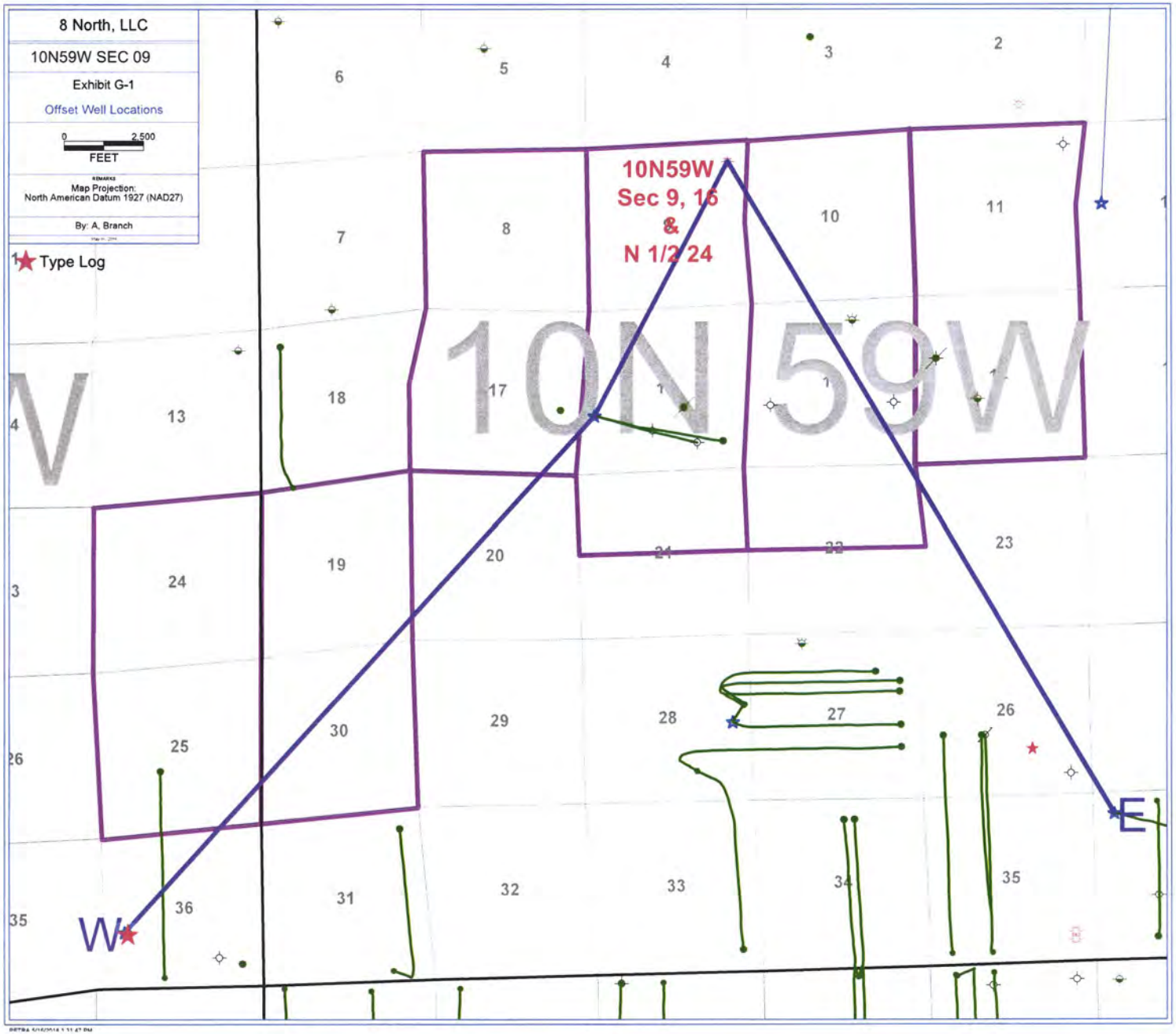
The foregoing instrument was subscribed and sworn to before me this 16th day of May, 2018, by Alicia Branch, Geologist for 8 North, LLC.

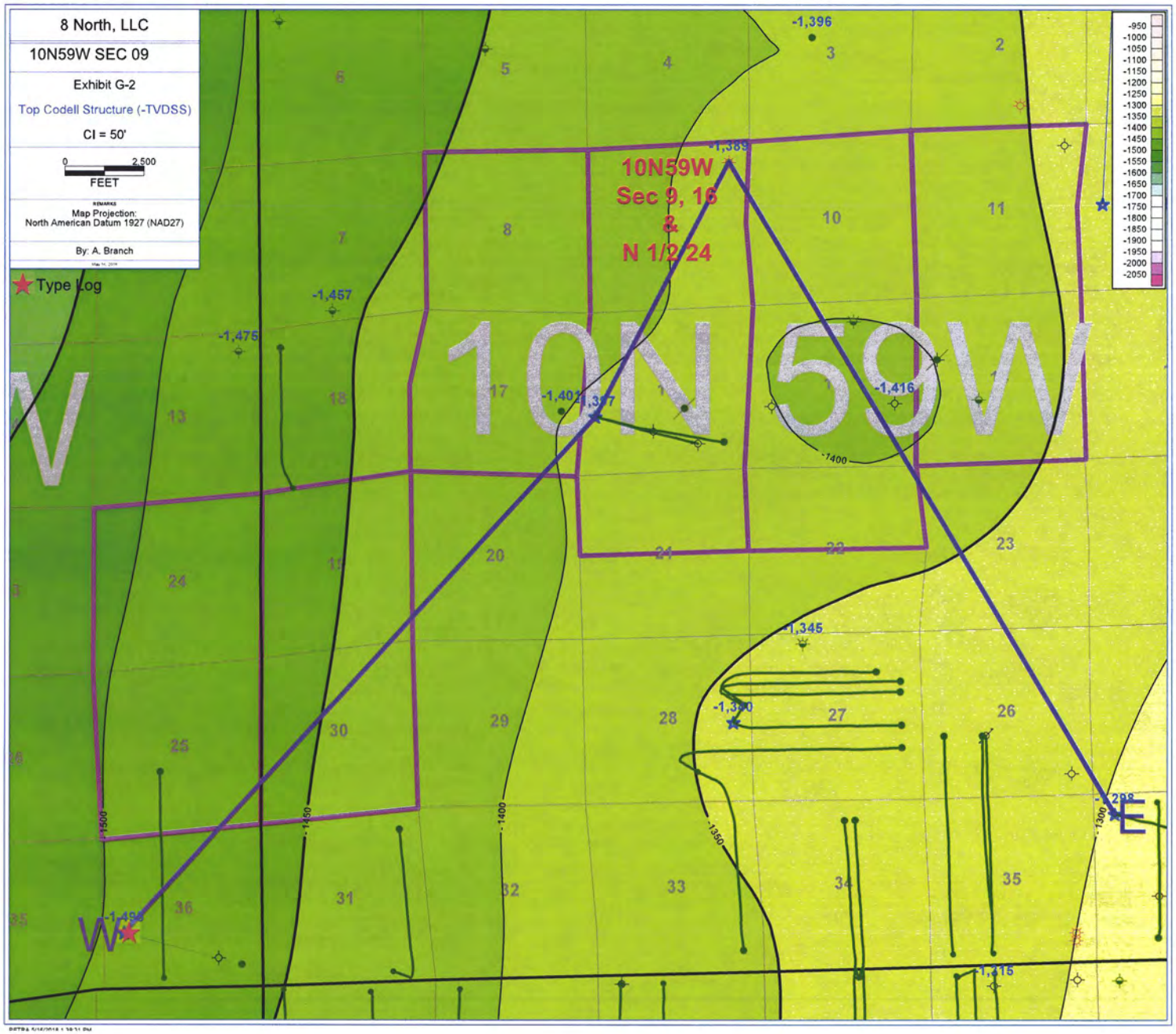
Witness my hand and official seal.

My Commission expires: 1/18/2022

Notary Public

ANGELA CHRISTINE NICKEL
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20184003200
MY COMMISSION EXPIRES JANUARY 18, 2022


8 North, LLC
10N59W SEC 09
Exhibit G-1
Offset Well Locations
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-2
Top Codell Structure (-TVDSS)
CI = 50'
0 2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
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-1,389
-1,457
-1,475
-1,401
-1,416
-1,345
-1,330
-1,315
-1,484
-1400
-1450
-1500
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-950
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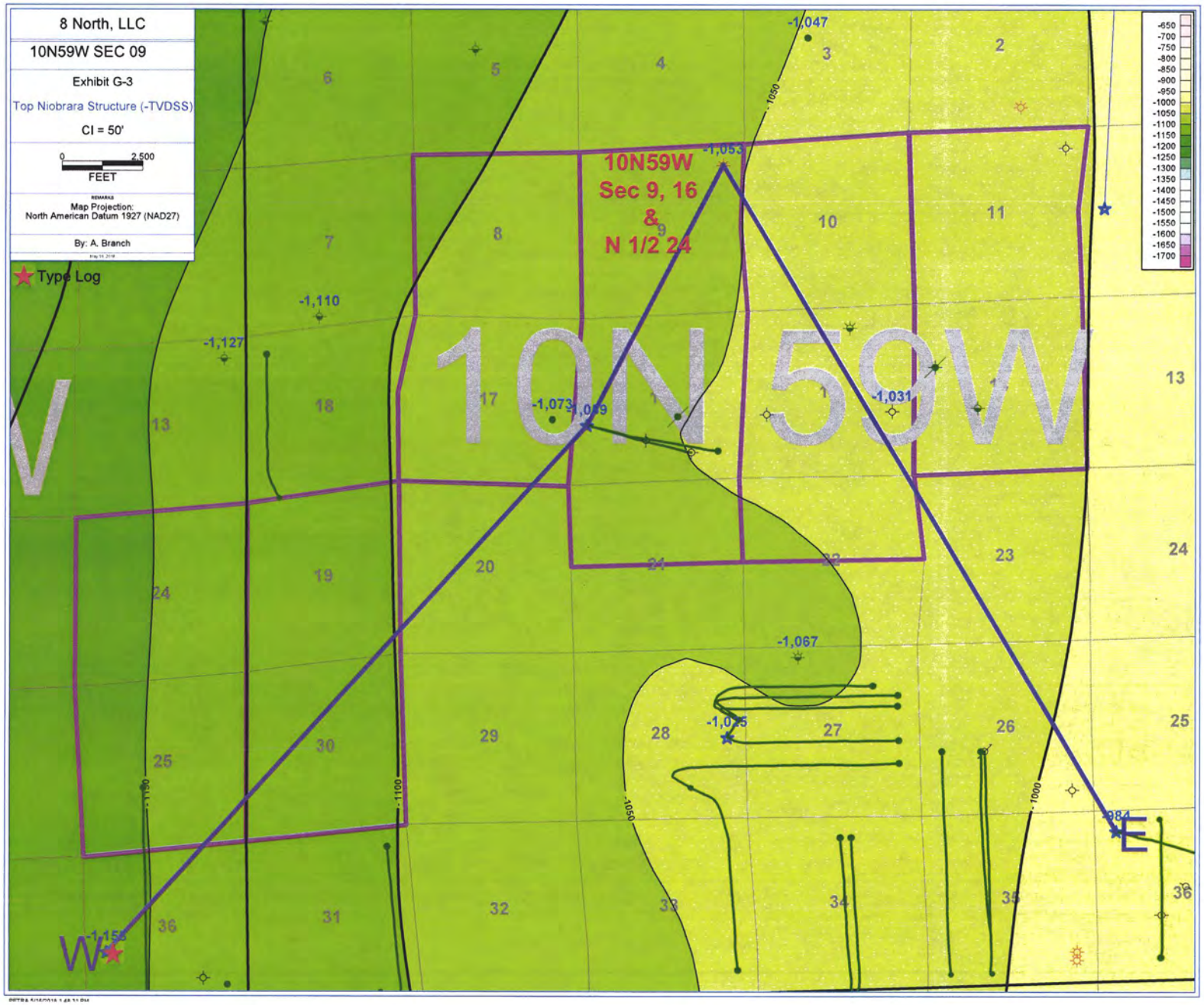
-2050


8 North, LLC
10N59W SEC 09
Exhibit G-3
Top Niobrara Structure (-TVDSS)
CI = 50'
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
-1,047
-1,053
-1,110
-1,127
-1,073
-1,079
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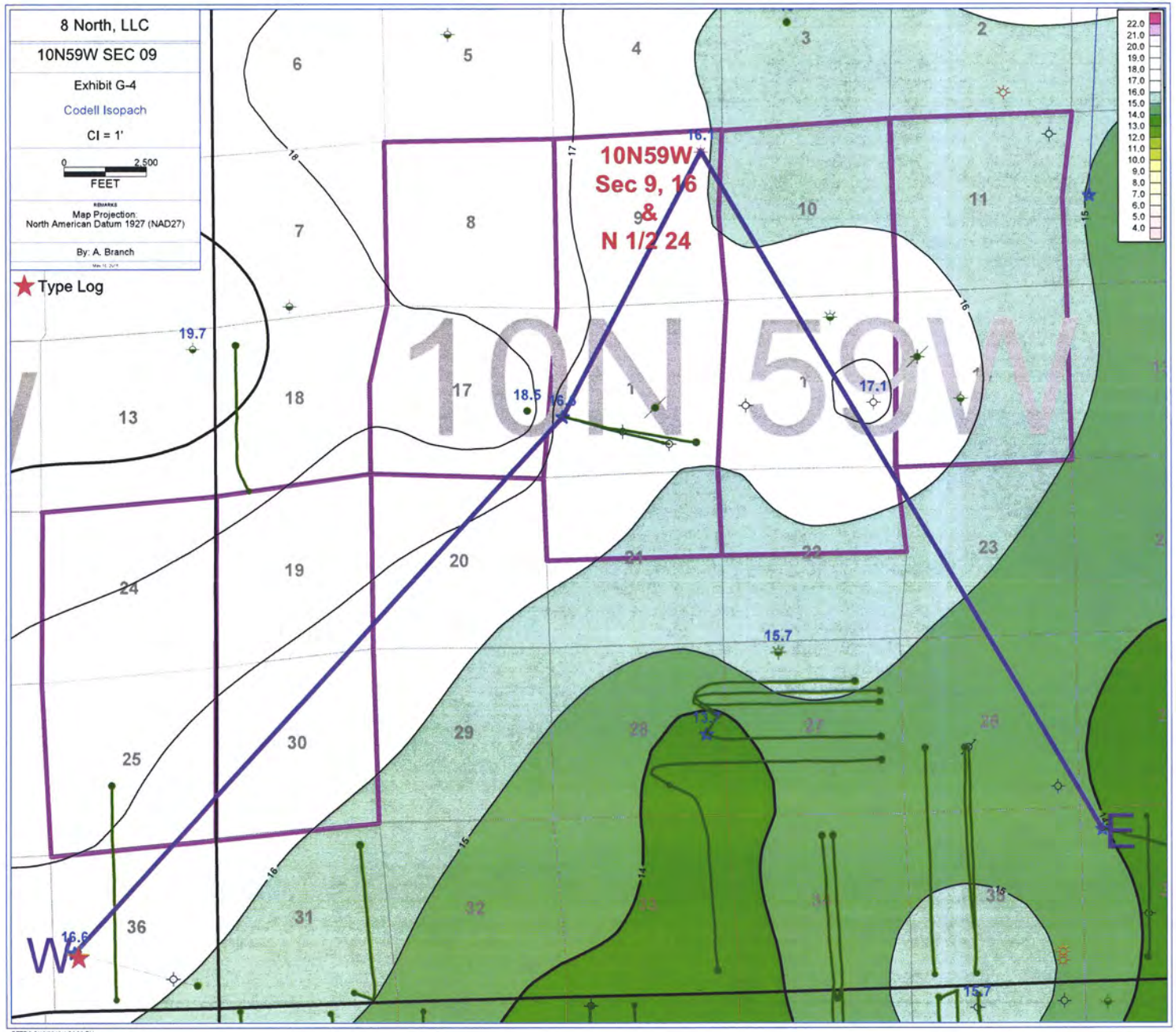
8 North, LLC
10N59W SEC 09
Exhibit G-4
Codell Isopach
CI = 1'
0
2,500
FEET
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
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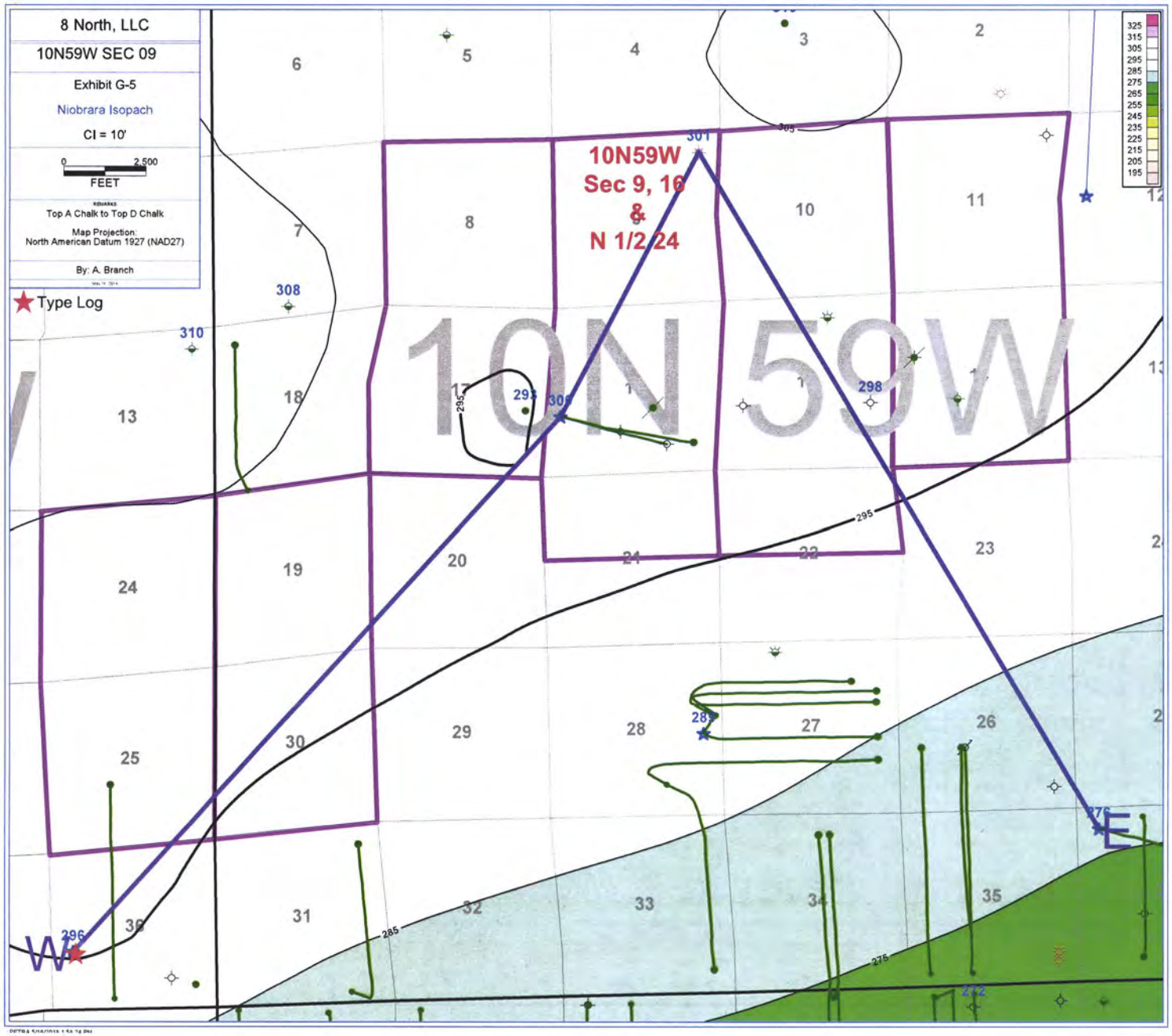
19.7
18.5
17.1
15.7
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-5
Niobrara Isopach
CI = 10'
0
2,500
FEET
Top A Chalk to Top D Chalk
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
325
315
305
295
285
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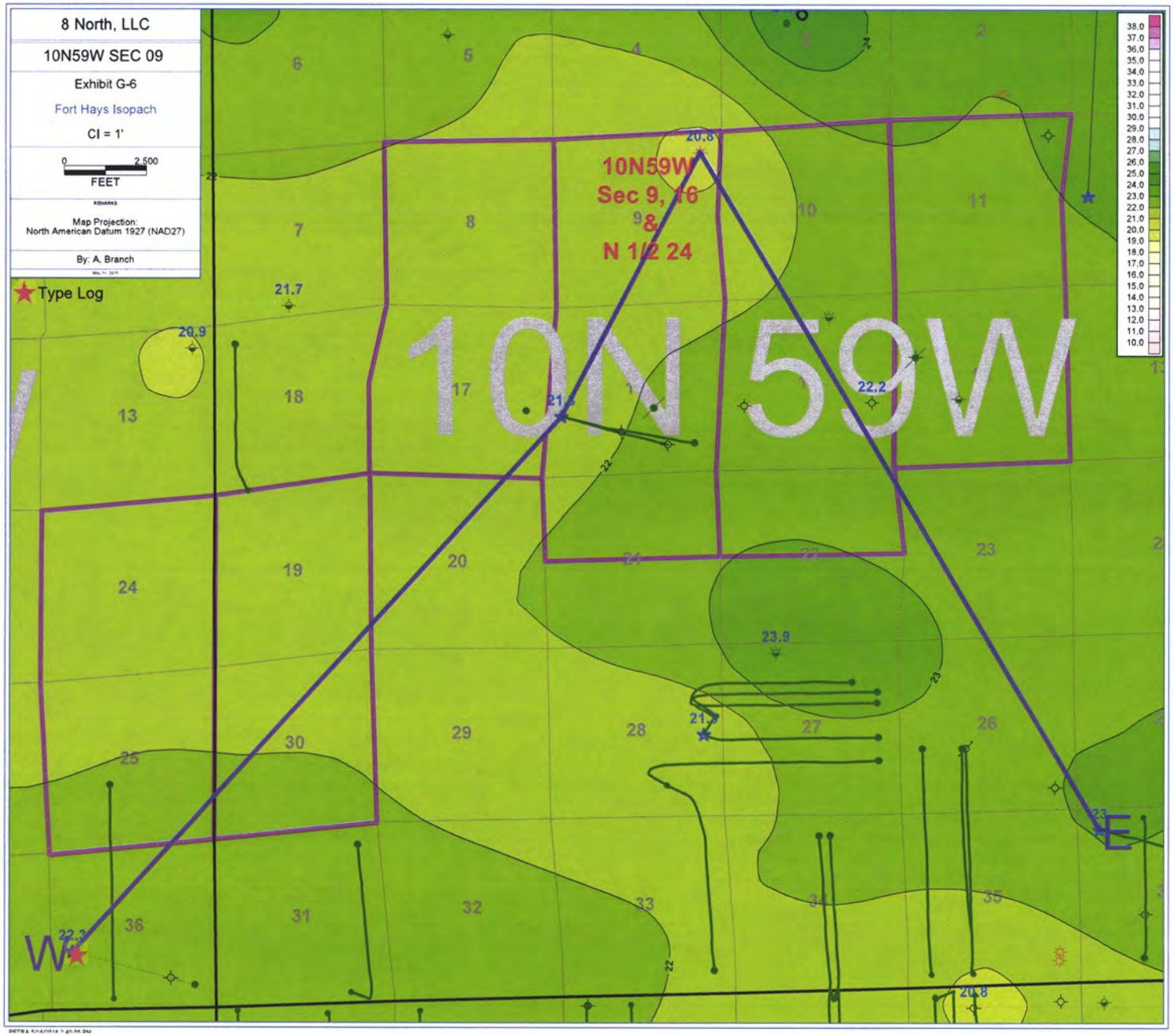
215
205
195
310
308
301
298
293
296
272


8 North, LLC
10N59W SEC 09
Exhibit G-6
Fort Hays Isopach
CI = 1'
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
W
E
20.8
21.7
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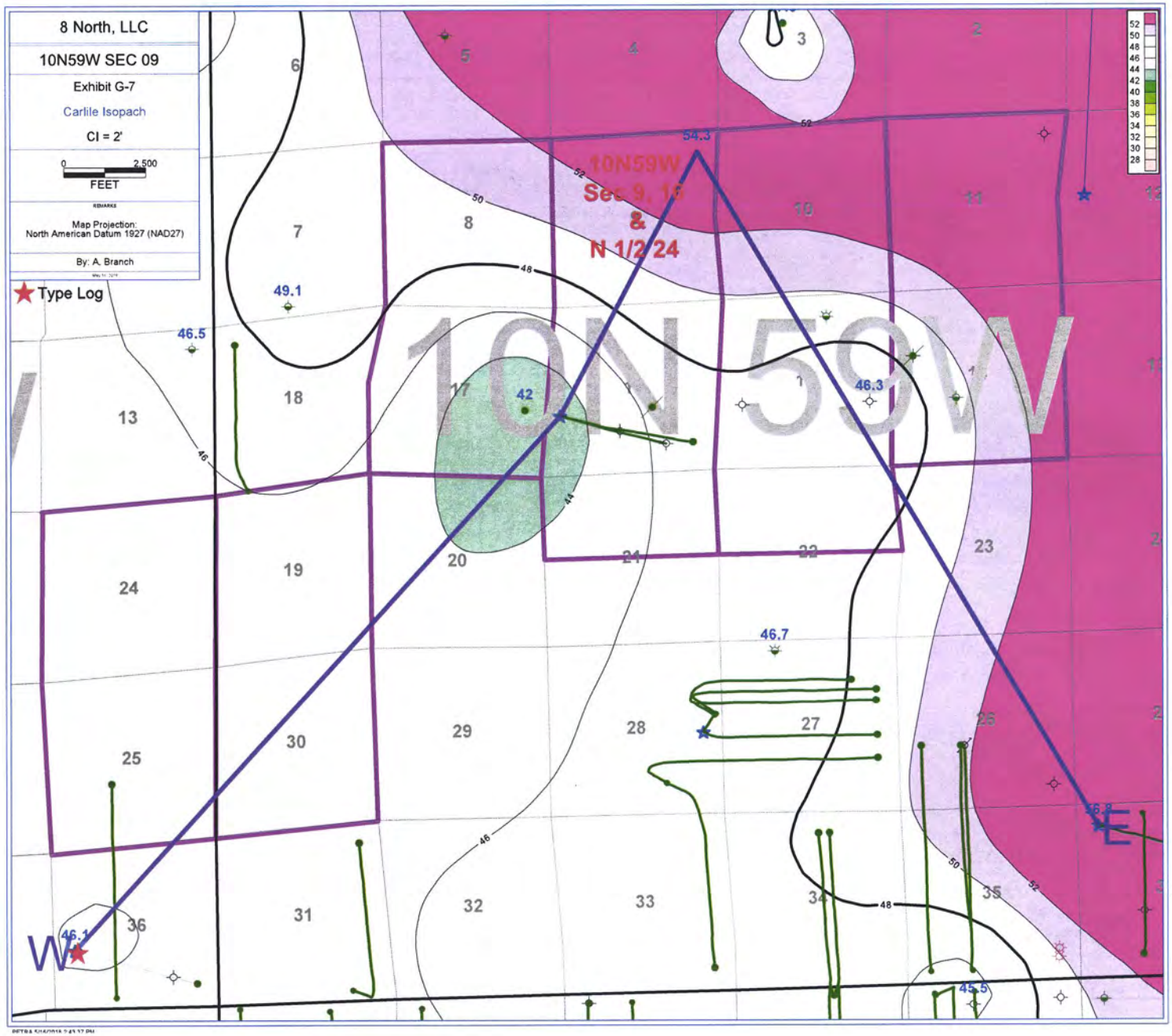
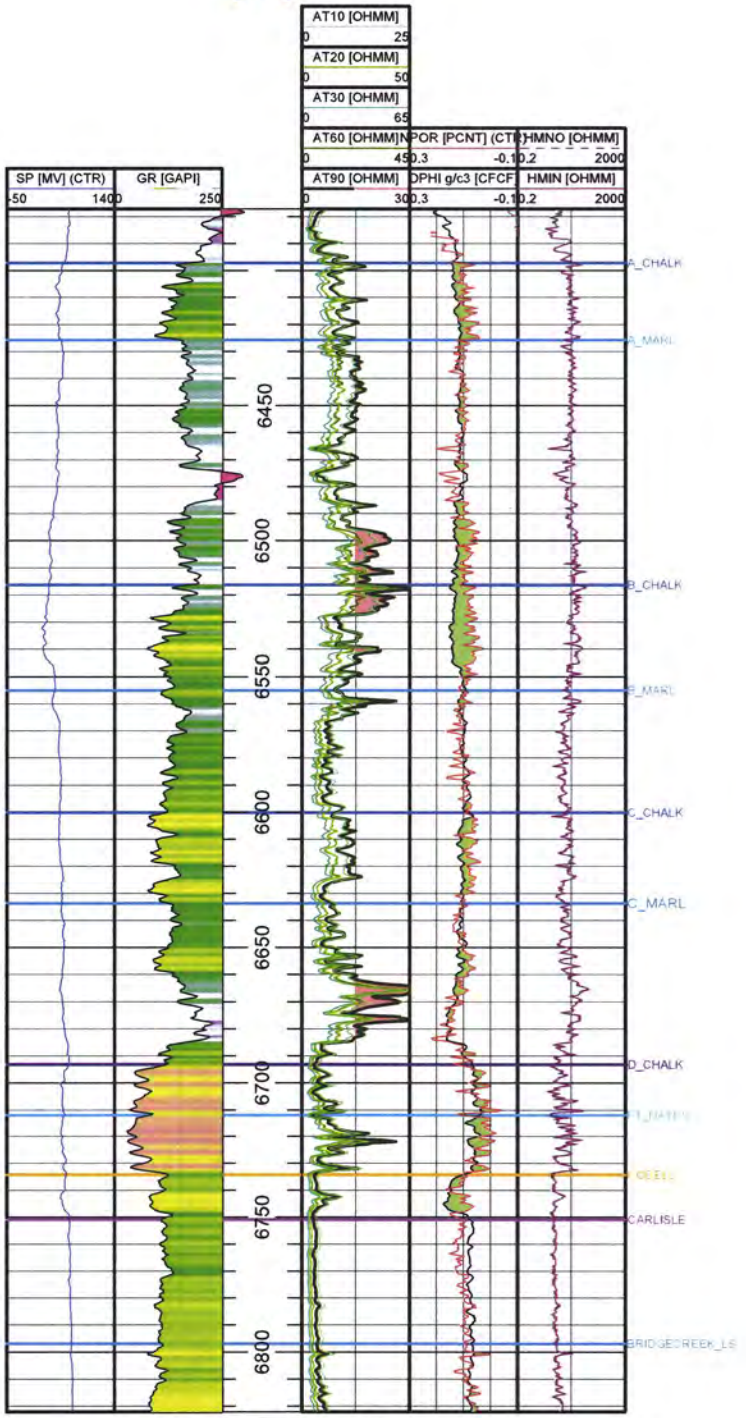
22.2
21.8
23.9
21.2
22.3
20.8


8 North, LLC
10N59W SEC 09
Exhibit G-7
Carlile Isopach
CI = 2'
0
2,500
FEET
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
54.3
49.1
46.5
42
46.3
46.7
46.1
45.5
W
E

CHALK BLUFFS 36-13H PILOT

05123324880000

T10N R60W S36



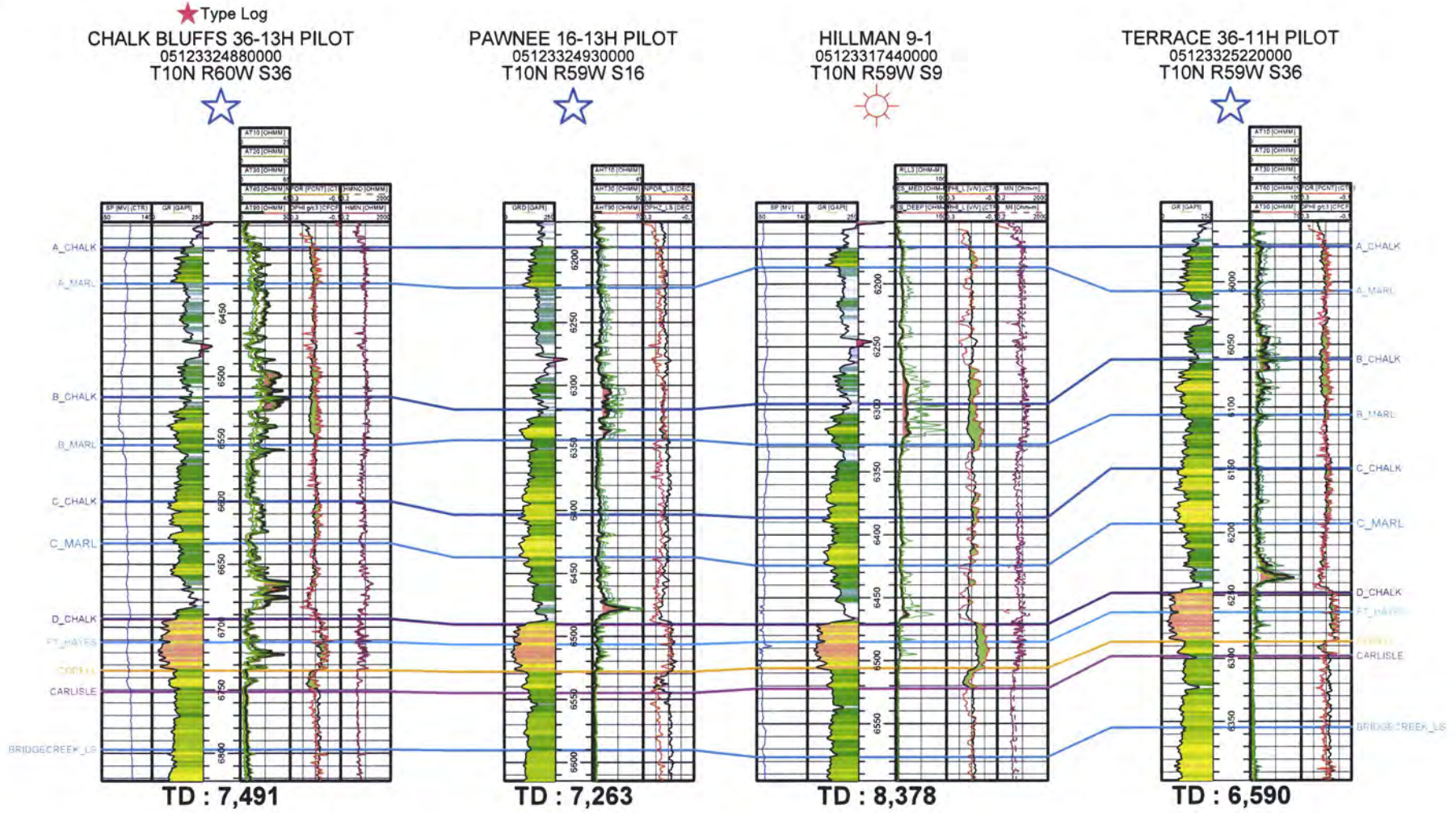
TD : 7,491

8 North, LLC
10N59W SEC 09
Geology Exhibit G-8
Type Log
Deep Resistivity filled >15 Ohmm.
By: A. Branch
May 16 2018 2:53 PM

PETRA 5/16/2018 2:53:07 PM (NoCo 10N59W Type Log Geology Exhibit G8.CSP)

W

E



8 North, LLC
10N59W SEC 09
Geology Exhibit G-9
Correlation Cross-Section
Deep Resistivity filled >15 Ohmm
By: A. Branch
May 16,2018 2:49 PM

PETRA 5/16/2018 2:49:31 PM (NoCo 10N59W Correlation Cross Section Geology Exhibit G9.CSP)

8 NORTH, LLC
Boyd McMaster – Engineering Testimony
Cause No. 535, Docket No. 180600473
Codell and Niobrara Formations
Weld County, Colorado

Colorado Oil and Gas Conservation Commission Hearing

My name is Boyd McMaster and I am currently employed as Petroleum Engineer for 8 North, LLC ("8 North"). I received a Bachelor of Science Degree from the University of Wyoming in Mechanical Engineering in 1993 and a Juris Doctorate of Law in 1996. I have over 20 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein.

In support of the Application, I am submitting four exhibits. These exhibit are attached to my sworn testimony and form a partial basis for support of the Application which requests an order to establish an approximate 1280-acre drilling and spacing unit authorizing the drilling of twelve (12) horizontal wells within said unit, for the production of oil, gas and associated hydrocarbons from the Codell and Niobrara Formations, with the treated intervals of any horizontal well permitted under this Application located not less than 300 feet from unit boundaries and not less than 150 feet from any other well producing or drilling from the Codell and Niobrara Formations, without exception being granted by the Director. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 09: All
Section 16: All
Section 21: N2

1600 acres, more or less, Weld County, Colorado

1. Exhibit No. E-1

Exhibit No. E-1 is a composite decline curve based on the production performance of adjacent Codell and Niobrara formation two-mile lateral horizontal wells. The decline curve is representative of the anticipated production from an average two-mile horizontal Codell/Niobrara wells to be drilled, completed and produced on the Application Lands. Based on the composite decline curve shown in the exhibit, the estimated ultimate recovery ("EUR") of an average Codell or Niobrara well located in the Application Lands is estimated to be 488000 STBO and 666250 MSCFG and 351000 STBO and 661000 MSCFG , respectively.

2. Exhibit No. E-2

Exhibit No. E-2 reflects an evaluation of analog horizontal well results, EUR's and estimated drainage acres from available public data. The analog wells have EUR's ranging from 42,000

to 227,000 bbl and 82,000 to 95,000 bbl for the Codell and Niobrara formations, respectively. Associated drainages per well are estimated from 47 to 131 acres 7 to 10 acres for the Codell and Niobrara formations, respectively. These estimates are within a reasonable expected range and supports the proposed well development on the Application Lands.

3. Exhibit No. E-3

Exhibit No. E-3 shows OOIP calculations and a range of possible well metrics for the Application Lands. Calculations show that the OOIP is estimated at 16881407 bbl and 192243240 bbl per approximate 1280-acre unit for the Codell and Niobrara formations, respectively. Estimated ultimate recoveries ranges are predicted at 1950000 bbl for four Codell wells and 2810000 bbl for eight Niobrara wells. The results in recovery factors or approximately 12% for the Codell wells and 1.4% for the Niobrara wells, which is within a reasonable expected range for an unconventional tight oil development.

4. Exhibit No. E-4

Exhibit No. E-4 shows the estimated drainage radius per well drilled within the Application Lands based on an empirical formula.

Summary of Testimony

Based on the exhibits described herein, in my opinion the twelve planned horizontal Codell and Niobrara wells to be drilled on the Application Lands can be completed and produced at a positive internal rate of return, calculated at 47-95%, assuming an average estimated well cost of $4.6-5.4 MM for the wells, using an oil price of $60/bbl, a natural gas price of $2.75/MCF, and estimated operating costs of $9,000 per well per month.

It is my opinion that the 12 planned horizontal Codell and Niobrara Formation wells are the appropriate well density for the Application Lands, and are an efficient and economic means to develop the resource and prevent waste, while protecting correlative rights. Further, the requested setback where the treated intervals of any horizontal well permitted under this Application should be located not less than 300 feet from unit boundaries and not less than 150 feet from any other well producing or drilling from the Codell and Niobrara Formations will prevent waste of the resource at the unit boundaries while protecting the correlative rights of adjacent owners to the unit area.

It is my further opinion that the proposed spacing unit is not smaller than the acreage that the planned wells will drain.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

Affirmation

The matters described herein were all conducted under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the exhibits are true, correct and accurate.

Dated this 20th day of May, 2018.

Boyd McMaster

STATE OF COLORADO)
)ss.
CITY AND COUNTY OF DENVER)

The foregoing instrument was subscribed and sworn to before me on this this 20th day of May, 2018, by Boyd McMaster.

Witness my hand and official seal.

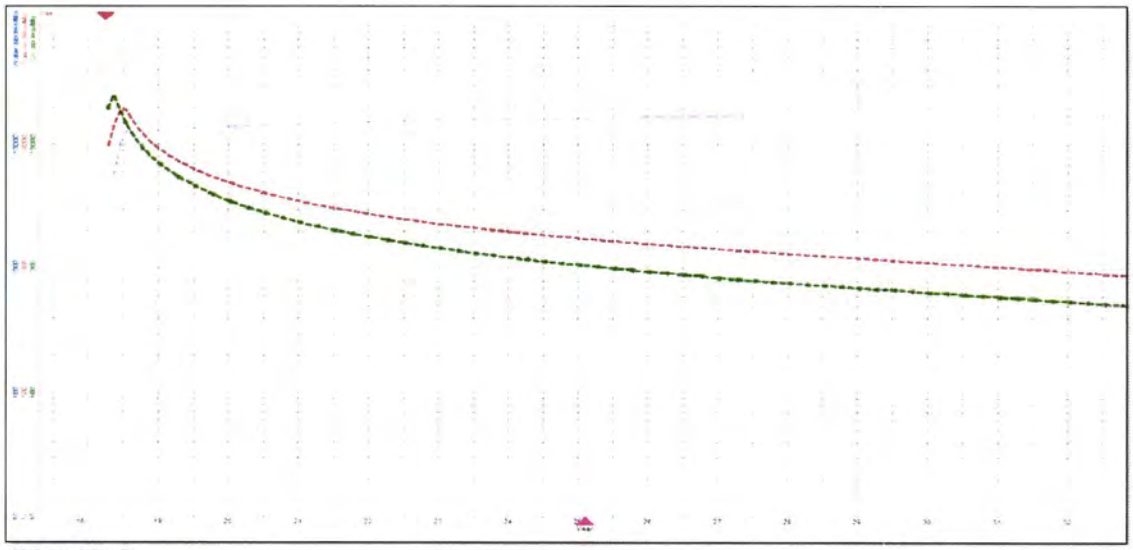
My commission expires: 1/4/21

ANNE MICHELLE PIERINI
Notary Public
State of Colorado
Notary ID # 20124036744
My Commission Expires 01-04-2021

Notary Public

Exhibit E-1
Date: 4/5/2018
Engineer: Boyd McMaster

Codell 2.5-mile



Niobrara 2.5-mile

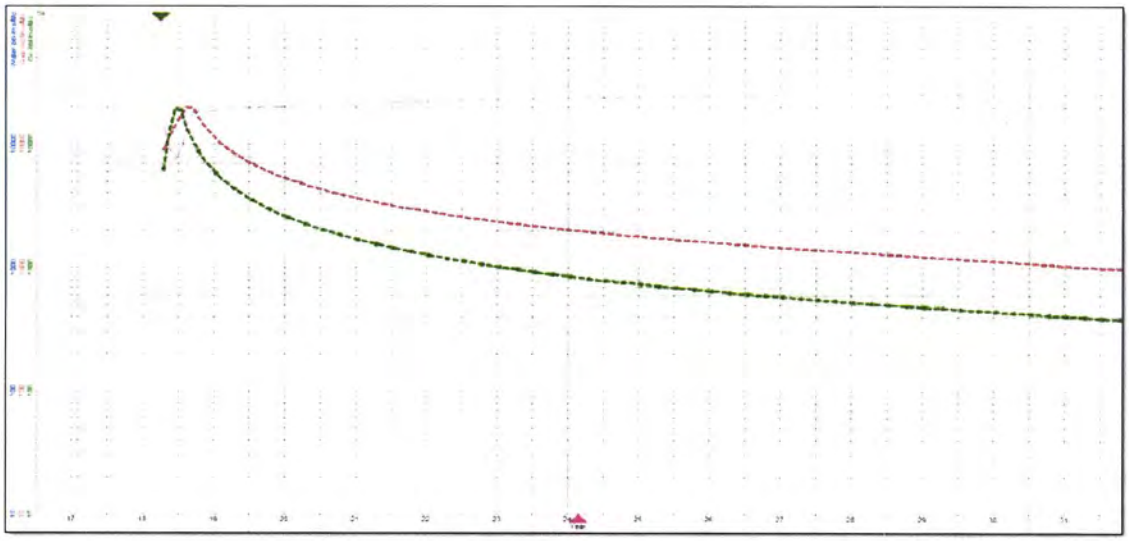


Exhibit E-2
Date 4/5/18
Engineer Boyd McMaster

Well	Formation	Location	Lateral Length (ft)	Oil EUR (Mbbl)	Net Pay (ft)	Porosity (%)	Oil Saturation (%)	Formation Volume Factor (RB/STB)	Recovery Factor (%)	Estimated Drainage Acres (Acres)	Estimated Drainage Radius (ft)
JD LC26-78O	Codell	9N59W - 26	3,295	227	13	12%	80%	1 2	20%	131	660
HILES 12-62-17-	Codell	12N62W-17	4,451	110	20	12%	65%	1 2	20%	51	231
RAZOR 22D-2208B	Codell	10N58W-22	4,427	88	14	12%	80%	1 2	20%	47	216
RAZOR 11G-0210B	Codell	10N58W-11	7,263	108	15	12%	80%	1 2	20%	54	157
GRACIE LD22-720	Codell	9N58W-22	4,284	259	18	12%	80%	1 2	20%	108	469
SILVERBACK 1	Codell	12N62W-36	4,510	201	21	12%	65%	1 2	20%	88	378
RAZOR 12F-0106B	Codell	10N58W-12	4,400	99	15	12%	80%	1 2	20%	49	226
RILEY LD19-752	Codell	9N58W-19	4,452	186	17	12%	80%	1 2	20%	82	358
HORSETAIL FEDERAL 07F-0639	Codell	10N57W-7	4,201	105	12	12%	80%	1 2	20%	66	306
WOLF 36-3624H	Codell	10N59W-36	3,853	42	8	12%	80%	1 2	20%	40	207
HILES CDH 12-62-17-	Codell	12N62W-17	4,451	83	15	12%	65%	1 2	20%	51	231
TALMADGE 12-62-17-	Codell	12N62W-17	3,912	72	15	12%	65%	1 2	20%	45	228
TALMADGE CDH 12-62-17-	Codell	12N62W-17	4,386	97	15	12%	65%	1 2	20%	60	270
									Average	67	303
WILDHORSE 18-1844H	Niobrara	9N59W-18	3,713	85	255	9%	70%	1 2	10%	8	47
RAINBOW LC28-79-1	Niobrara	9N59W-28	3,398	83	250	9%	70%	1 2	10%	8	51
RAINBOW LC28-76-1	Niobrara	9N59W-28	3,704	85	250	9%	70%	1 2	10%	8	48
BROOK LC28-77-1	Niobrara	9N59W-28	3,748	91	250	9%	70%	1 2	10%	9	51
RAINBOW LC28-74-1	Niobrara	9N59W-28	3,733	92	250	9%	70%	1 2	10%	9	52
CUTTHROAT LC28-79HN	Niobrara	9N59W-28	3,499	94	250	9%	70%	1 2	10%	9	56
CUTTHROAT LC28-78HN	Niobrara	9N59W-28	3,615	95	250	9%	70%	1 2	10%	9	55
CUTTHROAT LC28-77HN	Niobrara	9N59W-28	3,662	98	250	9%	70%	1 2	10%	10	56
WILDHORSE 06-0614H	Niobrara	9N59W-6	3,576	92	270	9%	70%	1 2	10%	8	50
STATE 2-16-9-60	Niobrara	9N60W-16	4,036	83	273	9%	70%	1 2	10%	7	40
STATE 4-16-9-60	Niobrara	9N60W-16	3,995	87	273	9%	70%	1 2	10%	8	42
STATE 3-16-9-60	Niobrara	9N60W-16	3,989	95	273	9%	70%	1 2	10%	9	46
NELSON 5-17-9-60	Niobrara	9N60W-17	4,190	93	275	9%	70%	1 2	10%	8	43
NELSON 2-17-9-60	Niobrara	9N60W-17	3,831	94	275	9%	70%	1 2	10%	8	47
SHULL 4-25-9-60	Niobrara	9N60W-25	4,489	88	250	9%	70%	1 2	10%	9	41
SHABLE LB 32-68HN	Niobrara	9N60W-33	3,730	84	245	9%	70%	1 2	10%	8	48
SHULL 3-35-9-60	Niobrara	9N60W-35	4,295	84	240	9%	70%	1 2	10%	9	43
SHULL 1-35-9-60	Niobrara	9N60W-35	4,299	98	240	9%	70%	1 2	10%	10	50
KRIER GV26-62HN	Niobrara	9N61W-26	3,650	92	250	9%	70%	1 2	10%	9	53
STATE 2-36-9-61	Niobrara	9N61W-36	4,048	82	252	9%	70%	1 2	10%	8	42
STATE 4-36-9-61	Niobrara	9N61W-36	3,818	83	250	9%	70%	1 2	10%	8	46
STATE 3-36-9-61	Niobrara	9N61W-36	3,841	84	250	9%	70%	1 2	10%	8	46
									Average	8	45

$$EUR = Rf * OOIP$$

$$OOIP = \frac{7758 * A * h * \phi * So}{Bo}$$

$$So = 1 - Sw$$

$$D = \frac{\pi * r^2 + 2r * L}{43560} \quad \text{(Joshi equation)}$$

EUR - Estimated Ultimate Recovery (bbls)
Rf - Recovery factor (%)
OOIP - Original Oil in Place (bbls)
A - Area (acres)
h - net pay (ft)
ϕ - porosity (%)
So - Oil Saturation (%)
Sw - Water Saturation (%)
Bo - Formation Volume Factor (rb/stb)

L - Lateral length of well (ft)
r = Effective drainage radius from wellbore (ft)
D = Drainage are for horizontal well

Exhibit E-3
Date:
Engineer: Boyd McMaster

CODELL FORMATION

Formation Variables

Porosity	12%	
Sw	20%	
Area	1,600	acres
Thickness (h)	17.5	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	17,377,920	BO
Gas in Place	34,755,840	MCF

Vertical Well Performance

# of existing wells	-	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	294,000	BO
# of Horizontal Wells	4	wells
Total EUR	1,176,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	6.8%
Total RF	6.8%

NIOBRARA FORMATION

Formation Variables

Porosity	9%	
Sw	30%	
Area	1,600	acres
Thickness (h)	295	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	192,243,240	BO
Gas in Place	384,486,480	MCF

Horizontal Well Performance

# of existing wells	0	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	209,000	BO
# of Horizontal Wells	8	wells
Total EUR	1,672,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	0.9%
Total RF	0.9%

Exhibit E-4
Date:
Engineer Boyd McMaster

CODELL FORMATION

Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	4	wells
Spacing Unit Acres per Well	400	acres
Length per Well	4680	feet

Estimated Drainage

Radius	272	feet

NIOBRARA FORMATION

Formation Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	8	wells
Spacing Unit Acres per Well	200	acres
Length per Well	4680	feet

Estimated Drainage

Radius	96	feet

$$D = \frac{\pi * r^2 + 2r * L}{43560}$$ (Joshi equation)

L - Lateral length of well (ft)
r = Effective drainage radius from welbore (ft)
D = Drainage area for horizontal well

(-(2*L)+SQRT((2*L)^2-(4*PI()*-EUR*43560)))/(2*PI())

Appendix

1. Resume / c.v. of Sean P. Flanagan
2. Resume / c.v. of Alicia Branch
3. Resume / c.v. of Boyd McMaster

Sean P. Flanagan

Objective

To obtain a land position within an oil and gas exploration and production company; which promotes a strong employer to employee relationship built on trust, work ethic, communication, and proven success.

Industry Experience

EXTRACTION OIL & GAS
Contract Landman — **July 2016 - Present**

- Coordinate the land function of development team; prepare and negotiate oil and gas leases, calculate working interests and net revenue interests, review title opinions, draft various contracts and instruments including assignments, deeds, JOA's, AFE letters, supervise brokers and field landman

HAWKWOOD ENERGY
Oil and Gas Accountant — **March 2016 – June 2016**

- Review incoming costs and compare to AFE/Estimates, Month end and accruals, heavy reconciliations, variance analysis of historical well costs. Work closely with Director of Finance and Drilling Manager on special projects related to costs analysis and budgeting.

FOREST OIL CORPORATION — **September, 2006 – April, 2015**
Landman — ***June, 2012 – April, 2015***
Land Technician — *May, 2010 – May, 2011*
Land Assistant — *June, 2008 – April 2010*
Joint Interest Billing Analyst — *September, 2006 – June 2008*
East Texas & Northern Louisiana

- Performed cradle to grave land functions for two (2) rig drilling program, including, but not limited to, coordination of development programs with technical and management teams, proposing new drills and subsequent operations, examining title opinion, satisfying title curative requirements, acting as point of contact for field landmen, rig companymen, survey crews and environmental agents, supervising brokerage firms and title abstract crews contracted to negotiate and acquire mineral/working interests, prepare abstracts of title and title memorandums
- Drafted and Negotiated standard and complex oil and gas leases, contracts and instruments, including, but not limited to, assignments, farmouts, unit designations/amendments, JOA's, purchase and sale agreements, participation agreements, AFE letters, lease extensions

Attributes

Proven Landman Professional with significant experience in diverse drilling processes. Strategic planner and innovative problem solver with strong negotiation skills working with owners and partners. Adept in preparing and interpreting lease and sale agreements. High adaptability, relationship building, natural leadership skills, strong multi-tasking abilities, works well under time and cost pressures, general understanding of GIS, proficient in Microsoft Office Suite, Bolo-Oil and Gas office system, AFE Navigator and DrillingInfo.com.

Education

Fort Lewis College, Durango, Colorado — **May, 2006**
Bachelor of Arts: Business Administration

Colorado School of Mines — **June, 2012**
Petroleum Engineering for Non-Engineers

Colorado School of Mines — **June, 2012**
Petroleum Geology for Non-Geologists

Involvement

Chairperson, Forest Oil Corporation – Contribution committee (2013-2015), Student-athlete, Fort Lewis College Men's Soccer – Division II National Champions 2005 (undefeated 22-0-1), Student Athlete Advisory Committee Member – UNCC, Charlotte, NC (2002-2003)

ALICIA BRANCH

EXPERTISE SUMMARY

- Twelve years industry experience supervising exploration and development projects in emerging plays.
- Self-motivated individual with drive to excel through continuously improving and learning new skills.
- Strong leadership experience with multidisciplinary teams, project management and business planning.
- Demonstrated success aggressively cutting costs while delivering timely projects.
- Building on-going relationships with key stakeholders.
- Extensive operations background specializing in Cretaceous and Devonian shales, carbonates and tight gas sand plays in Colorado, Oklahoma, Texas and New Mexico.
- Recent experience onshore Europe in conventional exploration in Rotliegend Permian Basin fairway.

PROFESSIONAL EXPERIENCE

AB Consulting, Inc., Denver, CO **6/2016 - present**

Owner, Geologist

Geologic consulting services for various operators around Denver.

- Acreage evaluations
- Operations
- Regional & detailed mapping
- Well planning & Permitting
- Geologic exhibits & Testimony

Palomar Natural Resources, Lakewood, CO **7/2014 – 2/2016**

Vice President of Global Operations *1/2015 – 2/2016*

Oversaw execution of all operations within the company. Most recent focus was redevelopment of 16,335 acres in Verde Gallup oil field in New Mexico on the Ute Mountain Ute Reservation. Deployed $13.5MM of capex to date and $1.3MM of net revenue. Duties included:

- Supervise technical teams that plan and execute drilling, completions and workovers
- Manage multiple regulatory agencies (BIA, BLM, NMOCD) and Sovereign Nation relationships
- Negotiate and award contracts with vendors
- Establish high level processes that ensure streamlined development of assets
- Responsible for creation and delivery of timelines and budgets related to all operations
- Ensure creation of data room and solicit capital investment from various banks
- Demonstrated a 28% reduction of New Mexico permit timeline and a 70% reduction in well permit costs in one year

Poland Country Manager *7/2014 – 1/2015*

Responsible for over 1MM acres (7 Concessions) in the Polish Permian Basin. Drilled and tested two wells in Rawicz field, leading to field recoverable reserves of 50.3 Bscf. Reduction of per well costs by $1.9MM over 2 years. Progress full field development plan. Identification of significant on trend upside oil and gas prospects. Designed a 3 horizontal well work-over program in the largest gas field in Poland (Estimated 2P reserves of 210 Bscf and upside of 420 Bscf). Duties included:

- Propose and manage PNR/JV budgets and cash calls
- Liaise with Polish authorities, including Ministry, Mining Authority and Local Government
- Represent PNR with JV Partners (TCM/OCM meetings)
- Work closely with JV partners to build consensus on strategic business decisions

- Direct the execution of all operations within Poland
- Ensure PNR compliance with JVA reporting requirements
- Collaborated with stakeholders in field commercialization negotiations
- Ensured creation of data room and solicit capital investment from various banks
- Charged with directing Ryder Scott on work scope and delivery of Estimated Future Reserves and Income Report

Noble Energy, Inc., Denver, CO **9/2008 – 7/2014**

DJ Basin Business Unit, Prospect Development Team Lead, Sr Geologist *2/2012 – 7/2014*

Oversaw delivery of Development Plans that deliver budget production. Duties included:

- Project manage multidisciplinary technical team that identified, evaluated and progressed new drill prospects
- Build and manage Integrated Development Plans (DPs) that utilize cross functional teams
- Progressed IDPs through upper management approval and ensure validity of key assumptions and economic uplifts throughout the life of development
- Ensure effective analysis and preparation of IDPs, DPs and new drill prospects, including reserve adds, reservoir characterization, EUR projection, type curve application, GOR estimates, offset production review, execution strategy
- Managed the forecasting of IPs, EURs and initial cost estimates for new projects and establish project level economics
- Ensured application of best available completions, drilling, production and reservoir technologies to projects
- Select and prioritize the best projects based on BU strategy, ROR, risked ranked projects, and PUDs
- Delivered wells that contribute to corporate goal of 23% CAGR in 2014

Niobrara Integration Team, Geologist III *8/2010 – 2/2012*

Emphasis was to understand and mitigate key uncertainties for Niobrara and Codell. Focus on variation in well performance, basin stress anisotropy, seismic acquisition, appraisal program, optimizing completions, production facility consolidation, schedule and cost management. Compiled, evaluated and shared Niobrara horizontal key learnings and implemented best practices with the BU. Duties included:

- Charged with planning and acquisition of all horizontal petrophysical data
- Designed & executed an 8 well coring program to calibrate petrophysical model
- Developed Mechanical Earth Model program & regional stress maps for the field
- Lead geologist for Root Cause Analysis on mechanical well failures, coil tubing and frac complications
- Lead NIT geologist in design of first comprehensive downspacing test
- Creation of key NIT maps & criteria for picking horizontal well locations
- Responsible for determining target zone for all horizontal wells in the 10 rig program (up to 300 wells per year)
- Lead Geologist in selection of extended reach lateral locations
- Responsible for geologic recommendation on Non-Op participation in all horizontal wells
- Initiated production comparison study with NIT completions team leading to determination of target bench over Wattenberg High

Wattenberg Business Unit, Geologist II *4/2009 – 8/2010*

Oversaw vertical and horizontal operations of ~300 mi^2 area of Wattenberg Field. Including determining target formations, geosteering horizontal wells, completion intervals, petrophysical evaluation, correlation, fault picking, etc. The asset had a field wide drilling program of 500+ vertical and horizontal wells per year. Also collaborated on evaluation of new exploration targets within the greater Denver-Julesburg Basin. Duties included:

- Developed standardized workflow for pre-drill planning and post-drill deliverables for horizontal Niobrara and Codell wells that is still used in the DJ Basin BU and has been adopted by the Rockies BU.
- Conducted analysis of Greenhorn and Graneros, proposed three vertical exploration wells, designed and oversaw data acquisition program
- Worked with integrated team and vendors on acquisition design and interpretation of microseismic on 7 vertical wells

Mid Continent Business Unit, Geologist II *9/2008 – 4/2009*
In charge of planning and geosteering 6 horizontal wells in the Upper Pennsylvanian Cleveland Tight Gas Sandstone. Designed coring program for first pilot hole in the Shattuck Field, Ellis County, Oklahoma. Duties included:
- Pre-drill planning & post-drill geologic interpretation of horizontal wells
- Geologic testimony at Oklahoma Corporation Commission
- Select and prioritize packer placement in laterals
- Collaborate in development of Mechanical Earth Model
- Research drilling reports for wellbore stability issues related to Marmaton Shale
- Design of multiple sidetracks with Drilling Engineer

BP America, Inc., Houston, TX **8/2007 – 9/2008**
North America Gas Reserves and Renewal, Geologist
Carried out basin scale evaluation of shale gas resources. Work formed foundation of basin ranking based on potential. Development of standardized workflow approach to shale gas evaluation. Calibration of workflow in basins with substantial production. Areas of work included Arkoma & Anadarko Basins, OK, Permian & Ft. Worth Basins, TX and Alberta Basin, Canada.

Pathfinder Exploration, Norman, OK **2/2004 – 5/2005 & 8/2005 – 8/2007**
Geologist, GeoTech
Involved in planning and drilling of 5 wells. Delivered an 8 well drilling program in Arkansas and Oklahoma in 4Q '05.

Marathon Oil Company, Houston, TX **5/2005 – 8/2005**
Alaska Asset Team, Geologic Intern
Project: Swanson River Field, Alaska. Work formed basis of a recommendation for a gas storage project and potential field extension.

EDUCATION

MS Geology 2007. University of Oklahoma, Norman, OK.
Thesis: Comprehensive characterization of a core from an over-mature Woodford Shale in LeFlore County, Oklahoma and comparison with data from other studies of the Woodford Shale across the Arkoma Basin.

BS Petroleum Geology 2004. University of Oklahoma. Norman, Oklahoma.

SOFTWARE SKILLS

Power user for Petra, MS Office suite, Petrel, Oracle, Access, Geolog, Petrosys (dbMap), UNIX and Zmap. Competent user for ArcGIS, Techlog, GeoFrame, Spotfire, Seisworks, BasinMod and Kingdom 3D. Familiar with Wellspring, PEEP, Aries, and Fekete.

OTHER ACTIVITES/ACCOMPLISHMENTS/MEMBERSHIPS

- Field trip leader for Wattenberg Field Operations course at 2015 AAPG Annual Convention
- Geology Mentor of the Year – 2014 Noble Tech Conference
- Business Innovation Award for Integrated Development Plan Process – 2014 Noble Tech Conference
- Noble Energy Lead Campus Recruiter University of Oklahoma 2009 - 2014
- Charity Coordinator Noble Activity Committee 2010 – 2014

Boyd McMaster

PROFESSIONAL EXPERIENCE

Extraction Oil and Gas, LLC — Denver, CO
Asset Planner — 11/2014 - present

- Lead multifunctional team that prepared comprehensive development plan for 40,000 GMA acquisition in urban/urbanized area, including interfacing with local governments, developers and community groups
- Participated in the development of midstream strategy for core and non-core assets, located in and around Windsor and Greeley, Colorado

Noble Energy, Inc. — Denver, CO
Major Projects Planning Lead — 4/2014 – 11/2014
Planning Engineer — 2/2013 – 4/2014

- Evaluate and analyze midstream projects needed to support horizontal drilling in Colorado DJ Basin
- Assist with initiative to monetize existing midstream infrastructure, including economic analysis, forecasts, fee calculations and implementation in preparation of converting into MLP.
- Lead and chair multi-functional teams; Prepare economics evaluations of integrated development plans for team and management review; assist in preparation of schedules, risk matrices and mitigation plans
- Prepare annual and long term forecasts and budgets for integrated development plans encompassing large geographic areas (70,000 to 150,000 GMA / 1,000 to 1,600 horizontal wells)

PDC Energy, Inc. — Denver, CO
Petroleum Engineer II — 10/2010 – 02/2013

- Identify and evaluate DJ Basin wells for re-frac and re-completions, prepare cost estimates and AFEs, track and analyze post operation performance; coordinate with land, field and regulatory personnel to execute over 75 projects in less than six (6) months under projected costs
- Use *Aries*, IHS Enerdeq and other data to evaluate well proposals from operators; track daily operations, cost and performance; prepare and track $30MM budget
- Lead engineer for evaluating and monitoring non-operated wells; identifying and capturing revenue from non-operated wells, as well improving internal process for communicating with and obtaining technical data from operators
- Review, evaluate and provide engineering support for workovers for PDC's Northeastern Colorado shallow gas fields; maintained, and in some cases reduced, lease operating expenses and workover expenses

Grey Bear, Inc. — Denver, CO
Owner — 07/2009 – 10/2010

- Consulted as engineer for EnCana with respect to salt water disposal pilot program initiated during employment with Berry Petroleum Company for Piceance Basin
- Performed due diligence of operator's records in preparation of potential acquisition
- Reviewed operator's lease records in preparation of re-development operations and divestiture

Berry Petroleum Company — Denver, CO
Senior Production Engineer — 09/2008 – 04/2009

- Review well production history and identified optimization opportunities and solutions for reducing corrosion and scaling problems

- Evaluate water production composition and history and identified strategies and options for managing flow-back and production water to reduce development costs in Piceance Basin
- Prepared RFP and evaluated proposals from chemical vendors for the treatment and prevention of corrosion, scaling and bacteria issues in wells, production facilities and pipelines.

Enerplus Resources (USA) Corporation Denver, CO
Production Engineer 2006 – 2008

- Initially employed as contract employee through Iron Creek Energy Group, LLC (Cody, Wyoming) to facilitate the transfer of the Elm Coulee field from Lyco Energy Corporation to Enerplus; offered and accepted permanent position with approval of Iron Creek
- Executed $110 million dollar budget that included completing 63 gross wells; refracing 24 gross wells and scheduling operations for 7 workover rigs; increased gross production from 12,923 BOEPD to 15,852 BOEPD
- Collaborated in development of completion and frac designs, workover techniques, IOR pilot and reviews of S.C.A.D.A system, chemical program and water source/disposal options
- Continuous review of Bakken horizontal well performance to identify re-stimulation and optimization candidates and lift repairs, as well as infill development opportunity
- Prepared workover procedures, AFEs, economic and technical well evaluations using IHS *PowerTools* evaluation software
- Assist development engineers in technical and economic evaluations of wells, including production forecasting for reserves and marketing
- Assisted in planning, implementation and review of capital and operating expenses
- Participated in technical review of performance of wells and comparison with field data

CBM Associates, Inc. Gillette, WY
Operations Manager/General Counsel 2005 – 2006

- Supervised 60+ people engaged in providing environmental and plan of development services to operators in the Powder River Basin
- Reviewed and provided analysis to operators regarding options for handling water produced from CBNG development, including developing federal plans of development for operator clients

Black Diamond Energy, Inc. Gillette, WY
General Counsel/Project Manager 2004 – 2005

- Coordinated and participated in the preparation, planning, and development of 100+ (gross) coal bed methane wells in Powder River Basin, including the formation of multiple federal exploratory units
- Prepared applications and oversaw expert testimony for various spacing, commingling and protests of applications before Wyoming Oil and Gas Commission
- Provided technical support and prepared documentation for acquisition of oil and gas properties
- Supported management in the reviewing of leases, contracts, and other legal documents, as well as including reviewing leases, contracts and other legal documents, as well as providing litigation support

McMaster & Fuller Law Offices, P.C. Gillette, WY
Principle/Attorney 2001 – 2004

- Led a law practice focused on natural resources, business litigation and transactions, bankruptcy and other commercial matters; worked for mid-size and small independent exploration and production companies, as well as small independent service providers
- Prepared and oversaw prosecution of applications and protests before Wyoming Oil and Gas Commission
- Performed due diligence and legal advice of oil and gas acquisitions
- Prepared drilling title opinions and division title opinions for oil and gas properties

EDUCATION

University of Wyoming College of Law — Laramie, WY
Juris Doctorate — Degree, 05/1996

University of Wyoming — Laramie, WY
Bachelor of Science in Mechanical Engineering — Degree, 05/1993

PROFESSIONAL MEMBERSHIPS

Society of Petroleum Engineers
Colorado Bar Association
American Association of Petroleum Landmen
Wyoming Bar Association

CONTINUING EDUCATION & PROFESSIONAL DEVELOPMENT

- Oil and Gas Economics and Uncertainty
- RMAG's Source Rocks 101
- IADC WellCap Well Control Training
- Theta Oilfield Services Rod Pumping Optimization
- Echometer Gas Deliquification Seminar
- Halliburton Rocky Mountain Cementing School
- Gopher Advanced Fracturing Design Theory & Model Introduction Course
- Severed Mineral, Split Estates, Rights of Access and Surface use in Mineral Extraction Operations
- Oil & Gas Agreements: the Exploration Phase

BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF 8 NORTH, LLC, FOR AN ORDER TO ESTABLISH AN APPROXIMATE 1,600-ACRE DRILLING AND SPACING UNIT FOR SECTIONS 9, 16 & N½ of 21, TOWNSHIP 10 NORTH, RANGE 59 WEST, 6TH P.M., AND AUTHORIZE THE DRILLING OF TWELVE HORIZONTAL WELLS WITHIN THE PROPOSED UNIT, FOR PRODUCTION FROM THE CODELL, FORT HAYS, CARLILE, AND NIOBRARA FORMATIONS, UNNAMED FIELD, WELD COUNTY, COLORADO	)	CAUSE NO. 535 DOCKET NO. 180600473 TYPE: Spacing

REQUEST FOR RECOMMENDATION OF
APPROVAL OF APPLICATION WITHOUT A HEARING

8 North, LLC ("8 North" or "Applicant"), by and through its undersigned attorneys, Poulson, Odell & Peterson, LLC, hereby requests, pursuant to Rule 511.a. of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission, the Director to recommend approval of the verified amended application ("Application") filed herein without a hearing.

Applicant requests that the Application be approved based on: (1) the merits of the Application, and (2) the attached sworn written testimony with supporting exhibits which support the relief requested in the Application. There are no protests or applications presently pending against the Application.

WHEREFORE, Applicant requests the Application be approved without a hearing and on the merits of the Application and sworn testimony with supporting exhibits as provided for by Rule 511.a.

DATED this 11th day of July, 2018.

8 NORTH LLC

By: _____

Robert A. Willis
Poulson, Odell & Peterson, LLC
1775 Sherman Street, Suite 1400
Denver, CO 80203
(303) 264-4418 - direct

8NORTH

Cause No. 535
Docket No. 180600473

Rule 511 written submission in support of uncontested Application requesting an order establishing an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorizing the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

8 North, LLC

Sean Flanagan – Land Testimony
Cause No. 535, Docket No. 180600473

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 and 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Sean Flanagan and I am currently Landman for 8 North, LLC ("8 North"). I graduated from Fort Lewis College with a Bachelor of Arts degree in Business Administration. I have over 11 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein. My resume/c.v. is attached to this submission. See Appendix.

In support of the Application, I am submitting two exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order: (1) amending Order No. 535-748 to establish an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, and (2) maintaining allocation of payment of proceeds for the Pawnee 16-13H well drilled within Section 16, Township 10 North, Range 59 West, 6th P.M., for production from the Niobrara Formation. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit L-1

Exhibit L-1 is an overhead map which shows the location of the Application Lands within Weld County, Colorado.

2. Exhibit L-2

Exhibit L-2 is a map that provides a closer view of the Application Lands and shows 8 North's leasehold positions in the Application Lands. 8 North owns substantial working interest / operating rights in these leases for the Codell, Fort Hays, Carlile, and Niobrara Formations.

Testimony

8 North owns substantial leasehold interests underlying the Application Lands, which include working interests / operating rights for the Codell, Fort Hays, Carlile, and Niobrara Formations. As of the date of this testimony, 8 North has not received any notice of objection or protest to the Application.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

DATED this 9TH day of July, 2018.

Sean Flanagan, Landman
8 North, LLC

VERIFICATION

STATE OF COLORADO)
) ss.
CITY & COUNTY OF DENVER)

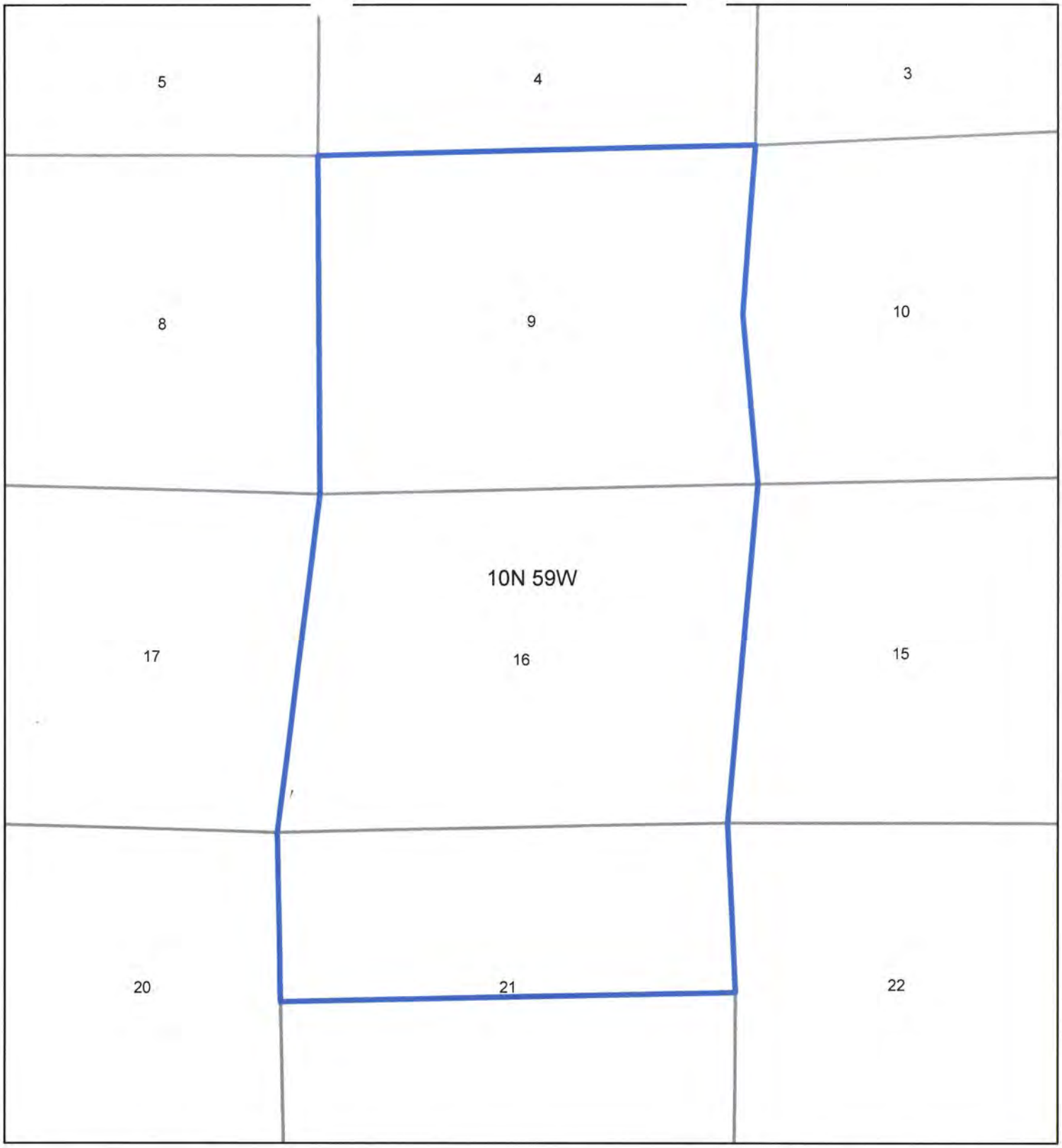
The foregoing instrument was subscribed and sworn to before me this 9th day of July, 2018, by Sean Flanagan, Landman for Extraction Oil & Gas, LLC.

Witness my hand and official seal.

My Commission expires: 1/4/21

ANNE MICHELLE PIERINI
Notary Public
State of Colorado
Notary ID # 20124036744
My Commission Expires 01-04-2021

Notary Public



8NORTH

EXHIBIT L-1

T10N R59W Sec: 9

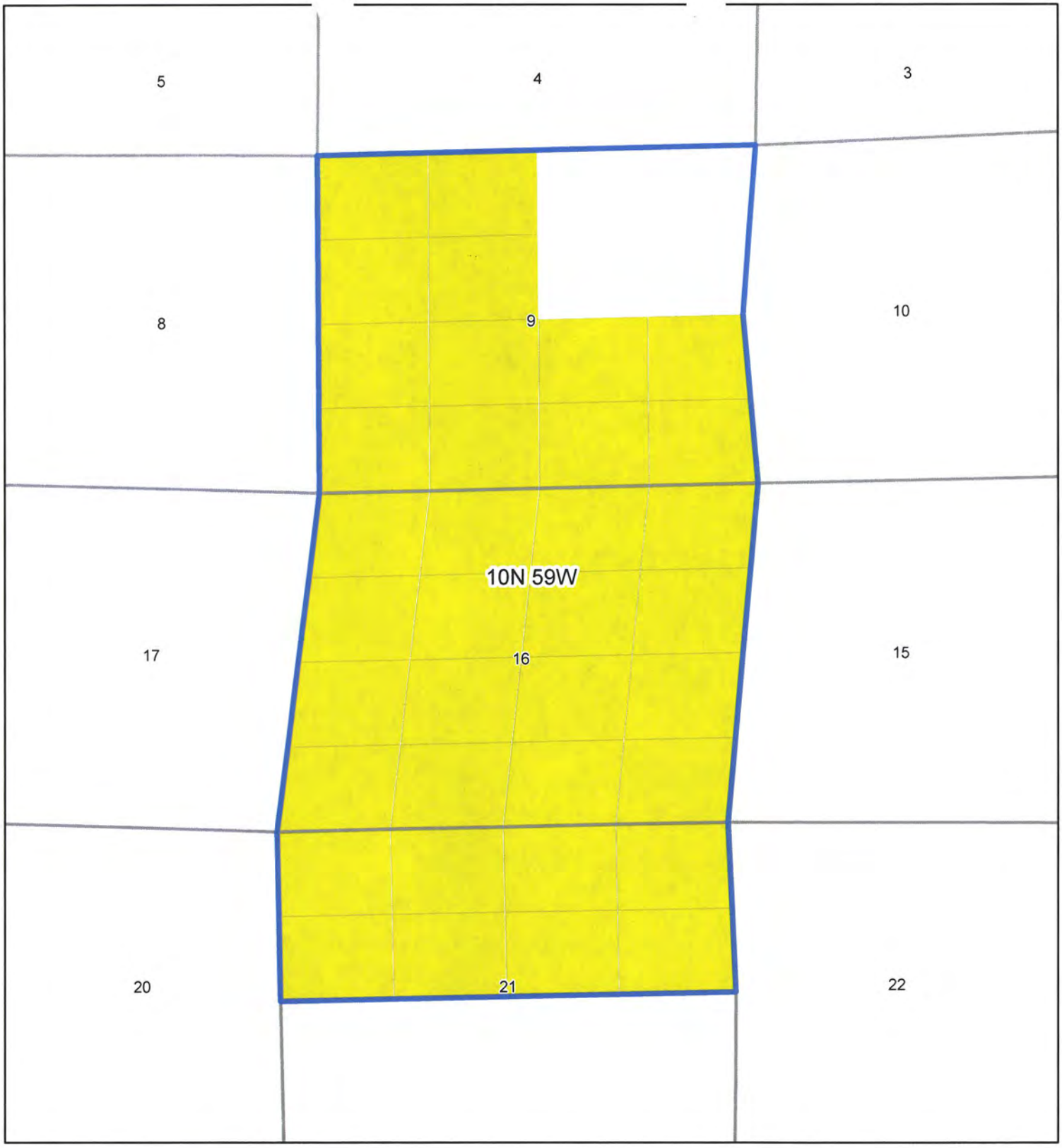
Scale:1:24,000	PRJ:GCS NAD83
Date: 7/10/2018	Author: ECP

Legend

Proposed Spacing Unit

1 inch = 2,000 feet

0 500 1,000 2,000 3,000 4,000 Feet



8 NORTH

EXHIBIT L-2

T10N R59W Sec: 9

Scale:1:24,000	PRJ:GCS NAD83
Date: 7/10/2018	Author: ECP

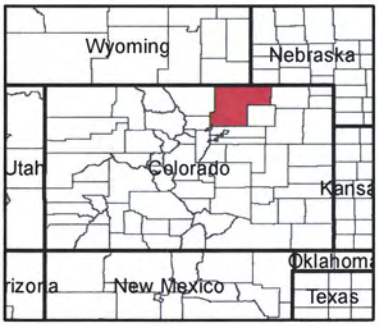
Legend

Proposed Spacing Unit

XOG Leasehold

1 inch = 2,000 feet

0 500 1,000 2,000 3,000 4,000 Feet



8 North, LLC

Alicia Branch – Geologic Testimony
Cause No. 535, Docket No. 180600473

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 and 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Alicia Branch and I am currently employed as Geologist for 8 North, LLC ("8 North"). I received a Bachelor of Science degree in Petroleum Geology from the University of Oklahoma in 2005, and Master of Science degree in Geology from the University of Oklahoma in 2007. I have over 15 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein. My resume/c.v. is attached to this submission. See Appendix.

In support of the Application, I am submitting nine exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order: (1) amending Order No. 535-748 to establish an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, and (2) maintaining allocation of payment of proceeds for the Pawnee 16-13H well drilled within Section 16, Township 10 North, Range 59 West, 6th P.M., for production from the Niobrara Formation. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit G-1 – Offset Well Locations

   Exhibit G-1 shows existing well locations on the Application Lands and surrounding area. These wells have been drilled on (or very near) the Application

lands. The geological cross section (Exhibit G-9) is designated as W-E on this map.

2. Exhibit G-2. Codell Structure Map (-TVDSS)

   Exhibit G-2 is a subsea true vertical depth structure map constructed on the top of the Codell Formation. The regional dip for the Codell Formation underlying the Application Lands is approximately 0.27 degree up-dip to the northeast or approximately 24 feet per mile.

3. Exhibit G-3. Niobrara Structure Map (-TVDSS)

   Exhibit G-3 is a subsea true vertical depth structure map constructed on the top of the Niobrara Formation. The regional dip for the Niobrara Formation underlying the Application Lands is approximately 0.28 degree up-dip to the northeast approximately 27 feet per mile.

4. Exhibit G-4. Codell Isopach Map

   Exhibit G-4 is an isopach map of the total thickness of the Codell Formation. Total thickness of the Codell Formation underlying the Application lands ranges 15 to 17 feet.

5. Exhibit G-5. Niobrara Isopach Map

   Exhibit G-5 is an isopach map of the gross productive thickness of the Niobrara Formation. This thickness excludes the Fort Hayes and D Lime. The gross productive thickness of the Niobrara underlying the Application Lands ranges from 295 to 300 feet.

6. Exhibit G-6 – Fort Hays Isopach Map

   Exhibit G-6 is an isopach map of the total thickness of the Fort Hays Formation. Total thickness of the Fort Hays Formation underlying the Application lands ranges 20 to 22 feet.

7. Exhibit G-7. Carlile Isopach Map

   Exhibit G-7 is an isopach map of the total thickness of the Carlile Formation. Total thickness of the Carlile Formation underlying the Application lands ranges 42 to 54 feet.

8. Exhibit G-8. Type Log

Exhibit G-8 shows a vertical well log through the Codell, Niobrara, Fort Hays, and Carlile Formations on (or very near) the Application Lands. The well log is from Chalk Bluffs 36-13H Pilot, located in the NWSW T10N-R60W S36. Niobrara A, B and C chalks, the Codell Sandstone, the Fort Hays Limestone, and the Carlile Marl are present in the well and should be encountered underlying the Application Lands. The type log illustrates that the Codell Formation underlying the Application Lands will likely consist of a sandstone and the Niobrara Formation under the Application Lands will consist of an alternating sequence of chalks and marls. The log also shows that the Fort Hays underlying the Applications Lands will consist of limestone, and the Carlile Formation will consist of marl.

9. Exhibit G-9. Correlation Cross Section

Exhibit G-9 shows a shows a stratigraphic cross section, flattened on the top of the Niobrara A Marl, across the proposed drilling and spacing unit. This cross section represents the vertical distribution of the Codell sandstone and the chalk benches within the Niobrara, commonly referred to as the A, B, C and D Chalks, as well as the Fort Hayes member and Carlile marl. The cross section shows that the Codell sandstone and the A, B and C chalk benches of the Niobrara Formation are present in potentially productive thicknesses under the proposed drilling and spacing unit.

Conclusions

The Codell and Niobrara Formations were deposited in the Western Interior Seaway during Cretaceous time. This seaway was vast in extent and covered much of present day North America from the Gulf of Mexico north to the Arctic.

These rocks were deposited as shallow water sediments and underlie most of the DJ Basin in parts of northeastern Colorado, southeastern Wyoming and southwestern Nebraska. The Codell and Niobrara Formations exist under the entirety of the Application Lands and are a common source of hydrocarbon production.

The Codell Formation is a shallow marine tight-sandstone reservoir. Permeability of the reservoir as characterized by published data ranges between 0.05-0.005 md and this is offered as characterization for the Codell reservoir under the Application Lands.

The Niobrara formation is both a hydrocarbon source rock and a reservoir. Permeability of the reservoir, as characterized by published data, is less than 0.001 md and this is offered as characterization for the Niobrara reservoir under the Application Lands.

The Fort Hays Formation is composed of limestone and lies between the Codell and Niobrara Formations and is an uneconomic target for drilling today. The Carlile Formation is a clay-rich shale underlying the Codell Formation and is not a target due to high water saturation. The Fort Hays and Carlile Formations underlie the entirety of the Application Lands in varying thicknesses. Both Fort Hays and Carlile Formations may be encountered during drilling and, thus, are included in the spacing application.

Affirmation

The matters described herein were all conducted under my direction and control. To the best of my knowledge and belief, all the matters set forth herein, my testimony and the exhibits are true, correct and accurate.

Dated this 9th day of July, 2018.

Alicia Branch
Geologist
Extraction Oil & Gas, Inc.

VERIFICATION

STATE OF COLORADO)
) ss.
CITY AND COUNTY OF DENVER)

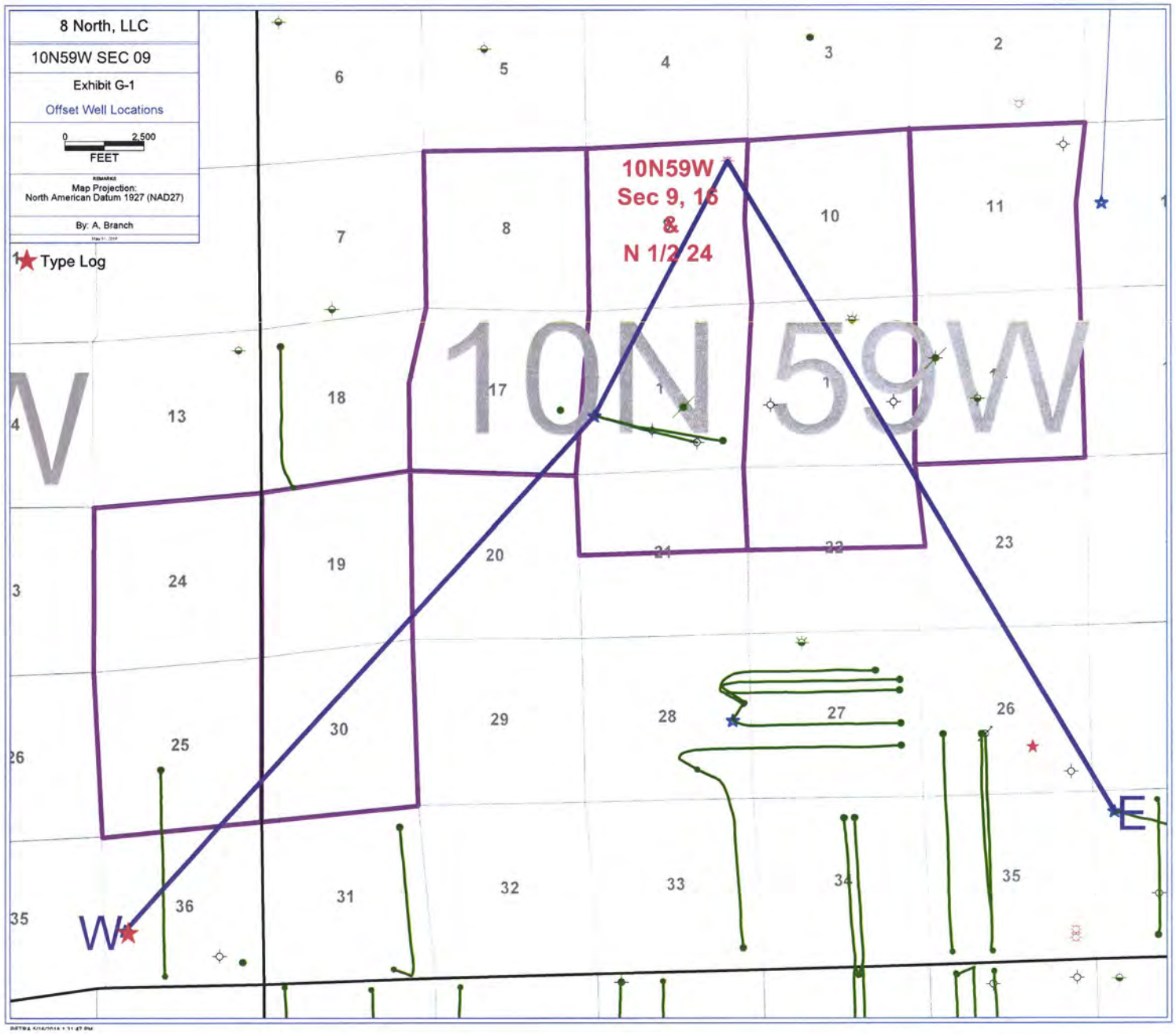
The foregoing instrument was subscribed and sworn to before me on this 9th day of July, 2018, by Alicia Branch, Geologist for Extraction Oil & Gas, Inc.

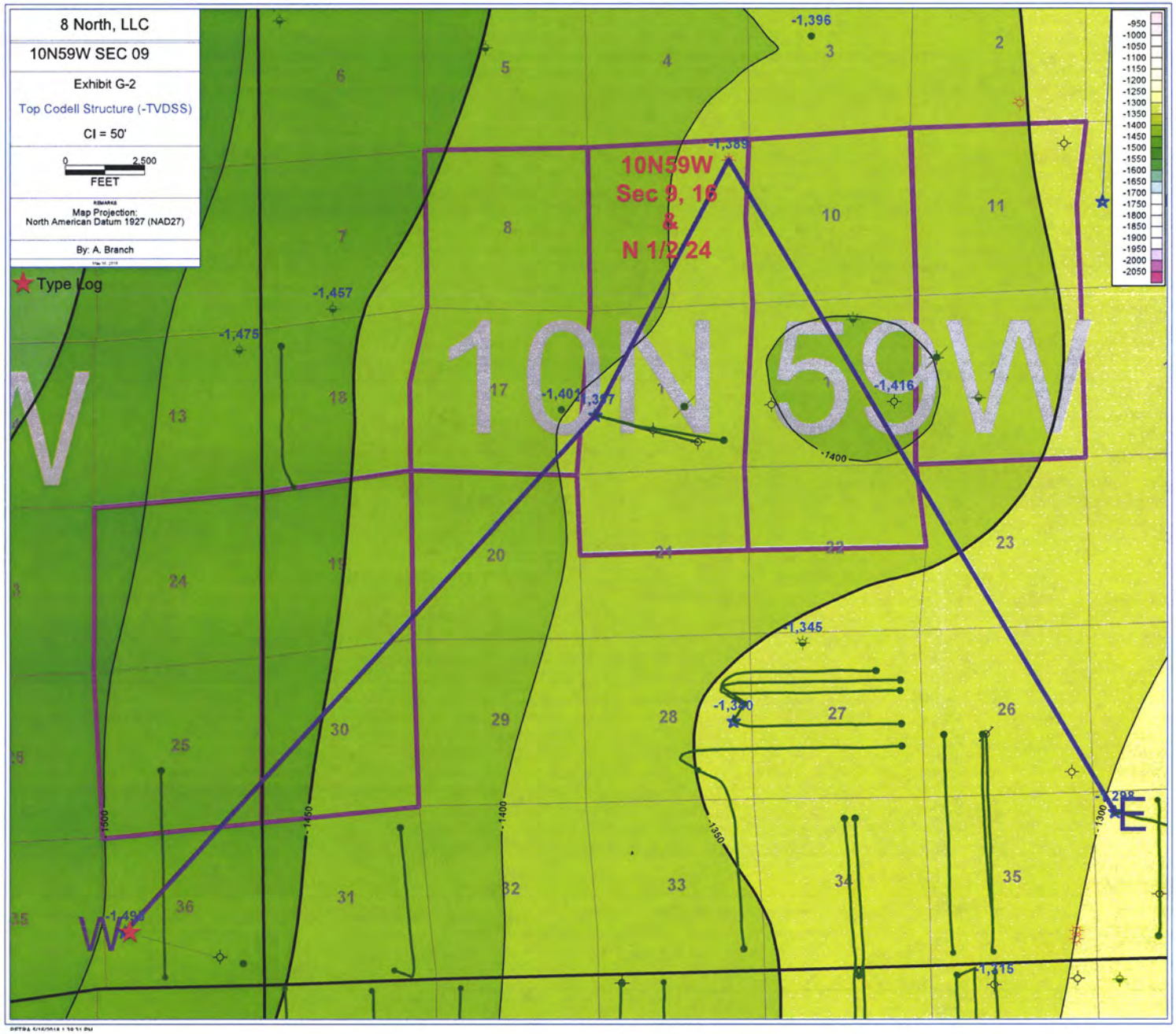
Witness my hand and official seal.

My commission expires: 1/18/2022.

ANGELA CHRISTINE NICKEL
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20184003200
MY COMMISSION EXPIRES JANUARY 18, 2022

Notary Public


8 North, LLC
10N59W SEC 09
Exhibit G-1
Offset Well Locations
0 2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-2
Top Codell Structure (-TVDSS)
CI = 50'
0 2,500
FEET
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
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-1,475
-1,401
-1,377
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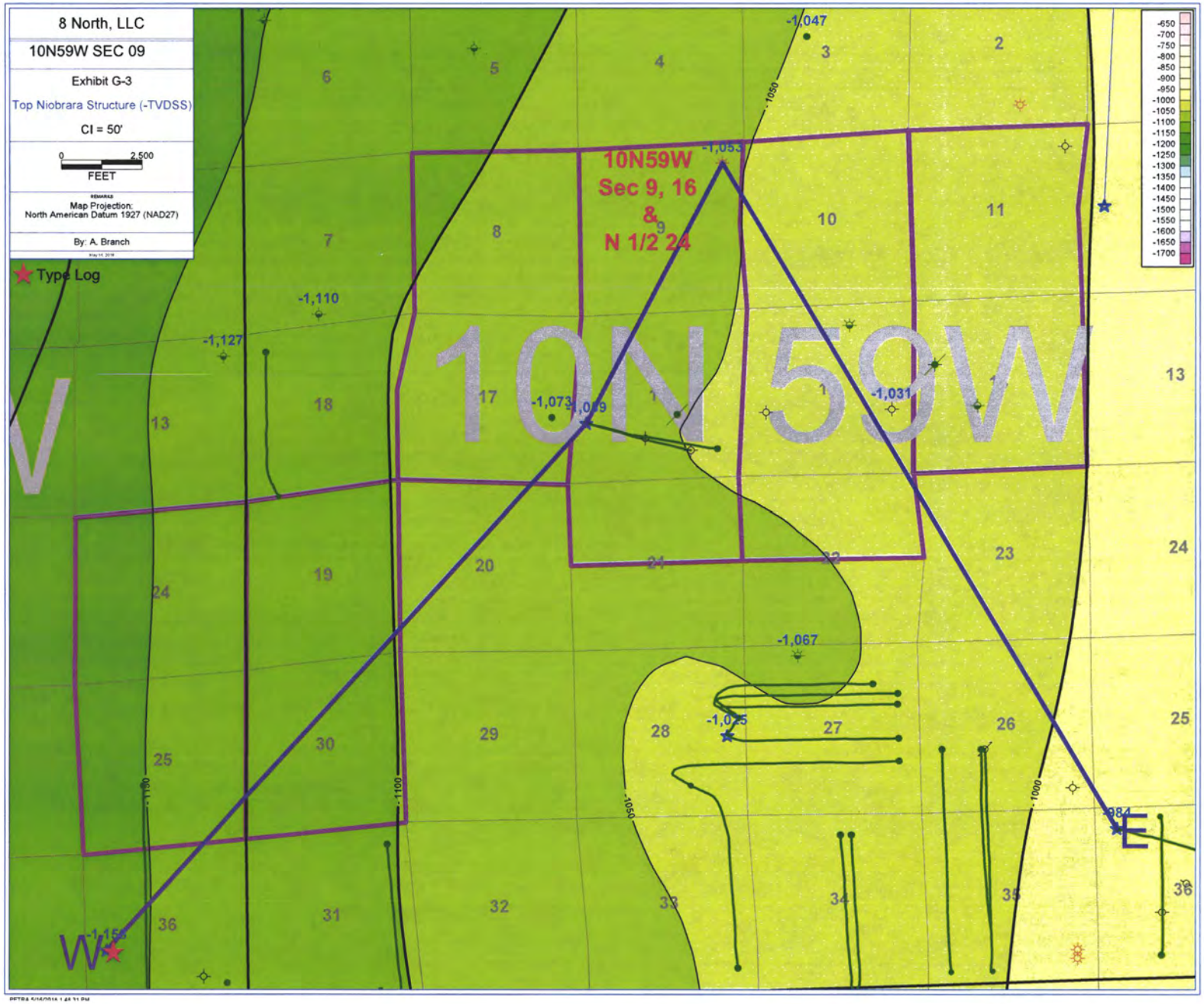
8 North, LLC
10N59W SEC 09
Exhibit G-3
Top Niobrara Structure (-TVDSS)
CI = 50'
0
2,500
FEET
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N59W
-1,047
-1,053
-1,110
-1,127
-1,073
-1,069
-1,031
-1,067
-1,025
-984
-1,156
-650
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-900
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-1000
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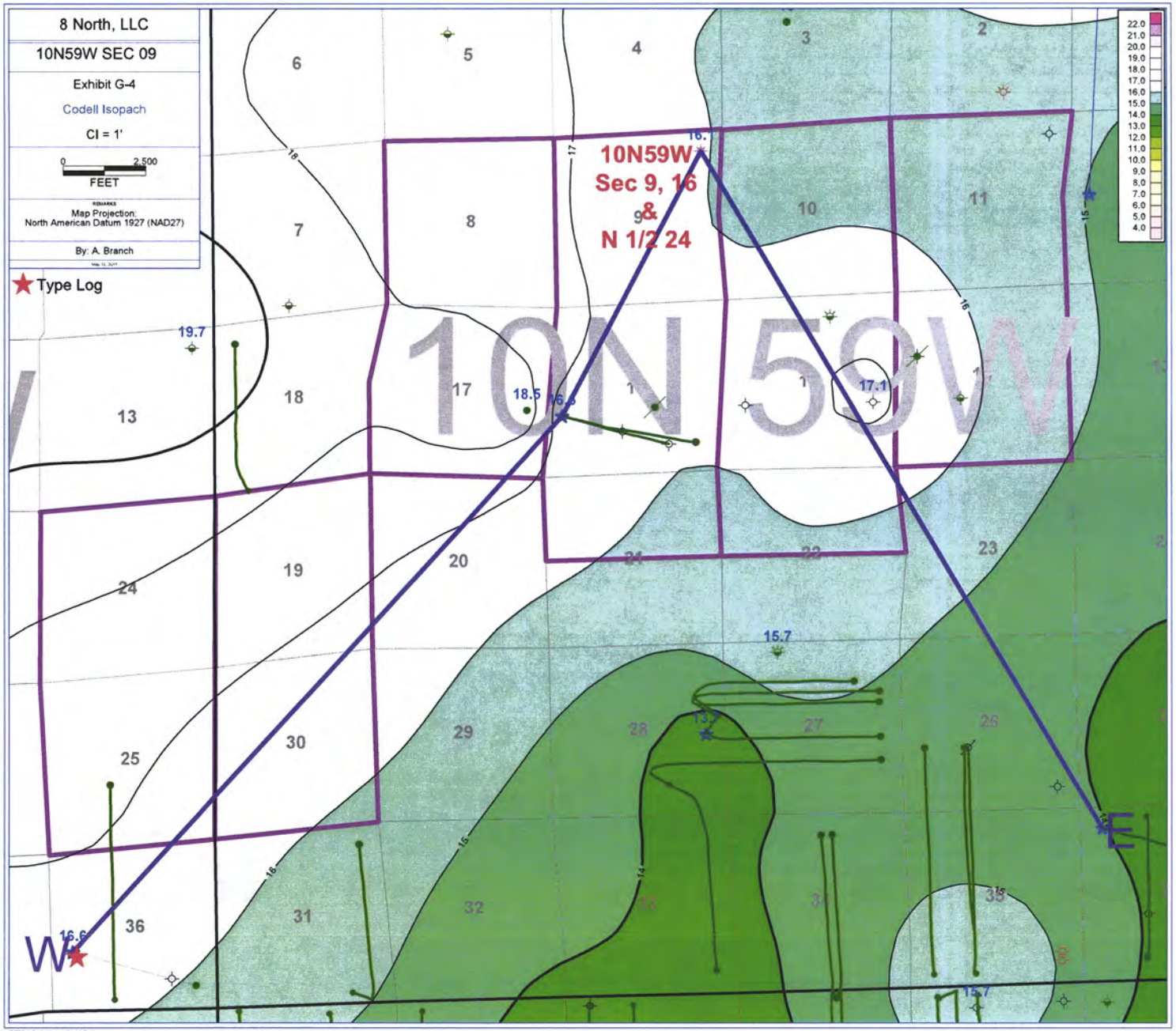
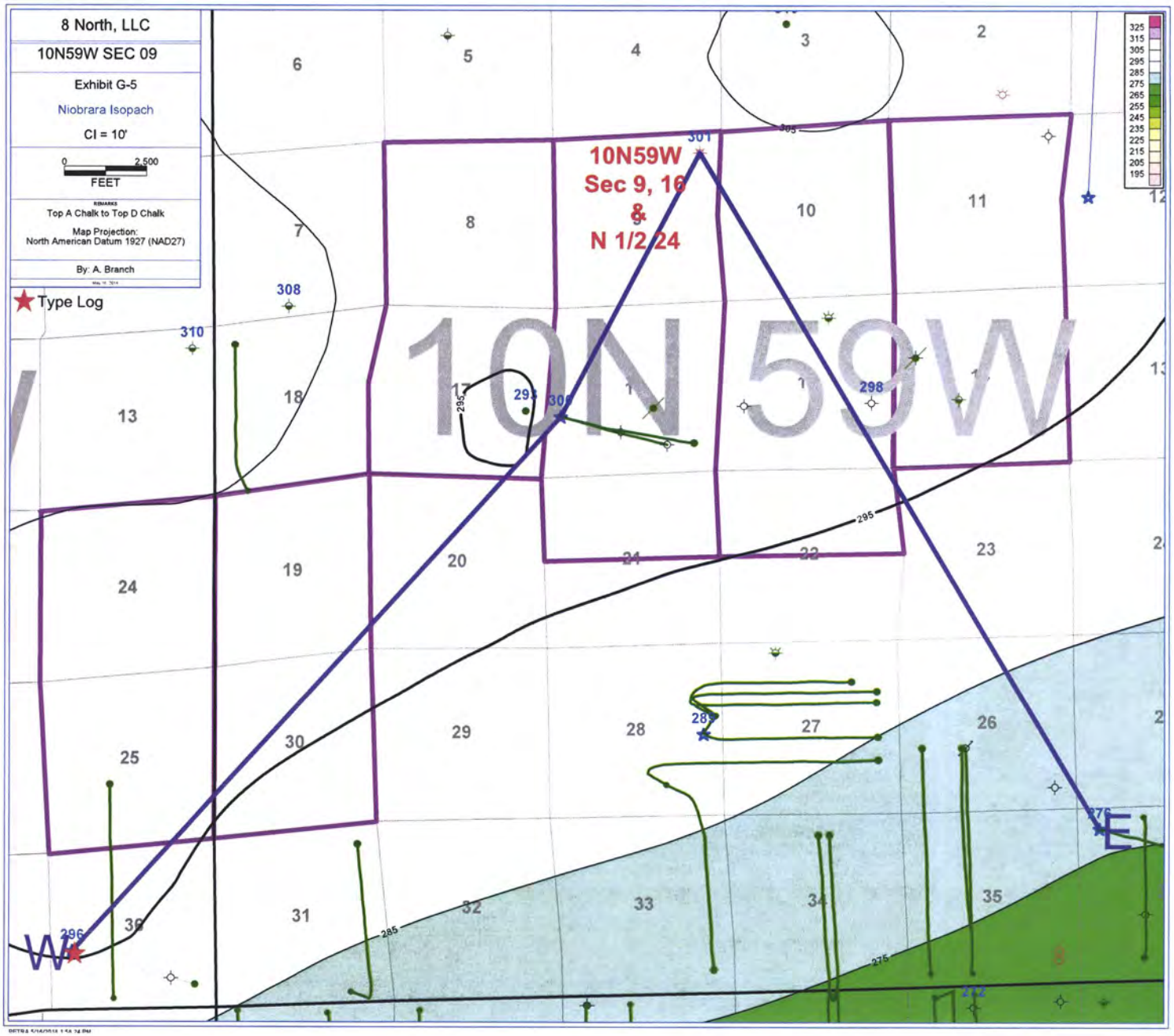
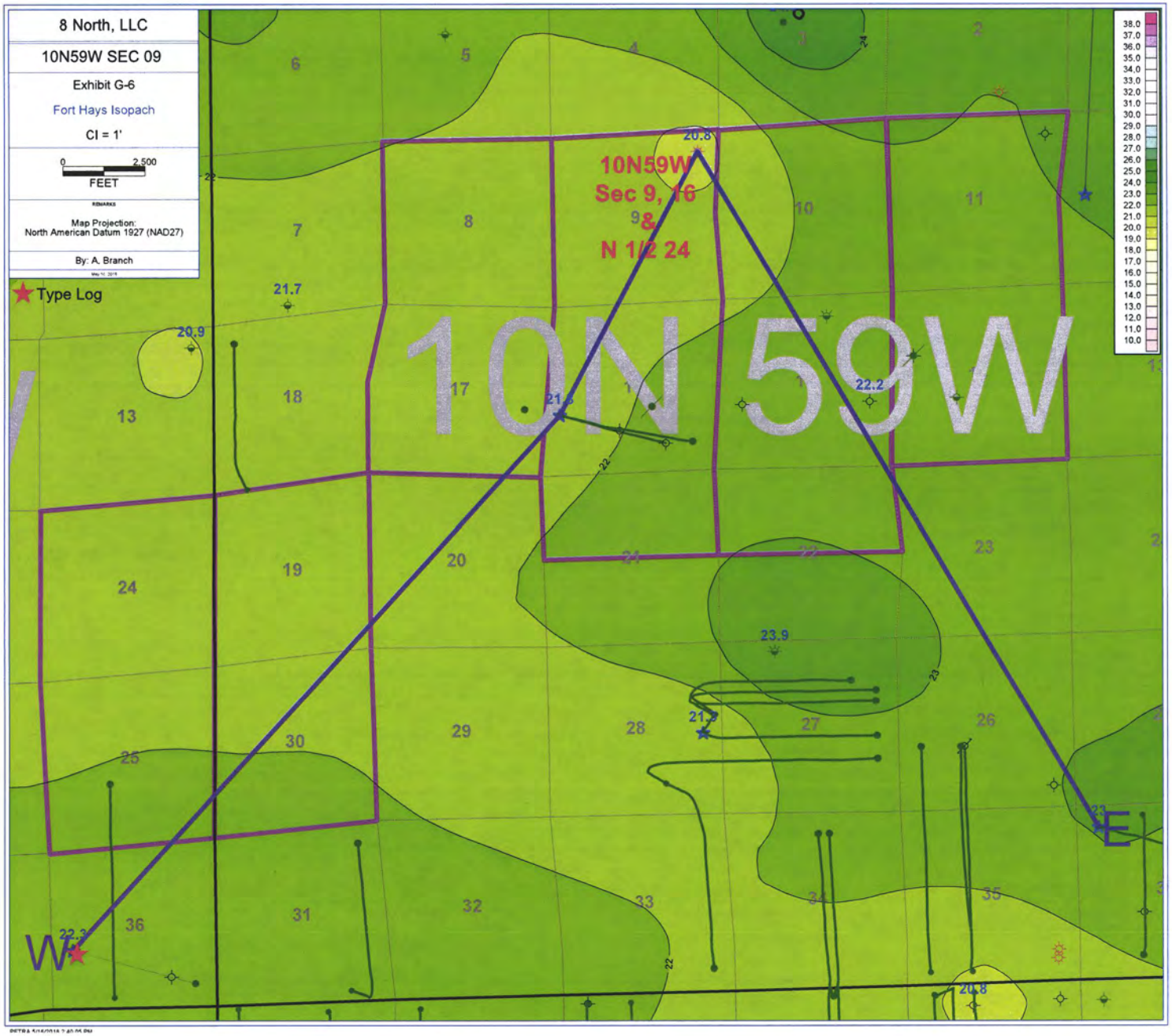
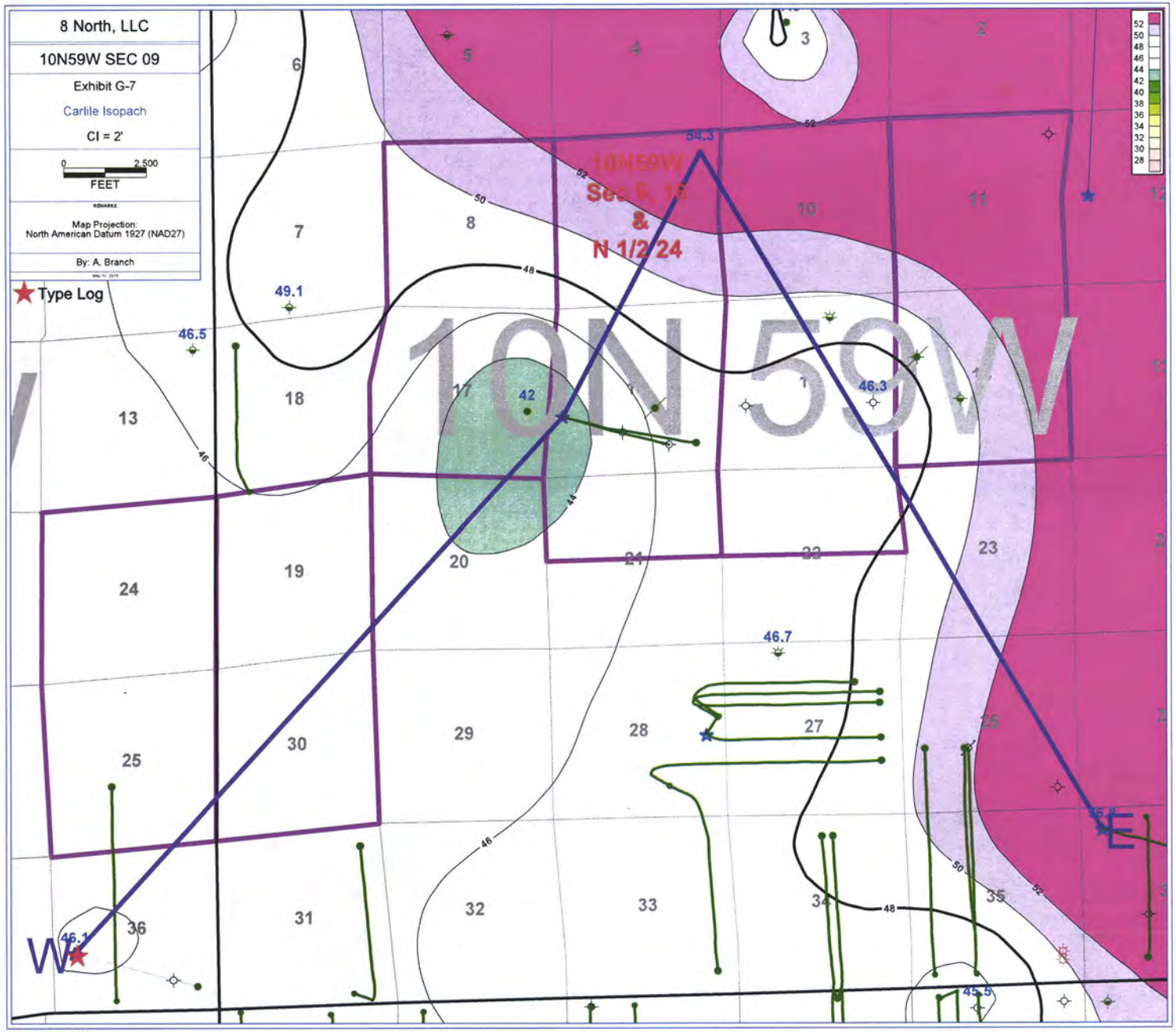

8 North, LLC
10N59W SEC 09
Exhibit G-4
Codell Isopach
CI = 1'
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
19.7
18.5
17.1
15.7
16.6
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-5
Niobrara Isopach
CI = 10'
0 2,500
FEET
REMARKS
Top A Chalk to Top D Chalk
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
325
315
305
295
285
275
265
255
245
235
225
215
205
195
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-6
Fort Hays Isopach
CI = 1'
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
9 &
N 1/2 24
10N 59W
20.8
21.7
20.9
22.2
23.9
22.3
W
E


8 North, LLC
10N59W SEC 09
Exhibit G-7
Carlile Isopach
CI = 2'
0
2,500
FEET
REMARKS
Map Projection:
North American Datum 1927 (NAD27)
By: A. Branch
Type Log
10N59W
Sec 9, 16
&
N 1/2 24
10N 59W
54.3
49.1
46.5
46.3
42
46.7
46.1
45.5
W
E
1
2
3
4
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6
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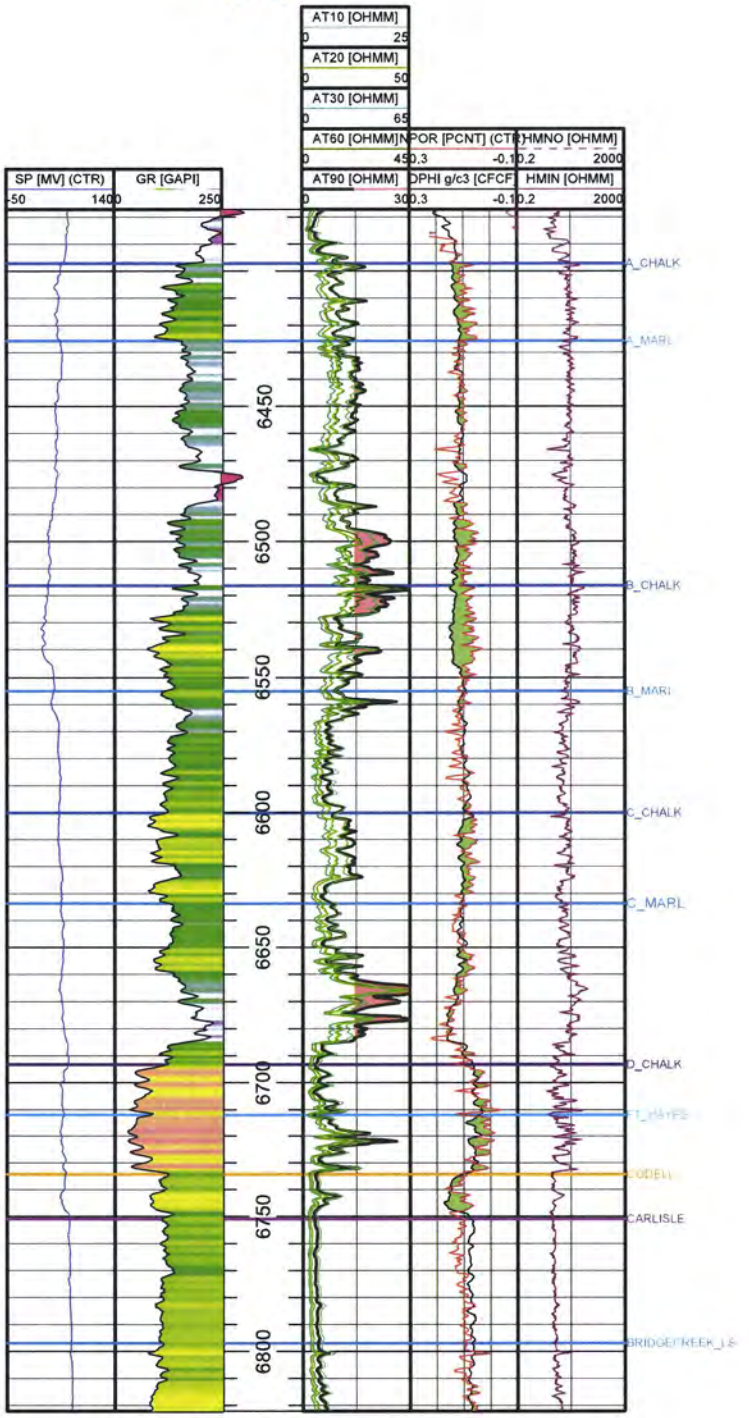
CHALK BLUFFS 36-13H PILOT

05123324880000

T10N R60W S36



TD : 7,491

8 North, LLC
10N59W SEC 09
Geology Exhibit G-8
Type Log
Deep Resistivity filled >15 Ohmm
By: A. Branch
May 16,2018 2:53 PM

PETRA 5/16/2018 2:53:07 PM (NoCo 10N59W Type Log Geology Exhibit G8.CSP)

W

E

Type Log

CHALK BLUFFS 36-13H PILOT
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T10N R60W S36

PAWNEE 16-13H PILOT
05123324930000
T10N R59W S16

HILLMAN 9-1
05123317440000
T10N R59W S9

TERRACE 36-11H PILOT
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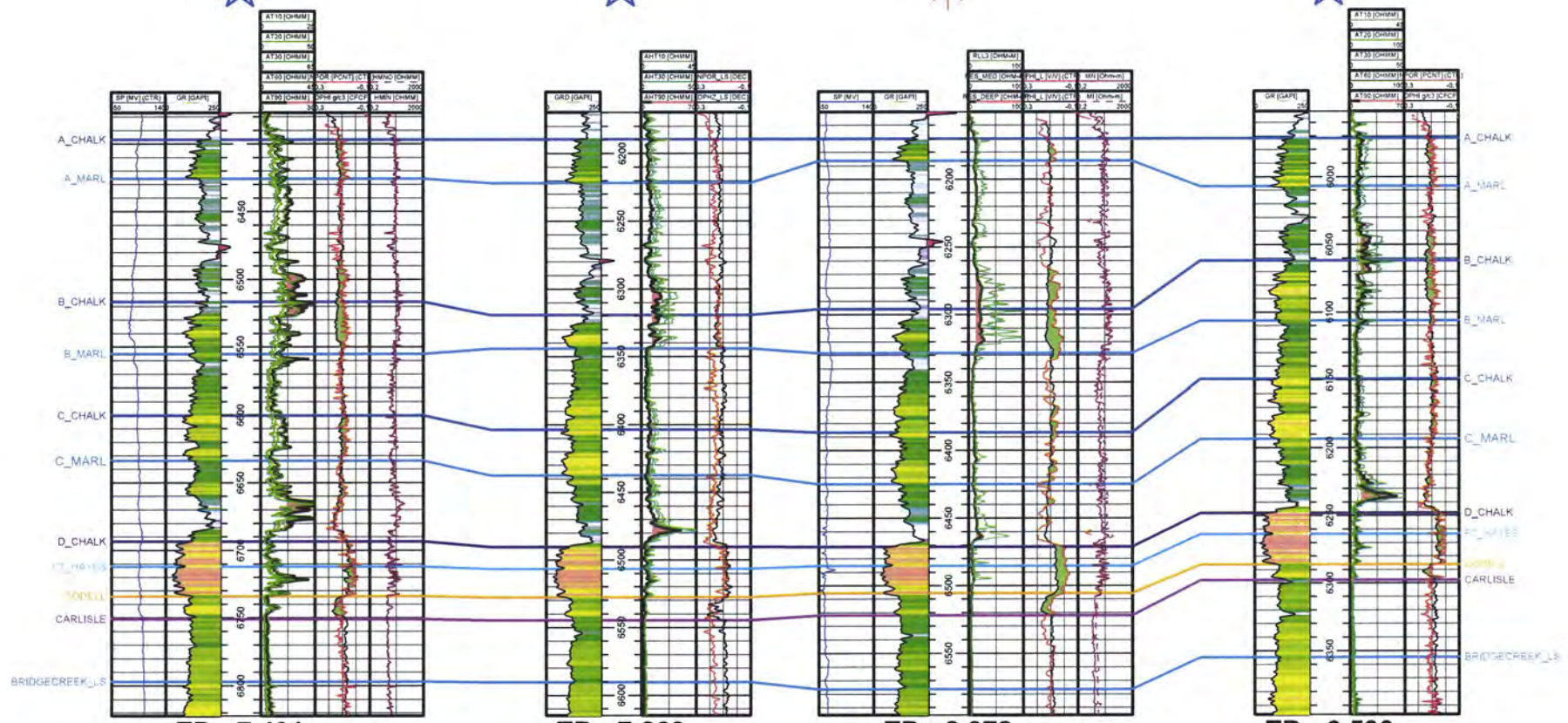


TD : 7,491

TD : 7,263

TD : 8,378

TD : 6,590

8 North, LLC
10N59W SEC 09
Geology Exhibit G-9
Correlation Cross-Section
Deep Resistivity filled >15 Ohmm
By: A. Branch
May 16,2018 2:49 PM

PETRA 5/16/2018 2:49:31 PM (NoCo 10N59W Correlation Cross Section Geology Exhibit G9.CSP)

8 North, LLC

Boyd McMaster – Supplement to Engineering Testimony, dated July 10, 2018
Cause No. 535, Docket No. 180300199

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 & 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Boyd McMaster and I am currently employed as Petroleum Engineer for 8 North, LLC ("8 North"). I received a Bachelor of Science degree in Mechanical Engineering from the University of Wyoming in 1993, and a Juris Doctorate of Law from the University of Wyoming in 1996. I have over 20 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein.

In support of the Application, I am submitting four exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order establishing an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorizing the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, without exception being granted by the Director. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit E-1

Exhibit E-1 is a composite decline curve based on the production performance of adjacent Codell and Niobrara Formation 2-½ mile lateral horizontal wells. The decline curve is representative of the anticipated production from an average 2-½ mile horizontal Codell/Niobrara well to be drilled, completed and produced on the Application Lands. Based on the composite decline curve shown in the exhibit, the estimated ultimate recovery ("EUR") of an average 2-½ mile Codell or Niobrara well located on the Application Lands is estimated to be

488,000 STBO and 666,250 MSCFG (Codell Formation) and 351,000 STBO and 661,000 MSCFG (Niobrara Formation).

2. Exhibit E-2

The purpose of Exhibit E-2 is to show the appropriate well density for horizontal wells to be drilled on the Application Lands, whether single length laterals (one-mile) or variation of an extended laterals (one and one-half mile, two-mile, or greater). Exhibit E-2 reflects an evaluation of analog horizontal well results, EUR's and estimated drainage acres from available public data. The analog wells have EUR's ranging from 42,000 to 227,000 bbl and 82,000 to 95,000 bbl per section for the Codell and Niobrara Formations, respectively. Associated drainages per well are estimated from 47 to 131 acres and 7 to 10 acres for the Codell and Niobrara Formations, respectively. These estimates are within a reasonable expected range and support the proposed well density for the Codell and Niobrara Formations underlying the Application Lands (whether the operator plans to drill single laterals or extended laterals, the requested 12 horizontal wells for the proposed unit prevents waste (the drilling of unnecessary wells), protects correlative rights, and is smaller than the area to be drained by the requested 12 wells).

3. Exhibit E-3

Exhibit E-3 shows original oil-in-place ("OOIP") calculations and a range of possible well metrics for the Application Lands. Caculations show that the OOIP is estimated at 16,881,407 bbl and 192,243,240 bbl for the Application Lands for the Codell and Niobrara Formations, respectively. EUR ranges are predicted at 1,950,000 bbl for four Codell wells and 2,810,000 for eight Niobrara wells, with anticipated recovery factors of approximately 12% for the Codell wells and 1.5% for the Niobrara wells – which are within reasonable expected ranges for an unconventional tight oil development.

4. Exhibit E-4

Exhibit E-4 shows the estimated drainage radius per well drilled within the Application Lands based on an empirical formula.

Summary of Testimony

Based on the exhibits described herein, in my opinion the 12 planned horizontal Codell and Niobrara wells to be drilled on the Application Lands can be completed and produced at a positive internal rate of return, calculated at 47 to 95%, assuming an average estimated well cost of $4.6-5.4 MM for each, using an oil price of $60/bbl, a natural gas price of $2.75/MCF, and estimated operating costs of $9,000 per well per month.

It is my opinion the 12 planned horizontal Codell and Niobrara Formation wells are the appropriate well density for the Application Lands, and are an efficient and economic means to develop the resource and prevent waste, while protecting correlative rights. Further, the requested setback where the treated intervals of any horizontal well permitted under this Application should be located not less than 300 feet from unit boundaries and not less than 150 feet from any other well producing or drilling from the Codell and Niobrara Formations will prevent waste of the resource at the unit boundaries while protecting the correlative rights of adjacent owners to the unit area.

It is my further opinion that the proposed spacing unit is not smaller than the acreage that the planned wells will drain.

The Fort Hayes and Carlile Formations are non-target formations and included in the drilling and spacing unit at the Commission's request in the event the horizontal wellbore of the proposed wells deviate into these formations.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

DATED this 10 day of July, 2018.

Boyd McMaster, Petroleum Engineer
8 North, LLC

VERIFICATION

STATE OF COLORADO)
) ss.
CITY & COUNTY OF DENVER)

The foregoing instrument was subscribed and sworn to before me this 10 day of July, 2018, by Boyd McMaster, Petroleum Engineer for 8 North, LLC.

Witness my hand and official seal.

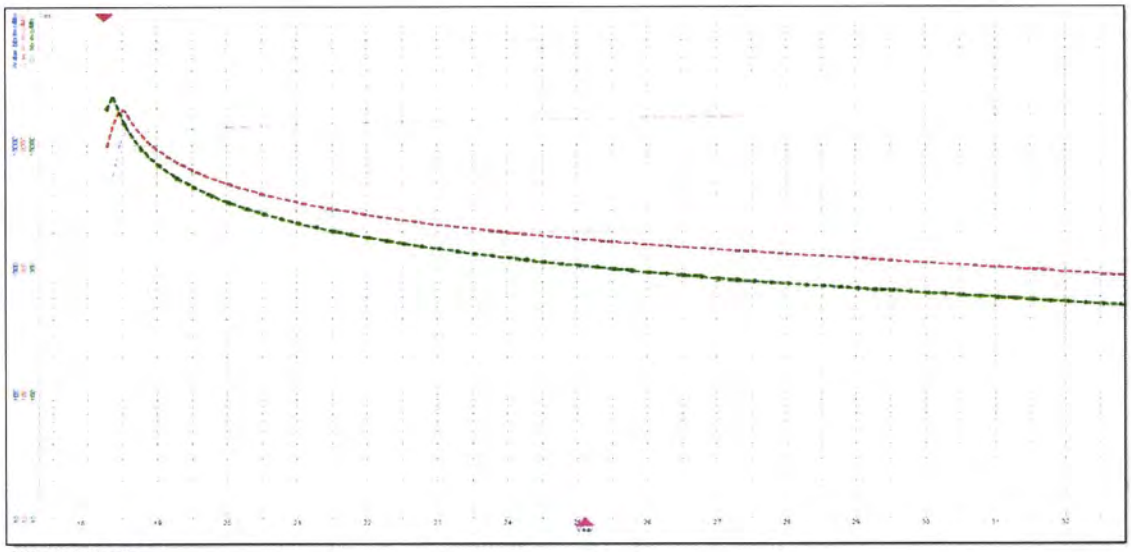
My Commission expires: 1/18/2022

ANGELA CHRISTINE NICKEL
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20184003200
MY COMMISSION EXPIRES JANUARY 18, 2022

Notary Public

Exhibit E-1
Date: 4/5/2018
Engineer: Boyd McMaster

Codell 2.5-mile



Niobrara 2.5-mile

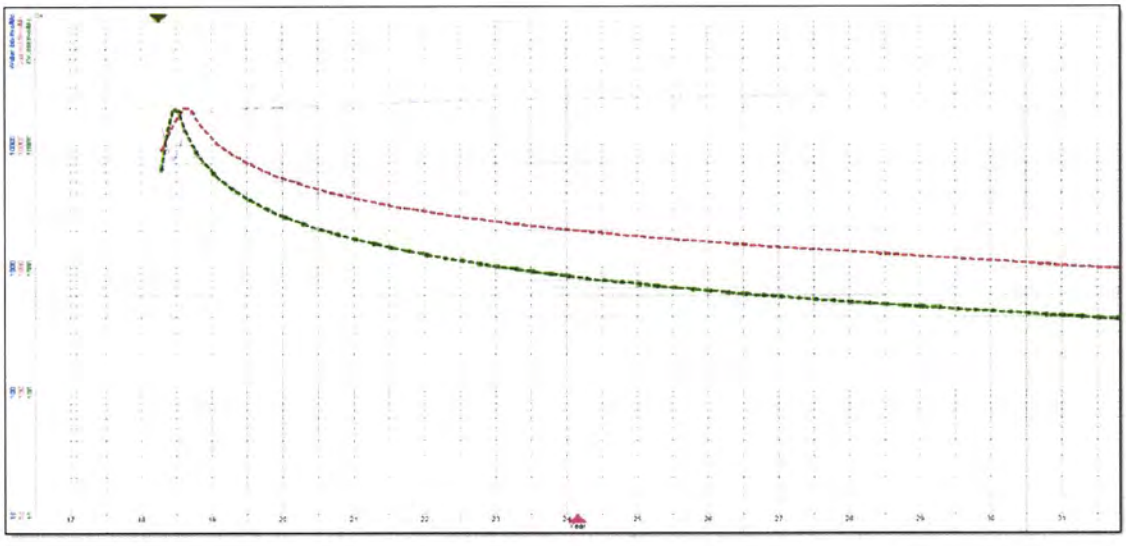


Exhibit E-2
Date 4/5/18
Engineer: Boyd McMaster

Well	Formation	Location	Lateral Length (ft)	Oil EUR (Mbbl)	Net Pay (ft)	Porosity (%)	Oil Saturation (%)	Formation Volume Factor (RB/STB)	Recovery Factor (%)	Estimated Drainage Acres (Acres)	Estimated Drainage Radius (ft)
JD LC26-78O	Codell	9N59W - 26	3,295	227	13	12%	80%	1.2	20%	131	660
HILES 12-62-17-	Codell	12N62W-17	4,451	110	20	12%	65%	1.2	20%	51	231
RAZOR 22D-2208B	Codell	10N58W-22	4,427	88	14	12%	80%	1.2	20%	47	216
RAZOR 11G-0210B	Codell	10N58W-11	7,263	108	15	12%	80%	1.2	20%	54	157
GRACIE LD22-720	Codell	9N58W-22	4,284	259	18	12%	80%	1.2	20%	108	469
SILVERBACK 1	Codell	12N62W-36	4,510	201	21	12%	65%	1.2	20%	88	378
RAZOR 12F-0106B	Codell	10N58W-12	4,400	99	15	12%	80%	1.2	20%	49	226
RILEY LD19-752	Codell	9N58W-19	4,452	186	17	12%	80%	1.2	20%	82	358
HORSETAIL FEDERAL 07F-0639	Codell	10N57W-7	4,201	105	12	12%	80%	1.2	20%	66	306
WOLF 36-3624H	Codell	10N59W-36	3,853	42	8	12%	80%	1.2	20%	40	207
HILES CDH 12-62-17-	Codell	12N62W-17	4,451	83	15	12%	65%	1.2	20%	51	231
TALMADGE 12-62-17-	Codell	12N62W-17	3,912	72	15	12%	65%	1.2	20%	45	228
TALMADGE CDH 12-62-17-	Codell	12N62W-17	4,386	97	15	12%	65%	1.2	20%	60	270
									Average	67	303
WILDHORSE 18-1844H	Niobrara	9N59W-18	3,713	85	255	9%	70%	1.2	10%	8	47
RAINBOW LC28-79-1	Niobrara	9N59W-28	3,398	83	250	9%	70%	1.2	10%	8	51
RAINBOW LC28-76-1	Niobrara	9N59W-28	3,704	85	250	9%	70%	1.2	10%	8	48
BROOK LC28-77-1	Niobrara	9N59W-28	3,748	91	250	9%	70%	1.2	10%	9	51
RAINBOW LC28-74-1	Niobrara	9N59W-28	3,733	92	250	9%	70%	1.2	10%	9	52
CUTTHROAT LC28-79HN	Niobrara	9N59W-28	3,499	94	250	9%	70%	1.2	10%	9	56
CUTTHROAT LC28-78HN	Niobrara	9N59W-28	3,615	95	250	9%	70%	1.2	10%	9	55
CUTTHROAT LC28-77HN	Niobrara	9N59W-28	3,662	98	250	9%	70%	1.2	10%	10	56
WILDHORSE 06-0614H	Niobrara	9N59W-6	3,576	92	270	9%	70%	1.2	10%	8	50
STATE 2-16-9-60	Niobrara	9N60W-16	4,036	83	273	9%	70%	1.2	10%	7	40
STATE 4-16-9-60	Niobrara	9N60W-16	3,995	87	273	9%	70%	1.2	10%	8	42
STATE 3-16-9-60	Niobrara	9N60W-16	3,989	95	273	9%	70%	1.2	10%	9	46
NELSON 5-17-9-60	Niobrara	9N60W-17	4,190	93	275	9%	70%	1.2	10%	8	43
NELSON 2-17-9-60	Niobrara	9N60W-17	3,831	94	275	9%	70%	1.2	10%	8	47
SHULL 4-25-9-60	Niobrara	9N60W-25	4,489	88	250	9%	70%	1.2	10%	9	41
SHABLE LB 32-68HN	Niobrara	9N60W-33	3,730	84	245	9%	70%	1.2	10%	8	48
SHULL 3-35-9-60	Niobrara	9N60W-35	4,295	84	240	9%	70%	1.2	10%	9	43
SHULL 1-35-9-60	Niobrara	9N60W-35	4,299	98	240	9%	70%	1.2	10%	10	50
KRIER GV26-62HN	Niobrara	9N61W-26	3,650	92	250	9%	70%	1.2	10%	9	53
STATE 2-36-9-61	Niobrara	9N61W-36	4,048	82	252	9%	70%	1.2	10%	8	42
STATE 4-36-9-61	Niobrara	9N61W-36	3,818	83	250	9%	70%	1.2	10%	8	46
STATE 3-36-9-61	Niobrara	9N61W-36	3,841	84	250	9%	70%	1.2	10%	8	46
									Average	8	45

$$EUR = Rf * ODIP$$

$$ODIP = \frac{7758 * A * h * \phi * So}{Bo}$$

$$So = 1 - Sw$$

EUR - Estimated Ultimate Recovery (bbls)
Rf - Recovery factor (%)
ODIP - Original Oil in Place (bbls)
A - Area (acres)
h - net pay (ft)
ϕ - porosity (%)
So - Oil Saturation (%)
Sw - Water Saturation (%)
Bo - Formation Volume Factor (rb/stb)

$$D = \frac{\pi * r^2 + 2r * L}{43560}$$ (Joshi equation)

L - Lateral length of well (ft)
r = Effective drainage radius from wellbore (ft)
D = Drainage are for horizontal well

Exhibit E-3
Date:
Engineer: Boyd McMaster

CODELL FORMATION

Formation Variables

Porosity	12%	
Sw	20%	
Area	1,600	acres
Thickness (h)	17.5	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	17,377,920	BO
Gas in Place	34,755,840	MCF

Vertical Well Performance

# of existing wells	-	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	294,000	BO
# of Horizontal Wells	4	wells
Total EUR	1,176,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	6.8%
Total RF	6.8%

NIOBRARA FORMATION

Formation Variables

Porosity	9%	
Sw	30%	
Area	1,600	acres
Thickness (h)	295	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	192,243,240	BO
Gas in Place	384,486,480	MCF

Horizontal Well Performance

# of existing wells	0	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	209,000	BO
# of Horizontal Wells	8	wells
Total EUR	1,672,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	0.9%
Total RF	0.9%

Exhibit E-4
Date:
Engineer: Boyd McMaster

CODELL FORMATION

Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	4	wells
Spacing Unit Acres per Well	400	acres
Length per Well	4680	feet

Estimated Drainage

Radius	272	feet

$$D = \frac{\pi * r^2 + 2r * L}{43560}$$ (Joshi equation)

NIOBRARA FORMATION

Formation Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	8	wells
Spacing Unit Acres per Well	200	acres
Length per Well	4680	feet

Estimated Drainage

Radius	96	feet

L - Lateral length of well (ft)
r = Effective drainage radius from wellbore (ft)
D = Drainage area for horizontal well

(-(2*L)+SQRT((2*L)^2-(4*PI()*-EUR*43560)))/(2*PI())

Appendix

1. Resume / c.v. of Sean P. Flanagan
2. Resume / c.v. of Alicia Branch
3. Resume / c.v. of Boyd McMaster

Sean P. Flanagan

Objective

To obtain a land position within an oil and gas exploration and production company; which promotes a strong employer to employee relationship built on trust, work ethic, communication, and proven success.

Industry Experience

EXTRACTION OIL & GAS
Contract Landman — **July 2016 - Present**

- Coordinate the land function of development team; prepare and negotiate oil and gas leases, calculate working interests and net revenue interests, review title opinions, draft various contracts and instruments including assignments, deeds, JOA's, AFE letters, supervise brokers and field landman

HAWKWOOD ENERGY
Oil and Gas Accountant — **March 2016 – June 2016**

- Review incoming costs and compare to AFE/Estimates, Month end and accruals, heavy reconciliations, variance analysis of historical well costs. Work closely with Director of Finance and Drilling Manager on special projects related to costs analysis and budgeting.

FOREST OIL CORPORATION — **September, 2006 – April, 2015**
Landman — ***June, 2012 – April, 2015***
Land Technician — *May, 2010 – May, 2011*
Land Assistant — *June, 2008 – April 2010*
Joint Interest Billing Analyst — *September, 2006 – June 2008*
East Texas & Northern Louisiana

- Performed cradle to grave land functions for two (2) rig drilling program, including, but not limited to, coordination of development programs with technical and management teams, proposing new drills and subsequent operations, examining title opinion, satisfying title curative requirements, acting as point of contact for field landmen, rig companymen, survey crews and environmental agents, supervising brokerage firms and title abstract crews contracted to negotiate and acquire mineral/working interests, prepare abstracts of title and title memorandums
- Drafted and Negotiated standard and complex oil and gas leases, contracts and instruments, including, but not limited to, assignments, farmouts, unit designations/amendments, JOA's, purchase and sale agreements, participation agreements, AFE letters, lease extensions

Attributes

Proven Landman Professional with significant experience in diverse drilling processes. Strategic planner and innovative problem solver with strong negotiation skills working with owners and partners. Adept in preparing and interpreting lease and sale agreements. High adaptability, relationship building, natural leadership skills, strong multi-tasking abilities, works well under time and cost pressures, general understanding of GIS, proficient in Microsoft Office Suite, Bolo-Oil and Gas office system, AFE Navigator and DrillingInfo.com.

Education

Fort Lewis College, Durango, Colorado — **May, 2006**
Bachelor of Arts: Business Administration

Colorado School of Mines — **June, 2012**
Petroleum Engineering for Non-Engineers

Colorado School of Mines — **June, 2012**
Petroleum Geology for Non-Geologists

Involvement

Chairperson, Forest Oil Corporation – Contribution committee (2013-2015), Student-athlete, Fort Lewis College Men's Soccer – Division II National Champions 2005 (undefeated 22-0-1), Student Athlete Advisory Committee Member – UNCC, Charlotte, NC (2002-2003)

ALICIA BRANCH

EXPERTISE SUMMARY

- Twelve years industry experience supervising exploration and development projects in emerging plays.
- Self-motivated individual with drive to excel through continuously improving and learning new skills.
- Strong leadership experience with multidisciplinary teams, project management and business planning.
- Demonstrated success aggressively cutting costs while delivering timely projects.
- Building on-going relationships with key stakeholders.
- Extensive operations background specializing in Cretaceous and Devonian shales, carbonates and tight gas sand plays in Colorado, Oklahoma, Texas and New Mexico.
- Recent experience onshore Europe in conventional exploration in Rotliegend Permian Basin fairway.

PROFESSIONAL EXPERIENCE

AB Consulting, Inc., Denver, CO **6/2016 - present**

Owner, Geologist

Geologic consulting services for various operators around Denver.

- Acreage evaluations
- Operations
- Regional & detailed mapping
- Well planning & Permitting
- Geologic exhibits & Testimony

Palomar Natural Resources, Lakewood, CO **7/2014 – 2/2016**

Vice President of Global Operations *1/2015 – 2/2016*

Oversaw execution of all operations within the company. Most recent focus was redevelopment of 16,335 acres in Verde Gallup oil field in New Mexico on the Ute Mountain Ute Reservation. Deployed $13.5MM of capex to date and $1.3MM of net revenue. Duties included:

- Supervise technical teams that plan and execute drilling, completions and workovers
- Manage multiple regulatory agencies (BIA, BLM, NMOCD) and Sovereign Nation relationships
- Negotiate and award contracts with vendors
- Establish high level processes that ensure streamlined development of assets
- Responsible for creation and delivery of timelines and budgets related to all operations
- Ensure creation of data room and solicit capital investment from various banks
- Demonstrated a 28% reduction of New Mexico permit timeline and a 70% reduction in well permit costs in one year

Poland Country Manager *7/2014 – 1/2015*

Responsible for over 1MM acres (7 Concessions) in the Polish Permian Basin. Drilled and tested two wells in Rawicz field, leading to field recoverable reserves of 50.3 Bscf. Reduction of per well costs by $1.9MM over 2 years. Progress full field development plan. Identification of significant on trend upside oil and gas prospects. Designed a 3 horizontal well work-over program in the largest gas field in Poland (Estimated 2P reserves of 210 Bscf and upside of 420 Bscf). Duties included:

- Propose and manage PNR/JV budgets and cash calls
- Liaise with Polish authorities, including Ministry, Mining Authority and Local Government
- Represent PNR with JV Partners (TCM/OCM meetings)
- Work closely with JV partners to build consensus on strategic business decisions

- Direct the execution of all operations within Poland
- Ensure PNR compliance with JVA reporting requirements
- Collaborated with stakeholders in field commercialization negotiations
- Ensured creation of data room and solicit capital investment from various banks
- Charged with directing Ryder Scott on work scope and delivery of Estimated Future Reserves and Income Report

Noble Energy, Inc., Denver, CO **9/2008 – 7/2014**

DJ Basin Business Unit, Prospect Development Team Lead, Sr Geologist *2/2012 – 7/2014*

Oversaw delivery of Development Plans that deliver budget production. Duties included:

- Project manage multidisciplinary technical team that identified, evaluated and progressed new drill prospects
- Build and manage Integrated Development Plans (DPs) that utilize cross functional teams
- Progressed IDPs through upper management approval and ensure validity of key assumptions and economic uplifts throughout the life of development
- Ensure effective analysis and preparation of IDPs, DPs and new drill prospects, including reserve adds, reservoir characterization, EUR projection, type curve application, GOR estimates, offset production review, execution strategy
- Managed the forecasting of IPs, EURs and initial cost estimates for new projects and establish project level economics
- Ensured application of best available completions, drilling, production and reservoir technologies to projects
- Select and prioritize the best projects based on BU strategy, ROR, risked ranked projects, and PUDs
- Delivered wells that contribute to corporate goal of 23% CAGR in 2014

Niobrara Integration Team, Geologist III *8/2010 – 2/2012*

Emphasis was to understand and mitigate key uncertainties for Niobrara and Codell. Focus on variation in well performance, basin stress anisotropy, seismic acquisition, appraisal program, optimizing completions, production facility consolidation, schedule and cost management. Compiled, evaluated and shared Niobrara horizontal key learnings and implemented best practices with the BU. Duties included:

- Charged with planning and acquisition of all horizontal petrophysical data
- Designed & executed an 8 well coring program to calibrate petrophysical model
- Developed Mechanical Earth Model program & regional stress maps for the field
- Lead geologist for Root Cause Analysis on mechanical well failures, coil tubing and frac complications
- Lead NIT geologist in design of first comprehensive downspacing test
- Creation of key NIT maps & criteria for picking horizontal well locations
- Responsible for determining target zone for all horizontal wells in the 10 rig program (up to 300 wells per year)
- Lead Geologist in selection of extended reach lateral locations
- Responsible for geologic recommendation on Non-Op participation in all horizontal wells
- Initiated production comparison study with NIT completions team leading to determination of target bench over Wattenberg High

Wattenberg Business Unit, Geologist II *4/2009 – 8/2010*

Oversaw vertical and horizontal operations of ~300 mi^2 area of Wattenberg Field. Including determining target formations, geosteering horizontal wells, completion intervals, petrophysical evaluation, correlation, fault picking, etc. The asset had a field wide drilling program of 500+ vertical and horizontal wells per year. Also collaborated on evaluation of new exploration targets within the greater Denver-Julesburg Basin. Duties included:

- Developed standardized workflow for pre-drill planning and post-drill deliverables for horizontal Niobrara and Codell wells that is still used in the DJ Basin BU and has been adopted by the Rockies BU.
- Conducted analysis of Greenhorn and Graneros, proposed three vertical exploration wells, designed and oversaw data acquisition program
- Worked with integrated team and vendors on acquisition design and interpretation of microseismic on 7 vertical wells

Mid Continent Business Unit, Geologist II *9/2008 – 4/2009*
In charge of planning and geosteering 6 horizontal wells in the Upper Pennsylvanian Cleveland Tight Gas Sandstone. Designed coring program for first pilot hole in the Shattuck Field, Ellis County, Oklahoma. Duties included:
- Pre-drill planning & post-drill geologic interpretation of horizontal wells
- Geologic testimony at Oklahoma Corporation Commission
- Select and prioritize packer placement in laterals
- Collaborate in development of Mechanical Earth Model
- Research drilling reports for wellbore stability issues related to Marmaton Shale
- Design of multiple sidetracks with Drilling Engineer

BP America, Inc., Houston, TX **8/2007 – 9/2008**
North America Gas Reserves and Renewal, Geologist
Carried out basin scale evaluation of shale gas resources. Work formed foundation of basin ranking based on potential. Development of standardized workflow approach to shale gas evaluation. Calibration of workflow in basins with substantial production. Areas of work included Arkoma & Anadarko Basins, OK, Permian & Ft. Worth Basins, TX and Alberta Basin, Canada.

Pathfinder Exploration, Norman, OK **2/2004 – 5/2005 & 8/2005 – 8/2007**
Geologist, GeoTech
Involved in planning and drilling of 5 wells. Delivered an 8 well drilling program in Arkansas and Oklahoma in 4Q '05.

Marathon Oil Company, Houston, TX **5/2005 – 8/2005**
Alaska Asset Team, Geologic Intern
Project: Swanson River Field, Alaska. Work formed basis of a recommendation for a gas storage project and potential field extension.

EDUCATION

MS Geology 2007. University of Oklahoma, Norman, OK.
Thesis: Comprehensive characterization of a core from an over-mature Woodford Shale in LeFlore County, Oklahoma and comparison with data from other studies of the Woodford Shale across the Arkoma Basin.

BS Petroleum Geology 2004. University of Oklahoma. Norman, Oklahoma.

SOFTWARE SKILLS

Power user for Petra, MS Office suite, Petrel, Oracle, Access, Geolog, Petrosys (dbMap), UNIX and Zmap.
Competent user for ArcGIS, Techlog, GeoFrame, Spotfire, Seisworks, BasinMod and Kingdom 3D.
Familiar with Wellspring, PEEP, Aries, and Fekete.

OTHER ACTIVITES/ACCOMPLISHMENTS/MEMBERSHIPS

- Field trip leader for Wattenberg Field Operations course at 2015 AAPG Annual Convention
- Geology Mentor of the Year – 2014 Noble Tech Conference
- Business Innovation Award for Integrated Development Plan Process – 2014 Noble Tech Conference
- Noble Energy Lead Campus Recruiter University of Oklahoma 2009 - 2014
- Charity Coordinator Noble Activity Committee 2010 – 2014

Boyd McMaster

PROFESSIONAL EXPERIENCE

Extraction Oil and Gas, LLC — Denver, CO
Asset Planner — 11/2014 - present

- Lead multifunctional team that prepared comprehensive development plan for 40,000 GMA acquisition in urban/urbanized area, including interfacing with local governments, developers and community groups
- Participated in the development of midstream strategy for core and non-core assets, located in and around Windsor and Greeley, Colorado

Noble Energy, Inc. — Denver, CO
Major Projects Planning Lead — 4/2014 – 11/2014
Planning Engineer — 2/2013 – 4/2014

- Evaluate and analyze midstream projects needed to support horizontal drilling in Colorado DJ Basin
- Assist with initiative to monetize existing midstream infrastructure, including economic analysis, forecasts, fee calculations and implementation in preparation of converting into MLP.
- Lead and chair multi-functional teams; Prepare economics evaluations of integrated development plans for team and management review; assist in preparation of schedules, risk matrices and mitigation plans
- Prepare annual and long term forecasts and budgets for integrated development plans encompassing large geographic areas (70,000 to 150,000 GMA / 1,000 to 1,600 horizontal wells)

PDC Energy, Inc. — Denver, CO
Petroleum Engineer II — 10/2010 – 02/2013

- Identify and evaluate DJ Basin wells for re-frac and re-completions, prepare cost estimates and AFEs, track and analyze post operation performance; coordinate with land, field and regulatory personnel to execute over 75 projects in less than six (6) months under projected costs
- Use *Aries*, IHS Enerdeq and other data to evaluate well proposals from operators; track daily operations, cost and performance; prepare and track $30MM budget
- Lead engineer for evaluating and monitoring non-operated wells; identifying and capturing revenue from non-operated wells, as well improving internal process for communicating with and obtaining technical data from operators
- Review, evaluate and provide engineering support for workovers for PDC's Northeastern Colorado shallow gas fields; maintained, and in some cases reduced, lease operating expenses and workover expenses

Grey Bear, Inc. — Denver, CO
Owner — 07/2009 – 10/2010

- Consulted as engineer for EnCana with respect to salt water disposal pilot program initiated during employment with Berry Petroleum Company for Piceance Basin
- Performed due diligence of operator's records in preparation of potential acquisition
- Reviewed operator's lease records in preparation of re-development operations and divestiture

Berry Petroleum Company — Denver, CO
Senior Production Engineer — 09/2008 – 04/2009

- Review well production history and identified optimization opportunities and solutions for reducing corrosion and scaling problems

- Evaluate water production composition and history and identified strategies and options for managing flow-back and production water to reduce development costs in Piceance Basin
- Prepared RFP and evaluated proposals from chemical vendors for the treatment and prevention of corrosion, scaling and bacteria issues in wells, production facilities and pipelines.

Enerplus Resources (USA) Corporation Denver, CO
Production Engineer 2006 – 2008

- Initially employed as contract employee through Iron Creek Energy Group, LLC (Cody, Wyoming) to facilitate the transfer of the Elm Coulee field from Lyco Energy Corporation to Enerplus; offered and accepted permanent position with approval of Iron Creek
- Executed $110 million dollar budget that included completing 63 gross wells; refracing 24 gross wells and scheduling operations for 7 workover rigs; increased gross production from 12,923 BOEPD to 15,852 BOEPD
- Collaborated in development of completion and frac designs, workover techniques, IOR pilot and reviews of S.C.A.D.A system, chemical program and water source/disposal options
- Continuous review of Bakken horizontal well performance to identify re-stimulation and optimization candidates and lift repairs, as well as infill development opportunity
- Prepared workover procedures, AFEs, economic and technical well evaluations using IHS *PowerTools* evaluation software
- Assist development engineers in technical and economic evaluations of wells, including production forecasting for reserves and marketing
- Assisted in planning, implementation and review of capital and operating expenses
- Participated in technical review of performance of wells and comparison with field data

CBM Associates, Inc. Gillette, WY
Operations Manager/General Counsel 2005 – 2006

- Supervised 60+ people engaged in providing environmental and plan of development services to operators in the Powder River Basin
- Reviewed and provided analysis to operators regarding options for handling water produced from CBNG development, including developing federal plans of development for operator clients

Black Diamond Energy, Inc. Gillette, WY
General Counsel/Project Manager 2004 – 2005

- Coordinated and participated in the preparation, planning, and development of 100+ (gross) coal bed methane wells in Powder River Basin, including the formation of multiple federal exploratory units
- Prepared applications and oversaw expert testimony for various spacing, commingling and protests of applications before Wyoming Oil and Gas Commission
- Provided technical support and prepared documentation for acquisition of oil and gas properties
- Supported management in the reviewing of leases, contracts, and other legal documents, as well as including reviewing leases, contracts and other legal documents, as well as providing litigation support

McMaster & Fuller Law Offices, P.C. Gillette, WY
Principle/Attorney 2001 – 2004

- Led a law practice focused on natural resources, business litigation and transactions, bankruptcy and other commercial matters; worked for mid-size and small independent exploration and production companies, as well as small independent service providers
- Prepared and oversaw prosecution of applications and protests before Wyoming Oil and Gas Commission
- Performed due diligence and legal advice of oil and gas acquisitions
- Prepared drilling title opinions and division title opinions for oil and gas properties

EDUCATION

University of Wyoming College of Law — Laramie, WY
Juris Doctorate — Degree, 05/1996

University of Wyoming — Laramie, WY
Bachelor of Science in Mechanical Engineering — Degree, 05/1993

PROFESSIONAL MEMBERSHIPS

Society of Petroleum Engineers
Colorado Bar Association
American Association of Petroleum Landmen
Wyoming Bar Association

CONTINUING EDUCATION & PROFESSIONAL DEVELOPMENT

- Oil and Gas Economics and Uncertainty
- RMAG's Source Rocks 101
- IADC WellCap Well Control Training
- Theta Oilfield Services Rod Pumping Optimization
- Echometer Gas Deliquification Seminar
- Halliburton Rocky Mountain Cementing School
- Gopher Advanced Fracturing Design Theory & Model Introduction Course
- Severed Mineral, Split Estates, Rights of Access and Surface use in Mineral Extraction Operations
- Oil & Gas Agreements: the Exploration Phase

BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE APPLICATION OF 8 NORTH, LLC, FOR AN ORDER TO ESTABLISH AN APPROXIMATE 1,600-ACRE DRILLING AND SPACING UNIT FOR SECTIONS 9 & 16, AND N½ OF SECTION 21, TOWNSHIP 10 NORTH, RANGE 60 WEST, 6TH P.M., AND AUTHORIZING THE DRILLING OF TWELVE HORIZONTAL WELLS WITHIN THE PROPOSED UNIT, FOR PRODUCTION FROM THE CODELL, FORT HAYS, CARLILE, AND NIOBRARA FORMATIONS, UNNAMED FIELD, WELD COUNTY, COLORADO	)	CAUSE NO. 535
	)	DOCKET NO. 180600473
	)	TYPE: Spacing

THIRD RENEWED REQUEST FOR RECOMMENDATION OF APPROVAL OF APPLICATION WITHOUT A HEARING

8 North, LLC ("8 North" or "Applicant"), by and through its undersigned attorneys, Poulson, Odell & Peterson, LLC, hereby requests, pursuant to Rule 511.a. of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission, the Director to recommend approval of the verified amended application ("Application") filed herein without a hearing.

Applicant requests that the Application be approved based on: (1) the merits of the Application, and (2) the attached sworn written testimony with supporting exhibits which support the relief requested in the Application (to include recently filed Revised Supplement to Engineering Testimony, dated October 2, 2018). There are no protests or interventions presently pending against the Application.

WHEREFORE, Applicant requests the Application be approved without a hearing and on the merits of the Application and sworn testimony with supporting exhibits as provided for by Rule 511.a.

DATED this 2nd day of October, 2018.

8 NORTH LLC

By: _____

Robert A. Willis
Poulson, Odell & Peterson, LLC
1775 Sherman Street, Suite 1400
Denver, CO 80203
(303) 264-4418 - direct

8NORTH

Cause No. 535
Docket No. 180600473

Rule 511 written submission in support of uncontested Application requesting an order establishing an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and the N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorizing the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

8 North, LLC

Boyd McMaster – Supplement to Engineering Testimony, dated October 2, 2018
Cause No. 535, Docket No. 180300473

Request for an order to establish an approximate 1,600-acre drilling and spacing unit for Sections 9 & 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorize the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations

My name is Boyd McMaster and I am currently employed as Petroleum Engineer for 8 North, LLC ("8 North"). I received a Bachelor of Science degree in Mechanical Engineering from the University of Wyoming in 1993, and a Juris Doctorate of Law from the University of Wyoming in 1996. I have over 20 years of experience in the oil and gas industry. I am familiar with the lands subject to, and the allegations and facts set forth in, the verified amended application (the "Application") filed herein.

In support of the Application, I am submitting four exhibits. The exhibits are attached to my sworn testimony and form a partial basis for support of the Application which requests an order establishing an approximate 1,600-acre drilling and spacing unit for Sections 9, 16 and N½ of Section 21, Township 10 North, Range 59 West, 6th P.M., and authorizing the drilling of 12 horizontal wells within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell, Fort Hays, Carlile, and Niobrara Formations, without exception being granted by the Director. The below-listed lands (the "Application Lands") are relevant to the Application:

Township 10 North, Range 59 West, 6th P.M.
Section 9: All
Section 16: All
Section 21: N½

List of Exhibits

1. Exhibit E-1

Exhibit E-1 is a composite decline curve based on the production performance of adjacent Codell and Niobrara Formation 2-½ mile lateral horizontal wells. The decline curve is representative of the anticipated production from an average 2-½ mile horizontal Codell/Niobrara well to be drilled, completed and produced on the Application Lands. **Based on the composite decline curve shown in the exhibit, the estimated ultimate recovery ("EUR") of an average 2-½ mile Codell or Niobrara well located on the Application Lands is**

estimated to be 488,000 STBO and 666,250 MSCFG (Codell Formation) and 351,000 STBO and 661,000 MSCFG (Niobrara Formation).

2. Exhibit E-2

The purpose of Exhibit E-2 is to show the appropriate well density for horizontal wells to be drilled on the Application Lands, whether single length laterals (one-mile) or variation of an extended laterals (one and one-half mile, two-mile, or greater). Exhibit E-2 reflects an evaluation of analog horizontal well results, EUR's and estimated drainage acres from available public data. The analog wells have EUR's ranging from 42,000 to 227,000 bbl and 82,000 to 95,000 bbl per section for the Codell and Niobrara Formations, respectively. Associated drainages per well are estimated from 47 to 131 acres and 7 to 10 acres for the Codell and Niobrara Formations, respectively, **with average drainage area of 67 acres per section for Codell wells and 8 acres per section for Niobrara wells. Extrapolating these anticipated drainage to a 1,600-acre unit area yield the following results:**

	Minimum drainage area	Maximum drainage area	Average drainage area of each proposed 2-½ mile well	Total est. average drainage area for proposed wells
Codell well	**117.5 acres**	**327.5 acres**	**167.5 acres**	**670 acres (4 wells)**
Niobrara well	**17.5 acres**	**25 acres**	**20 acres**	**160 acres (8 wells)**

These estimates are within a reasonable expected range and support the proposed well density for the Codell and Niobrara Formations underlying the Application Lands (whether the operator plans to drill single laterals or extended laterals, the requested 12 horizontal wells for the proposed unit prevents waste (the drilling of unnecessary wells), protects correlative rights, and is smaller than the area to be drained by the requested 12 wells).

3. Exhibit E-3

Exhibit E-3 shows original oil-in-place ("OOIP") calculations and a range of possible well metrics for the Application Lands. Caculations show that the OOIP is estimated at 16,881,407 bbl and 192,243,240 bbl for the Application Lands for the Codell and Niobrara Formations, respectively. EUR ranges are predicted at 1,950,000 bbl for four Codell wells and 2,810,000 for eight Niobrara wells, with anticipated recovery factors of approximately 12% for the Codell wells and 1.5% for the Niobrara wells – which are within reasonable expected ranges for an unconventional tight oil development.

4. Exhibit E-4

Exhibit E-4 shows the estimated drainage radius per well drilled within the Application Lands based on an empirical formula. **These calculations support the requested setbacks of 300 feet from proposed unit boundaries.**

Summary of Testimony

Based on the exhibits described herein, in my opinion the 12 planned horizontal Codell and Niobrara wells to be drilled on the Application Lands can be completed and produced at a positive internal rate of return, calculated at 47 to 95%, assuming an average estimated well cost of $4.6-5.4 MM for each, using an oil price of $60/bbl, a natural gas price of $2.75/MCF, and estimated operating costs of $9,000 per well per month.

It is my opinion the 12 planned horizontal Codell and Niobrara Formation wells are the appropriate well density for the Application Lands, and are an efficient and economic means to develop the resource and prevent waste, while protecting correlative rights. Further, the requested setback where the treated intervals of any horizontal well permitted under this Application should be located not less than 300 feet from unit boundaries and not less than 150 feet from any other well producing or drilling from the Codell and Niobrara Formations will prevent waste of the resource at the unit boundaries while protecting the correlative rights of adjacent owners to the unit area.

It is my further opinion that the proposed spacing unit is not smaller than the acreage that the planned wells will drain.

The Fort Hayes and Carlile Formations are non-target formations and included in the drilling and spacing unit at the Commission's request in the event the horizontal wellbore of the proposed wells deviate into these formations.

The matters described herein were devised under my direction and control. To the best of my knowledge and belief, all of the matters set forth herein, my testimony and the supporting exhibits, are true and accurate.

DATED this *2nd* day of October, 2018.

Boyd McMaster, Petroleum Engineer
8 North, LLC

VERIFICATION

STATE OF COLORADO)
) ss.
CITY & COUNTY OF DENVER)

The foregoing instrument was subscribed and sworn to before me this *2nd* day of Oct. 2018, by Boyd McMaster, Petroleum Engineer for 8 North, LLC.

Witness my hand and official seal.

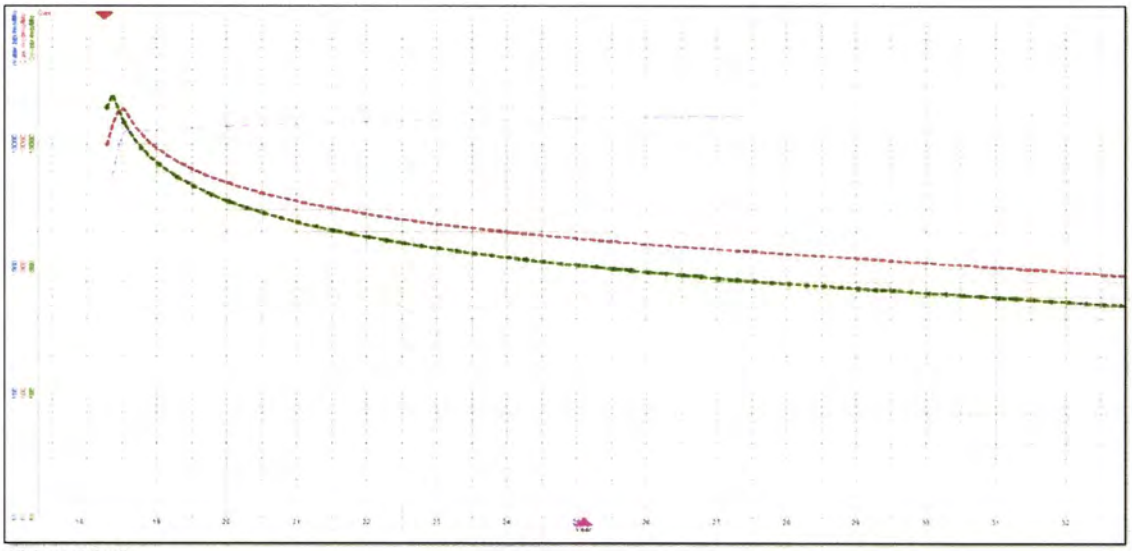
My Commission expires: 1/18/2022

ANGELA CHRISTINE NICKEL
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20184003200
MY COMMISSION EXPIRES JANUARY 18, 2022

Notary Public

Exhibit E-1
Date: 4/5/2018
Engineer: Boyd McMaster

Codell 2.5-mile



Niobrara 2.5-mile

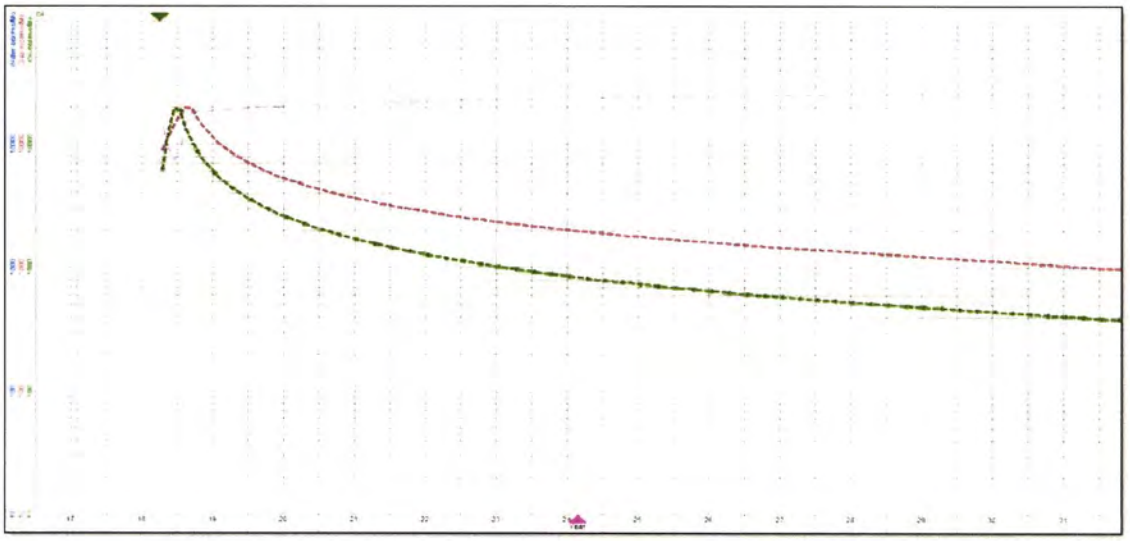


Exhibit E-2
Date 4/5/18
Engineer Boyd McMaster

Well	Formation	Location	Lateral Length (ft)	Oil EUR (Mbbl)	Net Pay (ft)	Porosity (%)	Oil Saturation (%)	Formation Volume Factor (RB/STB)	Recovery Factor (%)	Estimated Drainage Acres (Acres)	Estimated Drainage Radius (ft)
JD LC26-78D	Codell	9N59W - 26	3,295	227	13	12%	80%	1 2	20%	131	660
HILES 12-62-17-	Codell	12N62W-17	4,451	110	20	12%	65%	1.2	20%	51	231
RAZOR 22D-2208B	Codell	10N58W-22	4,427	88	14	12%	80%	1.2	20%	47	216
RAZOR 11G-0210B	Codell	10N58W-11	7,263	108	15	12%	80%	1 2	20%	54	157
GRACIE LD22-720	Codell	9N58W-22	4,284	259	18	12%	80%	1 2	20%	108	469
SILVERBACK 1	Codell	12N62W-36	4,510	201	21	12%	65%	1 2	20%	88	378
RAZOR 12F-0106B	Codell	10N58W-12	4,400	99	15	12%	80%	1 2	20%	49	226
RILEY LD19-752	Codell	9N58W-19	4,452	186	17	12%	80%	1 2	20%	82	358
HORSETAIL FEDERAL 07F-0639	Codell	10N57W-7	4,201	105	12	12%	80%	1.2	20%	66	306
WOLF 36-3624H	Codell	10N59W-36	3,853	42	8	12%	80%	1 2	20%	40	207
HILES CDH 12-62-17-	Codell	12N62W-17	4,451	83	15	12%	65%	1 2	20%	51	231
TALMADGE 12-62-17-	Codell	12N62W-17	3,912	72	15	12%	65%	1.2	20%	45	228
TALMADGE CDH 12-62-17-	Codell	12N62W-17	4,386	97	15	12%	65%	1.2	20%	60	270
									Average	67	300
WILDHORSE 18-1844H	Niobrara	9N59W-18	3,713	85	255	9%	70%	1 2	10%	8	47
RAINBOW LC28-79-1	Niobrara	9N59W-28	3,398	83	250	9%	70%	1 2	10%	8	51
RAINBOW LC28-76-1	Niobrara	9N59W-28	3,704	85	250	9%	70%	1 2	10%	8	48
BROOK LC28-77-1	Niobrara	9N59W-28	3,748	91	250	9%	70%	1 2	10%	9	51
RAINBOW LC28-74-1	Niobrara	9N59W-28	3,733	92	250	9%	70%	1 2	10%	9	52
CUTTHROAT LC28-79HN	Niobrara	9N59W-28	3,499	94	250	9%	70%	1 2	10%	9	56
CUTTHROAT LC28-78HN	Niobrara	9N59W-28	3,615	95	250	9%	70%	1 2	10%	9	55
CUTTHROAT LC28-77HN	Niobrara	9N59W-28	3,662	98	250	9%	70%	1 2	10%	10	56
WILDHORSE 06-0614H	Niobrara	9N59W-6	3,576	92	270	9%	70%	1 2	10%	8	50
STATE 2-16-9-60	Niobrara	9N60W-16	4,036	83	273	9%	70%	1 2	10%	7	40
STATE 4-16-9-60	Niobrara	9N60W-16	3,995	87	273	9%	70%	1 2	10%	8	42
STATE 3-16-9-60	Niobrara	9N60W-16	3,989	95	273	9%	70%	1 2	10%	9	46
NELSON 5-17-9-60	Niobrara	9N60W-17	4,190	93	275	9%	70%	1 2	10%	8	43
NELSON 2-17-9-60	Niobrara	9N60W-17	3,831	94	275	9%	70%	1 2	10%	8	47
SHULL 4-25-9-60	Niobrara	9N60W-25	4,489	88	250	9%	70%	1 2	10%	9	41
SHABLE LB 32-68HN	Niobrara	9N60W-33	3,730	84	245	9%	70%	1 2	10%	8	48
SHULL 3-35-9-60	Niobrara	9N60W-35	4,295	84	240	9%	70%	1.2	10%	9	43
SHULL 1-35-9-60	Niobrara	9N60W-35	4,299	98	240	9%	70%	1 2	10%	10	50
KRIER GV26-62HN	Niobrara	9N61W-26	3,650	92	250	9%	70%	1 2	10%	9	53
STATE 2-36-9-61	Niobrara	9N61W-36	4,048	82	252	9%	70%	1 2	10%	8	42
STATE 4-36-9-61	Niobrara	9N61W-36	3,818	83	250	9%	70%	1 2	10%	8	46
STATE 3-36-9-61	Niobrara	9N61W-36	3,841	84	250	9%	70%	1 2	10%	8	46
									Average	8	45

$EUR = Rf * OOIP$

$OOIP = \frac{7758 * A * h * \phi * So}{Bo}$

$So = 1 - Sw$

$D = \frac{\pi * r^2 + 2r * L}{43560}$ (Joshi equation)

EUR - Estimated Ultimate Recovery (bbls)
Rf - Recovery factor (%)
OOIP - Original Oil in Place (bbls)
A - Area (acres)
h - net pay (ft)
ϕ - porosity (%)
So - Oil Saturation (%)
Sw - Water Saturation (%)
Bo - Formation Volume Factor (rb/stb)

L - Lateral length of well (ft)
r = Effective drainage radius from wellbore (ft)
D = Drainage are for horizontal well

Exhibit E-3
Date:
Engineer: Boyd McMaster

CODELL FORMATION

Formation Variables

Porosity	12%	
Sw	20%	
Area	1,600	acres
Thickness (h)	17.5	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	17,377,920	BO
Gas in Place	34,755,840	MCF

Vertical Well Performance

# of existing wells	-	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	294,000	BO
# of Horizontal Wells	4	wells
Total EUR	1,176,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	6.8%
Total RF	6.8%

NIOBRARA FORMATION

Formation Variables

Porosity	9%	
Sw	30%	
Area	1,600	acres
Thickness (h)	295	feet
Bo	1.2	RB/STB
GOR	2	MCF/STB

Estimated Resources (OOIP & GIP)

Oil in Place	192,243,240	BO
Gas in Place	384,486,480	MCF

Horizontal Well Performance

# of existing wells	0	wells
Total EUR	0	BO

Horizontal Well Performance

EUR per Horizontal Well	209,000	BO
# of Horizontal Wells	8	wells
Total EUR	1,672,000	BO

Recovery Factor

Vertical Well RF	0.0%
Horzontal Well RF	0.9%
Total RF	0.9%

Exhibit E-4
Date:
Engineer: Boyd McMaster

CODELL FORMATION

Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	4	wells
Spacing Unit Acres per Well	400	acres
Length per Well	4680	feet

Estimated Drainage

Radius	272	feet

NIOBRARA FORMATION

Formation Variables

Proposed Spacing Unit	1,600	acres
# of Horizontal Wells	8	wells
Spacing Unit Acres per Well	200	acres
Length per Well	4680	feet

Estimated Drainage

Radius	96	feet

$$D = \frac{\pi * r^2 + 2r * L}{43560}$$ (Joshi equation)

L - Lateral length of well (ft)
r = Effective drainage radius from welbore (ft)
D = Drainage area for horizontol well

(-(2*L)+SQRT((2*L)^2-(4*PI()*-EUR*43560)))/(2*PI())